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"ECONOMY OF INTEGRATION" ICEI 2025

REGENERATIVE AND DIGITAL ECONOMY:
SOUTHEASTERN EUROPE´S PATH TO SUSTAINABLE COMPETITIVENESS

CONFERENCE PROCEEDINGS

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REGENERATIVE AND DIGITAL ECONOMY: SOUTHEASTERN EUROPE'S PATH TO SUSTAINABLE COMPETITIVENESS

CONFERENCE PROCEEDINGS

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Hidajet Klapić, PhD

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PREDGOVOR

Ekonomski fakultet Univerziteta u Tuzli na dvogodišnjoj osnovi organizuje internacionalnu naučnu konferenciju „Ekonomija integracija“ (ICEI), kao jednu od prepoznatljivih naučnih platformi posvećenih razmatranju savremenih ekonomskih, društvenih, tehnoloških i razvojnih izazova zemalja Jugoistočne Evrope. Od prve konferencije održane 2009. godine do danas, ICEI je postepeno izrastao u regionalno relevantan akademski forum koji povezuje istraživače, univerzitetske nastavnike, stručnjake iz prakse, predstavnike institucija, kreatore javnih politika, studente i druge aktere zainteresovane za razvoj privrede, unapređenje poslovnog okruženja i jačanje konkurentnosti u evropskom i globalnom kontekstu.

Kontinuitet održavanja konferencije potvrđuje opredijeljenost Ekonomskog fakulteta Univerziteta u Tuzli da kroz naučno-istraživački rad, međunarodnu saradnju i javni dijalog doprinosi boljem razumijevanju procesa ekonomskih integracija. U prethodnim izdanjima konferencije obrađivane su teme upravljanja u vrijeme krize, perspektive integracija zemalja Jugoistočne Evrope, uloga znanja u prevazilaženju recesije, izazovi ekonomija u kriznom okruženju, značaj ekonomske misli u savremenom društvu, emigracije i konkurentnost, ekonomski odgovor na krizu uzrokovanu pandemijom Covid-19, te održiva ekonomija i turizam na putu ka pridruživanju Evropskoj uniji. Svaka od ovih konferencija predstavljala je odgovor akademske zajednice na dominantne razvojne izazove vremena u kojem je održavana.

Deveta internacionalna naučna konferencija „Ekonomija integracija“ – ICEI 2025 održana je 4. i 5. decembra 2025. godine na Ekonomskom fakultetu Univerziteta u Tuzli, pod tematskim nazivom „Regenerativna i digitalna ekonomija: put Jugoistočne Evrope ka održivoj konkurentnosti“. Izbor ove teme proizašao je iz potrebe da se naučna i stručna javnost usmjeri na dva međusobno povezana razvojna pravca: regenerativnu ekonomiju, koja polazi od obnove resursa, održivosti, otpornosti i odgovornog upravljanja, te digitalnu ekonomiju, koja kroz nove tehnologije, podatke, digitalne platforme i vještačku inteligenciju snažno mijenja način poslovanja, javnog upravljanja, obrazovanja i istraživanja.

Savremene ekonomije suočavaju se s kompleksnim i višedimenzionalnim promjenama. Klimatske promjene, energetska tranzicija, digitalna transformacija, demografski pritisci, promjene na tržištu rada, nestabilnosti globalnih lanaca vrijednosti i potreba za većom institucionalnom učinkovitošću nameću zahtjev za novim razvojnim modelima. U takvim uslovima, koncept regenerativne ekonomije nadilazi tradicionalno razumijevanje održivosti, jer ne podrazumijeva samo smanjenje negativnih efekata ekonomskih aktivnosti, nego i aktivno obnavljanje prirodnog, društvenog, institucionalnog i ekonomskog kapitala. Digitalna ekonomija, s druge strane, pruža alate za povećanje produktivnosti, transparentnosti, inovativnosti i prilagodljivosti privrede, ali istovremeno otvara pitanja digitalnih kompetencija, etike, sigurnosti, uključivosti i ravnomjernog pristupa tehnologijama.

ICEI 2025 je organizovan s ciljem da ponudi prostor za akademsku raspravu o tome kako zemlje Jugoistočne Evrope mogu oblikovati održivu konkurentnost u uslovima ubrzane digitalizacije i potrebe za regenerativnim razvojnim pristupima. Poseban značaj konferencije ogleda se u nastojanju da se teorijski uvidi povežu s empirijskim nalazima i praktičnim preporukama, kako bi rezultati naučnih istraživanja mogli biti korisni ne samo akademskoj

zajednici, nego i privredi, institucijama vlasti, obrazovnim ustanovama, razvojnim organizacijama i drugim akterima društveno-ekonomskog razvoja.

Ekonomski fakultet Univerziteta u Tuzli realizovao je Devetu internacionalnu naučnu konferenciju u saradnji sa uglednim koorganizatorima iz regiona: Ekonomskim fakultetom Sveučilišta Josipa Jurja Strossmayera u Osijeku, Ekonomsko-poslovnom fakultetom Univerze v Mariboru, Beogradskom bankarskom akademijom – Fakultetom za bankarstvo, osiguranje i finansije, Ekonomskim fakultetom Univerziteta Crne Gore u Podgorici, Ekonomskim fakultetom Prilep Univerziteta „Sv. Kliment Ohridski“ iz Sjeverne Makedonije i Fakultetom za hotelijerstvo i turizam Vrnjačka Banja Univerziteta u Kragujevcu. Ova saradnja potvrđuje regionalni karakter konferencije i doprinosi snažnijem povezivanju ekonomskih fakulteta u zajedničkom evropskom prostoru visokog obrazovanja i naučno-istraživačkog rada.

Program konferencije bio je oblikovan tako da objedini svečano otvaranje, plenarnu sesiju, specijalnu sesiju, naučno-istraživačke sesije, studentsku sesiju i završnu raspravu. Uvodni dio konferencije otvorio je prostor za institucionalno obraćanje predstavnika organizatora, koorganizatora, Univerziteta u Tuzli i predstavnika javne vlasti. Time je dodatno naglašena važnost povezivanja akademske zajednice, javnih institucija i šire društvene zajednice u definisanju razvojnih pravaca koji se odnose na održivost, digitalnu transformaciju i konkurentnost.

Plenarna sesija pod nazivom „Regenerativna i digitalna ekonomija“ bila je posvećena ključnim konceptualnim i praktičnim pitanjima transformacije savremenih ekonomskih sistema. U okviru uvodnih predavanja otvorene su teme pametne, cirkularne i digitalne tranzicije, kao i uloge digitalne ekonomije kao stuba transformacije prema regenerativnim razvojnim modelima. Time je postavljen širi teorijski i razvojni okvir konferencije, koji je učesnike usmjerio prema razumijevanju digitalizacije ne samo kao tehnološkog procesa, nego kao temeljnog faktora promjene poslovnih modela, javnih usluga, istraživačkih praksi i razvojnih politika.

Posebno značajan dio konferencije predstavljala je specijalna sesija „Transformacijski putevi ka održivoj i digitalnoj ekonomiji“, zamišljena kao dijalog istraživača i praktičara o integraciji regenerativnih modela i novih tehnologija u ekonomijama Jugoistočne Evrope. Učešće univerzitetskih profesora i stručnjaka iz Bosne i Hercegovine, Hrvatske, Slovenije, Srbije, Sjeverne Makedonije i Crne Gore omogućilo je poređenje različitih iskustava i perspektiva. Ova sesija ukazala je na činjenicu da zemlje regiona dijele slične razvojne izazove, ali i da raspolažu značajnim znanjem, institucionalnim iskustvom i akademskim potencijalom koji može biti osnova za zajedničke projekte, istraživanja i razvojne inicijative. Naučno-istraživački dio konferencije obuhvatio je sedam tematskih oblasti: finansije i finansijsku politiku, marketing, digitalnu ekonomiju, računovodstvo i reviziju, menadžment i poduzetništvo, ekonomsku teoriju i politiku, te kvantitativnu ekonomiju. Ovakva struktura pokazuje širinu naučnog interesa i potvrđuje interdisciplinarni karakter konferencije. U okviru navedenih oblasti razmatrana su pitanja zelenih fiskalnih politika, javnih finansija, finansijske pismenosti, digitalnih javnih usluga, elektronskih plaćanja, cloud tehnologija u visokom obrazovanju, održivog izvještavanja, transformacije računovodstvene profesije, vještačke inteligencije u poslovanju, organizacijske kulture, poduzetničke orijentacije,

regenerativnog turizma, javnog duga, institucionalnog kvaliteta i primjene savremenih kvantitativnih metoda.

Posebno je važno istaći da je u Zborniku radova ICEI 2025 objavljeno 45 radova, raspoređena u sedam tematskih sekcija. Najveći broj radova pripada oblasti menadžmenta i poduzetništva, u kojoj je zastupljeno 13 radova, dok sekcija marketing sadrži osam, a sekcija finansije i finansijska politika sedam radova. Digitalna ekonomija obuhvatila je četiri rada, računovodstvo i revizija tri rada, ekonomska teorija i politika sedam radova, a kvantitativna ekonomija tri rada. Ovakva raspodjela pokazuje da je centralna tema konferencije prepoznata kroz više naučnih disciplina, s naročitim naglaskom na menadžerske, poduzetničke, finansijske i digitalne aspekte održive konkurentnosti.

U autorskoj strukturi Zbornika evidentirano je 107 autorskih pojavljivanja, odnosno 86 jedinstvenih autora. Od ukupnog broja radova, osam radova je pripremljeno kao samostalni autorski doprinos, dok je 37 radova rezultat koautorske saradnje. Ovi podaci potvrđuju izražen koautorski karakter konferencije, što je posebno važno za savremeni naučno-istraživački rad, jer složeni razvojni problemi zahtijevaju povezivanje različitih znanja, metodoloških pristupa i institucionalnih iskustava. Koautorstvo ujedno osnažuje regionalnu akademsku mrežu, omogućava razmjenu istraživačkih kompetencija i doprinosi kvalitetu objavljenih radova.

Sadržaj radova objavljenih u ovom zborniku pokazuje da se pitanje održive konkurentnosti Jugoistočne Evrope ne može posmatrati jednoznačno. Ono obuhvata sposobnost privreda da se prilagode zelenoj tranziciji, razvijaju digitalnu infrastrukturu, unapređuju institucionalni okvir, jačaju finansijsku stabilnost, uvode inovacije, osnažuju ljudski kapital, razvijaju odgovorne poslovne prakse i primjenjuju analitičke alate koji podržavaju kvalitetnije odlučivanje. Radovi iz oblasti finansija i finansijske politike ukazuju na značaj fiskalne održivosti, zelene javne potrošnje, poreskih politika i finansijske pismenosti. Radovi iz oblasti marketinga razmatraju promjene u ponašanju potrošača, digitalne kanale komunikacije, e-trgovinu i ulogu društvenih mreža u oblikovanju tržišnih odluka.

Radovi iz oblasti digitalne ekonomije posebno su važni za razumijevanje promjena koje digitalna infrastruktura, javne digitalne usluge, elektronska plaćanja i cloud tehnologije donose poslovnom sektoru i obrazovanju. Sekcija računovodstva i revizije ukazuje na transformaciju profesije u digitalnom dobu, ali i na rastući značaj održivog izvještavanja i novih standarda transparentnosti. Radovi iz menadžmenta i poduzetništva razmatraju vještačku inteligenciju, organizacijsku kulturu, inovativno ponašanje, upravljanje talentima, poduzetničku orijentaciju i nove kompetencije poslovnih lidera. Sekcija ekonomske teorije i politike doprinosi razumijevanju javnog duga, institucionalnog kvaliteta, regenerativnog turizma i regionalnog razvoja, dok kvantitativna ekonomija pokazuje rastući značaj mašinskog učenja, modeliranja i statističke analize u ekonomskim istraživanjima.

Studentska sesija pod nazivom „Strategije za zelenu i digitalnu transformaciju“ dodatno je obogatila konferencijski program. Učešće studenata i mladih istraživača ima poseban značaj jer potvrđuje da se teme regenerativne i digitalne ekonomije ne odnose samo na sadašnje razvojne izazove, nego i na buduće generacije stručnjaka, poduzetnika, menadžera i kreatora javnih politika. Kroz razgovor s predstavnicima realnog sektora, finansijske industrije, fintech oblasti, biodesigna i drugih savremenih područja, studenti su dobili priliku da

razumiju kako se koncepti zelene i digitalne transformacije primjenjuju u praksi i kako mogu oblikovati njihove buduće profesionalne puteve.

Deveta konferencija ICEI 2025 istovremeno je potvrdila važnost naučne recenzije i akademskih standarda. Objavljeni radovi prošli su postupak anonimne dvostruke recenzije, čime je osiguran viši nivo naučne utemeljenosti, metodološke odgovornosti i kvaliteta publikovanih doprinosa. Uloga programskog i organizacionog odbora, recenzenata, urednika, autora i koorganizatora bila je od presudnog značaja za uspješnu realizaciju konferencije i pripremu ovog zbornika.

Ovaj zbornik radova predstavlja vrijedan pregled savremenih istraživačkih pravaca u ekonomiji, menadžmentu, finansijama, marketingu, računovodstvu, digitalnoj ekonomiji i javnim politikama. On istovremeno dokumentuje stanje naučne rasprave o regenerativnoj i digitalnoj ekonomiji u Jugoistočnoj Evropi i nudi osnovu za buduća istraživanja, razvojne projekte, institucionalne reforme i nastavne sadržaje. Posebna vrijednost zbornika ogleda se u činjenici da okuplja autore različitih generacija, disciplina i institucija, čime doprinosi razvoju akademske zajednice i jačanju regionalne saradnje.

Vjerujemo da će radovi objavljeni u Zborniku Devete internacionalne naučne konferencije „Ekonomija integracija“ – ICEI 2025 biti korisni istraživačima, nastavnicima, studentima, stručnjacima iz prakse, predstavnicima javnog sektora i svim zainteresovanim akterima koji promišljaju budućnost privrede Jugoistočne Evrope. Regenerativna i digitalna ekonomija nisu samo istraživačke teme, nego razvojni pravci koji zahtijevaju strateško promišljanje, institucionalnu spremnost, interdisciplinarnu saradnju i odgovorno djelovanje. Upravo zato ICEI 2025 predstavlja doprinos razumijevanju puteva kojima zemlje regiona mogu graditi održivu, otpornu i konkurentnu budućnost.

Zahvaljujemo svim autorima, recenzentima, članovima programskog i organizacionog odbora, koorganizatorima, panelistima, studentima, medijima, partnerima i učesnicima konferencije na doprinosu uspješnoj realizaciji ICEI 2025. Njihov angažman potvrđuje da akademska zajednica ima važnu ulogu u oblikovanju znanja, politika i praksi potrebnih za razvoj ekonomija koje su istovremeno digitalno napredne, društveno uključive, institucionalno odgovorne i usmjerene ka dugoročnoj održivosti.

Predsjednik Programskog odbora ICEI 2025
Prof. dr. Bahrija Umihanić

FOREWORD

The Faculty of Economics, University of Tuzla organizes, on a biennial basis, the international scientific conference "Economy of Integration" (ICEI) as one of the recognized scholarly platforms devoted to examining contemporary economic, social, technological, and developmental challenges facing the countries of South-East Europe. From the first conference held in 2009 to the present day, ICEI has gradually grown into a regionally relevant academic forum that connects researchers, university teachers, practitioners, representatives of institutions, policymakers, students, and other stakeholders interested in economic development, the improvement of the business environment, and the strengthening of competitiveness in the European and global context.

The continuity of the conference confirms the commitment of the Faculty of Economics, University of Tuzla to contribute—through scientific research, international cooperation, and public dialogue—to a better understanding of the processes of economic integration. Previous editions of the conference addressed topics such as governance in times of crisis, the prospects for integration of the countries of South-East Europe, the role of knowledge in overcoming recession, the challenges faced by economies in a crisis environment, the importance of economic thought in contemporary society, (e)migration and competitiveness, the economic response to the crisis caused by the COVID-19 pandemic, and sustainable economy and tourism on the path toward European Union accession. Each of these conferences represented the academic community's response to the dominant developmental challenges of the time in which it was held.

The Ninth International Scientific Conference "Economy of Integration" – ICEI 2025 was held on 4 and 5 December 2025 at the Faculty of Economics, University of Tuzla, under the thematic title "Regenerative and Digital Economy: South-East Europe's Path to Sustainable Competitiveness." The choice of this theme arose from the need to direct the scholarly and professional public toward two interconnected developmental directions: the regenerative economy, which proceeds from the restoration of resources, sustainability, resilience, and responsible management; and the digital economy, which—through new technologies, data, digital platforms, and artificial intelligence—is profoundly changing the way business, public administration, education, and research are conducted.

Contemporary economies face complex and multidimensional changes. Climate change, the energy transition, digital transformation, demographic pressures, shifts in the labour market, the instability of global value chains, and the need for greater institutional efficiency all impose a demand for new development models. Under such conditions, the concept of the regenerative economy goes beyond the traditional understanding of sustainability, since it implies not only reducing the negative effects of economic activity but also actively restoring natural, social, institutional, and economic capital. The digital economy, on the other hand, provides tools for increasing the productivity, transparency, innovativeness, and adaptability of the economy, while at the same time raising questions of digital competences, ethics, security, inclusiveness, and equitable access to technology.

ICEI 2025 was organized with the aim of offering a space for academic debate on how the countries of South-East Europe can shape sustainable competitiveness under conditions of accelerated digitalization and the need for regenerative development approaches. The particular significance of the conference lies in the effort to connect theoretical insights with

empirical findings and practical recommendations, so that the results of scientific research may be useful not only to the academic community but also to the economy, government institutions, educational institutions, development organizations, and other actors in socio-economic development.

The Faculty of Economics, University of Tuzla organized the Ninth International Scientific Conference in cooperation with distinguished co-organizers from the region: the Faculty of Economics in Osijek, Josip Juraj Strossmayer University of Osijek; the Faculty of Economics and Business, University of Maribor; the Belgrade Banking Academy – Faculty of Banking, Insurance and Finance; the Faculty of Economics, University of Montenegro in Podgorica; the Faculty of Economics – Prilep, "St. Kliment Ohridski" University of North Macedonia; and the Faculty of Hotel Management and Tourism in Vrnjačka Banja, University of Kragujevac. This cooperation confirms the regional character of the conference and contributes to a stronger connection among faculties of economics within the common European area of higher education and scientific research.

The conference programme was designed to bring together the opening ceremony, a plenary session, a special session, scientific research sessions, a student session, and a closing discussion. The introductory part of the conference provided space for institutional addresses by representatives of the organizer, the co-organizers, the University of Tuzla, and representatives of public authorities. This further emphasized the importance of connecting the academic community, public institutions, and the wider society in defining development directions relating to sustainability, digital transformation, and competitiveness.

The plenary session, entitled "Regenerative and Digital Economy," was devoted to key conceptual and practical questions concerning the transformation of contemporary economic systems. The keynote lectures opened topics of smart, circular, and digital transition, as well as the role of the digital economy as a pillar of transformation toward regenerative development models. This established the broader theoretical and developmental framework of the conference, directing participants toward an understanding of digitalization not merely as a technological process but as a fundamental factor in the transformation of business models, public services, research practices, and development policies.

A particularly significant part of the conference was the special session "Transformational Pathways toward a Sustainable and Digital Economy," conceived as a dialogue between researchers and practitioners on the integration of regenerative models and new technologies into the economies of South-East Europe. The participation of university professors and experts from Bosnia and Herzegovina, Croatia, Slovenia, Serbia, North Macedonia, and Montenegro made it possible to compare different experiences and perspectives. This session highlighted the fact that the countries of the region share similar developmental challenges, but also that they possess significant knowledge, institutional experience, and academic potential that can serve as a basis for joint projects, research, and development initiatives.

The scientific research part of the conference covered seven thematic areas: finance and financial policy; marketing; the digital economy; accounting and auditing; management and entrepreneurship; economic theory and policy; and quantitative economics. This structure demonstrates the breadth of scientific interest and confirms the interdisciplinary character of the conference. Within these areas, the following issues were considered: green fiscal

policies, public finance, financial literacy, digital public services, electronic payments, cloud technologies in higher education, sustainability reporting, the transformation of the accounting profession, artificial intelligence in business, organizational culture, entrepreneurial orientation, regenerative tourism, public debt, institutional quality, and the application of contemporary quantitative methods.

It is particularly important to note that 45 papers were published in the ICEI 2025 Conference Proceedings, distributed across seven thematic sections. The largest number of papers belongs to the field of management and entrepreneurship, comprising 13 papers, while the marketing section contains eight papers and the section on finance and financial policy seven papers. The digital economy comprised four papers, accounting and auditing three papers, economic theory and policy seven papers, and quantitative economics three papers. This distribution shows that the central theme of the conference was recognized across several scientific disciplines, with particular emphasis on the managerial, entrepreneurial, financial, and digital aspects of sustainable competitiveness.

In the authorship structure of the Proceedings, 107 author appearances were recorded, corresponding to 86 unique authors. Of the total number of papers, eight were prepared as single-authored contributions, while 37 papers resulted from co-authored collaboration. These data confirm the pronounced co-authorship character of the conference, which is particularly important for contemporary scientific research, since complex developmental problems require the bringing together of different bodies of knowledge, methodological approaches, and institutional experiences. Co-authorship also strengthens the regional academic network, enables the exchange of research competences, and contributes to the quality of the published papers.

The content of the papers published in this volume shows that the question of the sustainable competitiveness of South-East Europe cannot be viewed in a one-dimensional way. It encompasses the ability of economies to adapt to the green transition, develop digital infrastructure, improve the institutional framework, strengthen financial stability, introduce innovations, build human capital, develop responsible business practices, and apply analytical tools that support better decision-making. Papers in the field of finance and financial policy point to the importance of fiscal sustainability, green public spending, tax policies, and financial literacy. Papers in the field of marketing examine changes in consumer behaviour, digital communication channels, e-commerce, and the role of social media in shaping market decisions.

Papers in the field of the digital economy are particularly important for understanding the changes that digital infrastructure, public digital services, electronic payments, and cloud technologies bring to the business sector and to education. The accounting and auditing section points to the transformation of the profession in the digital age, as well as to the growing importance of sustainability reporting and new standards of transparency. Papers in management and entrepreneurship address artificial intelligence, organizational culture, innovative behaviour, talent management, entrepreneurial orientation, and the new competences of business leaders. The economic theory and policy section contributes to an understanding of public debt, institutional quality, regenerative tourism, and regional development, while quantitative economics demonstrates the growing importance of machine learning, modelling, and statistical analysis in economic research.

The student session, entitled "Strategies for Green and Digital Transformation," further enriched the conference programme. The participation of students and young researchers is of particular significance, as it confirms that the themes of the regenerative and digital economy concern not only present developmental challenges but also future generations of experts, entrepreneurs, managers, and policymakers. Through dialogue with representatives of the real sector, the financial industry, the fintech field, biodesign, and other contemporary areas, students had the opportunity to understand how the concepts of green and digital transformation are applied in practice and how they may shape their future professional paths.

The Ninth ICEI 2025 Conference also affirmed the importance of scientific peer review and academic standards. The published papers underwent a double-blind anonymous review process, which ensured a higher level of scientific soundness, methodological responsibility, and quality of the published contributions. The role of the programme and organizing committees, the reviewers, the editors, the authors, and the co-organizers was of decisive importance for the successful realization of the conference and the preparation of this volume of proceedings.

This volume of proceedings represents a valuable overview of contemporary research directions in economics, management, finance, marketing, accounting, the digital economy, and public policy. At the same time, it documents the state of scholarly debate on the regenerative and digital economy in South-East Europe and offers a basis for future research, development projects, institutional reforms, and teaching content. The particular value of the proceedings lies in the fact that it brings together authors of different generations, disciplines, and institutions, thereby contributing to the development of the academic community and the strengthening of regional cooperation.

We believe that the papers published in the Proceedings of the Ninth International Scientific Conference "Economy of Integration" – ICEI 2025 will be useful to researchers, teachers, students, practitioners, representatives of the public sector, and all interested stakeholders reflecting on the future of the economy of South-East Europe. The regenerative and digital economy are not merely research topics but development directions that require strategic thinking, institutional readiness, interdisciplinary cooperation, and responsible action. It is precisely for this reason that ICEI 2025 represents a contribution to understanding the paths along which the countries of the region can build a sustainable, resilient, and competitive future.

We thank all the authors, reviewers, members of the programme and organizing committees, co-organizers, panellists, students, media, partners, and participants of the conference for their contribution to the successful realization of ICEI 2025. Their engagement confirms that the academic community plays an important role in shaping the knowledge, policies, and practices needed for the development of economies that are at once digitally advanced, socially inclusive, institutionally responsible, and oriented toward long-term sustainability.

President of the ICEI 2025 Programme Committee
Prof. Dr. Bahrija Umihanić

FINANCE AND FINANCIAL POLICY / FINANSIJE I FINANSIJSKA POLITIKA

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PERSPECTIVES OF FACTORING AS AN ALTERNATIVE SOURCE FOR FINANCING MACEDONIAN SMEs

ABSTRACT

Factoring as a product of autonomous trade practice has become a very popular method for small and medium enterprises' (SMEs) financing. The financing through factoring is a specific way of fundraising through the account receivables sale by the factor provider who buys the account receivables for some financial interest. The main aim of the research is to analyze the factoring legal regime and practical application of factoring in the Republic of North Macedonia through some economic indicators. More specifically, it will be implemented comparative analysis on the legal regime and application in some Balkan countries. The main findings of the research highlight that the factoring in the Republic of North Macedonia is recognized in many legal acts but it's still missing a unitary regulation for the way on which the financial companies and banks will perform this service as factors. Considering the results of the research, the authors provide recommendations aimed to improve the application of factoring as an alternative source for SME's finding in North Macedonia.

Keywords: *factoring contract, SMEs, financing, lex specialis.*
JEL: K22, K12, C00, G32

1. INTRODUCTION

Factoring is a specific way of fundraising through the account receivables sale by the business entity via intermediary organization, i.e., factor or factoring-organization. This way of financing is characterized by many advantages where the client (producer) may collect its receivables before their maturity date, while the client (producer) maintains its current liquidity without new debits.

According to Bhogal and Trivedi, factoring is the selling of invoices by a seller to a third party called a factor. The factor processes invoices and allows the seller to withdraw money against the amount owed under the invoices (Bhogal & Trivedi, 2008, p. 132). Factoring is a combination of different services, ranging from risk hedging through collection and recovery management to invoice portfolio control (Flores-Ureba et all., 2023, p. 39).

With factoring, the company may obtain financing more easily and faster compared to how to obtain funding from banks. Factoring enables immediate cash flows by selling invoices to a third party at a discount (Palmieri & Ferilli, 2024, p. 497). In developed countries factoring is increasingly common as a source of external financing because of its uniqueness and the unique role of getting funds to companies. Considering the fact that SMEs are dominant in each economy and they are unable to raise sufficient financing, they are the main target group for factoring and reverse factoring.

Factoring helps in improving the cash flow of the companies, provides fresh working capital at the moment when they need it most and supports their growth and development. Also, the factor provider fills the lack of SMEs in the area of management, organization, promotion and commercial planning, thus the factor has elements of specialization, rationalization and information (Carvalho, 2021, p. 92).

The factoring market has demonstrated robust growth, increasing from $3590.13 billion in 2023 to $3876.8 billion in 2024, and is expected to reach $5238.82 billion in 2028. (Credence Research Report). Due to the rise of cross-border trade and the number of SMEs that will need to mitigate the risks of non-paying trade partners, the potential of the factoring market is expected to grow constantly.

Annual Factoring data published by EU Federation shows that the total turnover for the factoring and commercial finance industry across Europe in 2023 was over 2,44 trillion euros and represented 12% of Europe GDP in 2023 (EU Federation Factoring and Commerce Finance, 2024). The statistics shows that the industry of factoring develops rapidly in China where the total volume reached 469,575 million euros in 2021 and the potential for growth is still great (Jing, 2023).

Small and medium sized enterprises (SMEs) are the backbone of many economies (Dörr, Schönhofer & Schwarz, 2024, p. 1). They are recognized as the engine of economic growth through employment generation, contribution to GDP, technological innovations, and other aspects of economic and social development. Many researches have shown that SMEs are faced with problems when they decide to acquire the necessary resources through external funding. Factoring is the alternative form for SMEs funding.

The paper is structured as follows. Section 2 elaborates on the recent research made on factoring and international legal framework. Section 3 explains data and research methodology. In Section 4, the authors present the legal framework of factoring with an overview of the case of North Macedonia and comparative analysis of the legal framework in some Balkan countries. The Factoring application in the Republic of North Macedonia through analysis of some economic indicators is elaborated in section 5. The last section concludes and recommends.

2. RECENT RESEARCH

The businesses can use different sources of financing during the different stages of a company's life. Factoring is a widely used source of business funding and established as a financial tool for a company's cash management (Flores-Ureba et all. 2023, p. 39). Many studies have attempted to explore the importance of factoring, the legal framework, the nature of factoring contracts and the role of factoring for financing SMEs.

The legal nature of factoring contract is unclear and complex (Paraschiv, 2013, p. 139), due to the fact that contract is mixed (Xinjun, 2020, p. 107) and contains elements from different types of trade contracts such as cession, contract for credit, service contract etc., but considering its originality (as a consequence of its origin and functioning in business practice) it is most correct to treat it as a specific sui generis contract (Spasić, 2010, p. 131).

It is essential to be pointed out that this contract is formal, must be signed in written form, prior prepared and offered by the factor. According to Dogaru and Bratiloveanu (2016, p. 29-30) some of the legal characteristics of factoring agreements are: mutually binding contract, consensual contract, onerous contract, continuing contract, contract of adhesion, ancillary contract, complex contract etc.

In practice there are different types of factoring. Hubbard (1987) points out that there is a difference between maturity factoring (the customer only expects to receive the full payment of the invoice in maturity date capitalizing on the credit protection given by factor) and discounting factoring (the customer receives a sight payment, as a discount, against assignment of the invoice to the factor). He also added a so-called over advance factoring which implies financing of customer's inventory (purchases) in anticipation of an assigning of future receivable to be created after sale of this inventory (Hubbard, 1987, p. 72). This practice ideally suits business with seasonal purchases/sales.

According to Erić et all. (2012, p. 132) factoring is primarily intended for small and medium enterprises that traditionally have harder access to bank loans, because of low credit capacity or inadequate collateral and is one of the best ways of securing a fast and safe payment of accounts receivable, based on the sale of goods or services.

Klapper (2006, p. 311) argues that factoring is becoming a growing source of external financing for SMEs and it is a comprehensive financial service that includes credit protection, accounts receivable bookkeeping, collection services and financing.

The globalization of factoring has been reinforced by some international bodies whose aim is to improve the process of harmonization and modernization of some trade acts. The most

important factoring international regulative, rules, definitions, guidance papers or other acts that are related to factoring are: UNIDROIT Convention on international factoring, Model law on factoring by UNIDROIT, United Nations Convention on the Assignment of Receivables in International Trade by UNCITRAL, FCI General rules for international factoring, Model Factoring law by IFG etc. The main purpose of all of these documents is establishing greater standardization, transaction rules as well as legal and regulatory frameworks in the area of factoring. The greater standardization will strengthen the profound effect of factoring, its utilization and transparency while using this alternative financing model worldwide.

On a national level, different national approaches may be noticed in the way the factoring is regulated. There are countries where factoring has not been regulated yet, countries that have adopted some articles in their civil or commercial codes/laws, and countries that have adopted special factoring law or special contract law provisions for factoring. Factoring is a legal product of common law but has been accepted by many jurisdictions that have a civil law tradition, thus becoming a global phenomenon. (Ruddy, Mills, Davidson, 2017). The survey conducted by EBRD in 2018 shows that many of EBRD countries of operation have started working on or have already introduced specialized laws or specific provisions in general commercial legislation facilitating factoring operations (EBRD, 2018).

The newest factoring survey in selected EBRD jurisdictions published in 2024, shows that Egypt, Greece and Türkiye have adopted a specific law on factoring, Armenia and Ukraine have some specific provisions on factoring in their civil codes, Georgia, Romania, Kyrgyz Republic and Uzbekistan do not have specific contract law rules on factoring and parties rely on the general assignment provisions when drafting contracts (EBRD, 2024, p. 14). One of the novelties of the new Chinese civil code, that entered into force on the first of January 2021 is that four new nominate contracts were added, including factoring contract (Herbots, 2021, p. 45).

The situation with the legislation in the range of European Union shows that several European countries have adopted factoring *lex specialis,* e.g. Germany, Italy, Austria, Hungary, France, Greece, Spain and Portugal (Gongeta, 2017, p. 321). The background of this situation stems from the fact that factoring as a specific financial service is not regulated on European Union level.

From the analysis on published papers and research in Macedonia related to factoring, Koevski, (2007, p. 43) states that in the country there is still not enough precision in the legal regulation, that does not allow interested subjects to use factoring advantages in full. Dabovic-Anastasovska et all. (2013, p. 113-114), elaborate all domestic laws where factoring as a contract or as activity is mentioned.

It is evident that in time of rapid development of factoring regulation and application in developed countries, there is a research gap into the field of factoring such as alternative way of business funding in the Republic of North Macedonia.

3. RESEARCH METHODOLOGY

The paper employs qualitative and quantitative methods based on the analysis of secondary data. Broaden analysis on the factoring legal framework including factoring related laws and by-laws adopted in Republic of North Macedonia, Serbia, Croatia, Bulgaria, Albania, Kosovo, Bosnia and Herzegovina and Montenegro, was made by using a qualitative method, method of analysis and comparative method.

Quantitative methods were used for analyzing collected data from the annual reports of National Bank of the Republic of North Macedonia (Data and Indicators of the Banking System in the Republic of North Macedonia), the State Statistical Office of the Republic of North Macedonia (Gross Domestic Product approach) issued for the time period 2009-2024 and Annual Review of FCI for 2023.

These data were compiled and analyzed by using Microsoft Excel in way to show the share of factoring to non-financial institutions incomes in North Macedonia and share of factoring to non-financial institutions in the North Macedonia in GDP and sum factoring volume by some Balkan countries. The visuals produced in Excel contribute to greater accuracy and clarity in the research.

4. ANALYSIS ON FACTORING LEGAL FRAMEWORK IN THE REPUBLIC OF NORTH MACEDONIA AND SOME BALKAN COUNTRIES

The Republic of North Macedonia has not signed the UNIDROIT Convention on international factoring nor the United Nations Convention on the Assignment of Receivables in International Trade by UNCITRAL. Factoring in the Republic of North Macedonia until recently was mentioned only in certain provisions of the Law on Banks and the Law on foreign exchange operations. The Law on Banks from 2007 formally recognized factoring as one of the financial activities that may be conducted by both banks and non-banking financial institutions. The Law does not specify the essence of factoring, types of factoring, operations of factors, legal relations between the contracting parties etc.

The basic text of the Law on Financial Companies adopted in 2010, has regulated factoring as a financial activity based on contract concluded in writing, where the financial company (factor) assumes the claims of another domestic or foreign legal entity (creditor), with or without recourse. The legislator refers to an application of the provisions of the Law on Obligations for the rights and obligations of the factor and creditor, although factoring as a named contract is not mentioned in the Law on Obligations.

The Law on amendments and supplements to the Law on Financial Companies (National Gazette No.154/2023) adopted in 2023, regulates in details the types of factoring (domestic or international, factoring with the right recourse and reverse factoring), the content of the factoring contracts, the legal repercussions in case of bankruptcy of the factor or the debtor.

The definition of factoring was also modernized and now states: “factoring is financial activity based on a contract concluded in written or electronic form, where the financial company (factor) buys receivables from another domestic or foreign legal entity (debtor or

client)". This is in line with contemporary legislation, where the electronic form of contracts is already widespread in all the areas of commerce.

Although banks and financial companies are the only entities in North Macedonia that may be allowed to be factors, the legal sources regulating their factoring operations are different, the Law on Banks and the Law on Financial Companies. Law on Banks regulate factoring operations of banks in only a few provisions, thus it is necessary to regulate factoring in the Law on Banks in the same way as it is done by the Law on Financial Companies, or factoring should be regulated in a specialized factoring law.

The possibility for implementing factoring contracts in the Civil Code that is in the initial stage of drafting, may be insufficient in the manner that Civil Code won't prescribe the financial and administrative activities of banks and financial service companies. Therefore, it needs some form of legislation that specifically regulates the financing activities of factoring in order to fill the weakness of the Civil Code, and is more tailored to the practical needs of financing activities of factoring (Fauzie Yusuf, Ahmad, & Hamid, 2005, p. 52-53).

For the purpose of this research the authors made a comparative analysis on the legal framework of the Republic of North Macedonia with some Balkan countries: Serbia, Croatia, Bulgaria, Albania, Kosovo, Bosnia and Herzegovina and Montenegro. The table below presents: the valid legal framework; the minimum basic capital of factors and the number of registered factors.

The data is obtained from the official national gazette, and the number of the registered factors are from the national registers, publicly available on the web pages of competent national authority or bodies such as: National Banks, Agencies or Ministries of finance. The methodology of issuing a list of authorized factors differs in the Balkan countries: in some the lists of factors are published including both banks and non-banking financial institutions as factors (e.g. Kosovo), in other countries are published lists of non-banking financial companies with activities they are allowed to provide (e.g. Republic of North Macedonia, Bulgaria, Albania).

In the region, most of the Balkan countries, regulate factoring in *lex specialis*. Albania was the first of the analyzed Balkan countries that enacted a specialized law on factoring in 2006. Followed by Serbia, when in 2013 the Law on factoring have been adopted and further amended in 2018. Croatia have adopted the Law on factoring in 2014 and amended it in 2016. Afterwards the Federation Bosnia and Herzegovina have adopted a Law on factoring in 2016 and amended in 2020. In Montenegro factoring is regulated in special law dedicated to leasing, factoring, purchase of receivables, micro crediting and credit guarantee (Official Gazette Montenegro 73/17, 44/20). In this context, in those countries factoring is observed as a named contract (Bikić, 2021, p.11).

Table 1. Factoring regulation in some Balkan countries

Country	Factoring legislative	Factoring providers	Minimum basic capital for factor registration (excluding banks)	Number of registered factors
Republic of North Macedonia	the Law on Financial Companies (No. 158/10, … 154/2023); Law on Banks (67/2007, 90/2009, and 122/2021)	a) Banks and b) non-banking financial companies	30.000.000 denars such as financial company (approx. 482.580 EUR)	16 out from 26 non-banking financial companies published in the Registry of non-banking financial companies, are allowed to be factors
Serbia	the Law on Factoring, dated 16.07.2013 (Gazette of the Republic of Serbia No. 62/2013) amended in 2018 (Gazette of the Republic of Serbia No 30/2018);	a) banks, b) companies organized such as joint stock companies or limited liability companies, licensed for factoring activity and c) foreign banks and foreign companies - exclusively for international factoring.	40.000.000 dinars (approx. 340.804 EUR)	26 factoring companies registered in Factoring register
Croatia	the Law on Factoring (No. 94/14, 85/15, 41/16);	a) companies organized such as joint stock companies or limited liability companies, licensed for factoring activity, b) factoring companies from other EU members c) subsidiary of foreign factor companies d) banks	1 million kuna (approx. 132.720 EUR)	3 factoring companies registered in a register published by Croatian financial services supervisory agency
Bulgaria	Law on Credit Institutions, dated 1.1.2007, last amended n. 70/2024	a) banks and b) financial institutions	1 million Bulgarian leva (approx. 511.290 EUR)	70 financial out of 252 financial companies registered in the Registry are allowed to be factors.

Country	Factoring legislative	Factoring providers	Minimum basic capital for factor registration (excluding banks)	Number of registered factors
	Corporate Income Tax Act Promulgated, State Gazette No. 105/22.12.2006, effective 1.01.2007, amended and supplemented, SG No. 52/29.06.2007		According to Order No. 26, adopted by Bulgarian National Bank	12 financial companies from EU countries registered in Register in Bulgaria out of 15 are allowed to be factors
Albania	Law on Factoring, No. 9630 dated 30 October 2006, amended no.10029 dated 11.12.2008	a) a) banks b) b) non-banking financial institutions and c) c) commercial companies allowed for factoring services	Banks and commercial companies with minimum basic capital 20,000,000 (twenty million) all.) (approx. 193.760 EUR)	From 24 licensed non-banking financial entities, only 7 companies are allowed to be factors
Kosovo	Law on Banks, Microfinance Institutions and non-Banking Financial Institutions, No. 04/L-093 Official Gazette of the Republic of Kosova/ No. 11, 11 May 2012, Regulation on the registration of non-banking financial institutions, adopted by Central Bank of	a) Banks and b) Registered NBFI	EUR 150,000.00	List of 11 Banks and 25 NBFI. Only 1 NBFI is registered as a factor

Country	Factoring legislative	Factoring providers	Minimum basic capital for factor registration (excluding banks)	Number of registered factors
	the Republic of Kosovo on 29 November 2019; Regulation on Factoring,Central Bank of the Republic of Kosovo on 29 October 2018;			
Montenegro	Law on Financial Leasing, Factoring, Purchase of Receivables, Micro-Lending and Credit-Guarantee Operations (Official Gazette of Montenegro, No 73/2017 of 3 November 2017)	a) factoring companies and b) banks	EUR 125.000,00	2 factoring companies
Bosnia and Herzegovina	Law on factoring (Sl. novine FBiH 14/16, 74/2020)	a) companies organized such as joint stock companies or limited liability companies, licensed for factoring activity, b) banks c) foreign banks and foreign factor companies	750.000,00 km (approx. 383.226 euro)	1 factoring company with revoked license

Source: Authors' research based on national legislative and National registers for factors

From the data presented above, five of the analyzed countries have adopted *lex specialis* on factoring. Kosovo and Bulgaria regulate factoring services while prescribing the work of Non-Banking Financial Institutions. The Republic of North Macedonia is unique in the way it regulates factoring as a financial activity. Unlike many other jurisdictions, factoring is merely mentioned in the Law on Banks, without any further elaboration or even a formal definition of the term.

For the first time the notion of factoring, types of factoring and factoring contract, the legal repercussions in case of bankruptcy of the factor or the debtor, were defined in the Law on amendments and supplements to the Law on Financial Companies adopted in 2023. Consequently, at this moment there is a legal gap in the factoring operation provided by the Banks. Dualism in the regulation of factoring services provided by banks or non-banking financial institutions should be resolved by unification of the provisions dedicated to factoring in both laws, or by adopting one specialized on factoring operation.

The number of registered factors in analyzed Balkan countries presented in Table 1, shows that there is a significant disproportion, starting with only a few registered factors in some Balkan countries, till lists of more than 70 registered factors. This may be a consequence of a wide range of circumstances such as: the number of active trade companies in the country that may have a role of debtor or creditor of receivables whose assignment may be an object of the factoring contract; number of populations; demand and popularity of these kind of services; the encouraging and suitable regulatory and legislative frame-work that generates more interest for financial companies to register for providing these kind of services, taxation of the factoring services etc.

In the region, a factor service permission may be given to banks, non-banking financial companies or other factor companies organized such as joint stock companies or limited liability companies with adequate basic capital. The amount of the basic capital for the non-banking financial institutions that offer factoring services varies from 125.000 euros in Montenegro, approx. 132.000 euro in Croatia, 150.000 euros in Kosovo, approx. 193.000 euros in Albania, approx. 383.000 euros in Bosnia and Herzegovina, approx. 340.00 euros in Serbia, approx. 482.000 euros in the Republic of North Macedonia, to approximately 511.300 euros in Bulgaria.

Also, taxation could accelerate or slow down the application of factoring. Comparative research has shown that in some Balkan countries the rate of VAT ranges from 0% (Croatia, Albania, Kosovo) to 18% (the Republic of North Macedonia) (EBRD, 2018, p: 11,32,47,68).

5. FACTORING APPLICATION IN NORTH MACEDONIA THROUGH ANALYSIS OF SOME ECONOMIC INDICATORS

For the analysis of factoring volume and its proportion of GDP in the Republic of North Macedonia in the period 2009-2024, data were utilized from the annual reports published by the National Bank of the Republic of North Macedonia and the State Statistical Office.

Figure 1 illustrates that the lowest recorded factoring volume occurred in 2011, amounting to 44 million MKD, while the highest was observed in 2012, reaching 378 million MKD. Namely, unlike the developed market economies where the share of factoring in GDP is over 12%, in our country it is insignificant and in the period from 2009-2024 it was between 0.006% and 0.081% in relation to GDP (Figure 2).

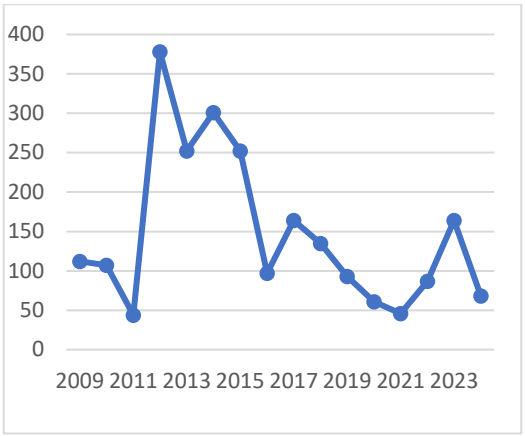


Fig. 1 Factoring to non-financial institutions in North Macedonia in MKD 2009-2024

Source: Authors' compilation from the annual reports issued by NBRM and the State Statistical Office of the Republic of North Macedonia, 2009–2024.

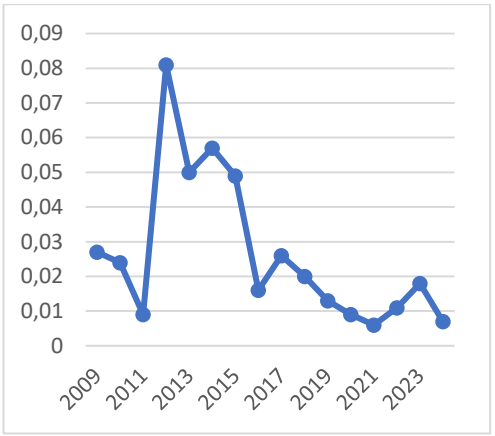


Fig. 2. % share of factoring to non-financial institutions in North Macedonia in GDP 2009-2024

Source: Authors' compilation from the annual reports issued by NBRM and the State Statistical Office of the Republic of North Macedonia, 2009–2024.

The data in the Figure 3 shows the factoring volume in millions of euros in some Balkan countries in the period 2018-2022, and it can be concluded that total factoring volume in most of the analyzed Balkan countries is increasing, especially in Bulgaria in 2022.[1]

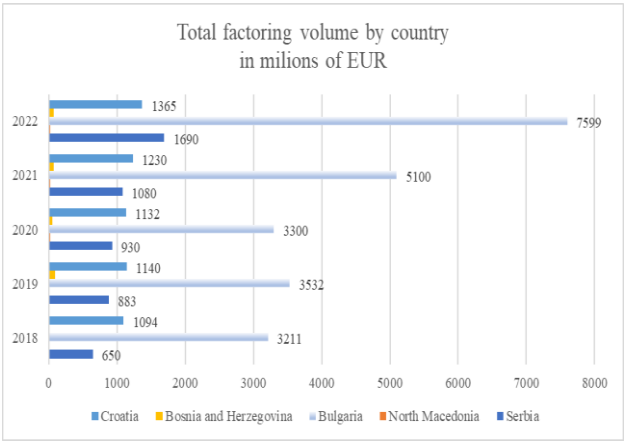


Fig. 3. Total Factoring volume by some Balkan countries

Source: FCI, Annual Review 2023, (FCI, 2023):31,32.

[1] n/a data for North Macedonia 2018, 2019 and Bosnia and Herzegovina for 2018.

Considering the data presented in above graphs, it can be concluded that in the Republic of North Macedonia the usage of factoring is trivial compared to the developed market economies where has been an evident growth. The rate of factoring volume even in some Balkan countries, such as Serbia, Croatia and Bulgaria shows an increasing trend. The international factoring statistics indicate that in the last 20 years the annual growth rate of global factoring is 8.68% (FCI, 2023, p.4). The strongest growth took place in the Asian continent between 2008 and 2015 (161%), followed by Europe (including Eastern Europe) with its plus 65 percent growth (Darabos & Bernadett Béresné, 2017, p.144). Statistical data in the EU shows that the total turnover for the factoring and commercial finance industry across Europe in 2023 was over 2,44 trillion Euros (EU Federation Factoring and Commerce Finance, 2024). The research confirms that this growth results mainly from the increased number of clients from the group of SMEs, which are in fact the backbone of each national economy. In particular, the clients' portfolio of FCI members consist mainly of SMEs, close to 64% in 2023 (FCI, 2023, p.23).

6. CONCLUSION

The SMEs in the Republic of North Macedonia rarely use factoring as a source of financing their business activities. Also, the application of factoring after the introduction into the legal system of Republic of North Macedonia, is in the initial stage of its development. The number of countries that have adopted specialized laws on factoring is increasing every year. Even five of seven forehead analyzed Balkan countries have adopted a factoring *lex specialis*. The Republic of North Macedonia, unfortunately keeps the particularism and dualism in regulating factoring services. The most desirable solution is adopting a specialized law for factoring services that will regulate the banks and the non-banking financial institutions factoring services in the same law. Unified law and introduction of a register of factors, would enable higher legal certainty for the participants in these contractual relations. While adopting the *lex specialis*, the legislator would take into consideration the international acts – conventions referring to factoring, the UNIDROIT model law and the positive experiences of the countries in the region.

In order to overcome this situation, it is important to increase the SMEs knowledge about the advantages of this funding source, since through factoring the businesses could provide the necessary resources and maintain their liquidity in a very simple and cheap way.

Considering this, it is recommended to:

- improve the factoring law regulation, time to rethink about adaptation of factoring *lex specialis*;
- establish a publicly available factors' register as a way to familiarize legal entities with all registered and authorized factors;
- carry out more aggressive campaign for promoting the factoring as an alternative source for financing the businesses;
- organize info sessions and presentations about the factoring in order to increase the awareness of business entities, especially SMEs about the benefits of this kind of funding.

EU and the Court of Justice of the European Union (CJEU) classify factoring as a debt-collection service, not as credit provision and the factoring services are subject to VAT in all EU Member States. In neighboring non-EU countries, approaches differ some countries treat factoring similarly to credit, making it VAT-exempt; others treat it as administrative/debt-collection services, making it VAT-taxable. The candidate countries should harmonize this issue with EU practice.

Only in this way, through adoption of a precise framework, by overcoming the legal gaps in factoring, also by increasing the knowledge about factoring, businesses will be encouraged to use this source for financing their investment projects. Therefore, the benefits of factoring will be recognized by the SMEs; banks, non-banking financial institutions and the whole national economy.

The introduction of a unified legal solution and the implementation of recommendations for promoting factoring could form the basis for future research, assessing their effectiveness in encouraging the application of factoring as an alternative financing tool for SMEs.

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GREEN FISCAL POLICY THROUGH NATURAL RESOURCE TAXATION – THE CASE OF THE EUROPEAN UNION AND BOSNIA AND HERZEGOVINA

ABSTRACT

The European Green Deal and the Sofia Declaration on the Green Agenda for the Western Balkans emphasise sustainable natural resource management, biodiversity conservation, and the transition to a circular economy as central priorities in pursuing climate neutrality. The main objective is to improve management practices and prevent the overexploitation of natural resources while recognising the critical importance of ecosystem services. This priority is equally relevant for Bosnia and Herzegovina, considering its rich yet vulnerable natural capital, high dependence on natural resources for economic activities, and the need to align with EU environmental standards and sustainable development goals as part of its EU integration process. Across Europe, market-based policy instruments reinforcing the polluter-pays principle, such as environmental taxes, particularly resource taxes, have become increasingly favoured as tools for pollution control and natural resource management.

This paper explores the relationship between resource taxes and resource productivity within the green and circular economy context, focusing on the EU member states and Bosnia and Herzegovina from 2014 to 2023. Using a panel dataset and static panel regression models – including pooled Ordinary Least Squares (OLS), Fixed Effects (FE), and Random Effects (RE) – the study examines whether fiscal instruments, especially resource taxes, are associated with improvements in resource productivity and progress toward EU environmental performance targets. The expected findings will provide empirical insights into the role of fiscal policy in supporting the green transition and identify potential pathways for Bosnia and Herzegovina to fulfil its commitments under the Sofia Declaration for the Western Balkans, the European Green Deal, and relevant national strategies.

Keywords: *resource taxes, environmental taxes, resource productivity, circular economy, panel regression, European Union, Bosnia and Herzegovina, Sofia Declaration on the Green, European Green Deal.*

JEL: H21, H22, H23, C23, O44, Q54

1. INTRODUCTION

The growing global population, expanding economy, rapid urbanisation and a growing middle class have increased the demand for resources such as materials, water and land,

putting pressure on these natural resources (UNEP, 2024). The current utilisation of natural resources, especially non-renewable resources, is not sustainable for the environment (considering climate change, biodiversity loss, and natural resource degradation) (Wilts & O'Brien, 2018). Recent events and changes in global geopolitics continue to impact how resources are managed. In the last few years, the Covid-19 pandemic and recent global inflation have highlighted the vulnerability of the global supply chain of material resources (also referred to as "materials"), as well as the need to secure the supply of essential materials while reducing materials demand at the same time. This has been reflected in resource policy developments, particularly on energy use, plus business actions to restructure supply chains and reduce supply disruption risks. Companies and countries are investing in extraction and processing projects in producing countries. Alongside the vulnerability of supply chains, material demand (including materials classed as "critical") is expected to continue increasing in the coming decades (UNEP, 2024). This will be in order to feed an increasing population with changing models of consumption and to supply the materials required for goods, infrastructure and services, as well as for the deployment of the clean energy transition.

The global average of material demand *per capita* was 8.4 tonnes in 1970 and grew to 12.2 tonnes *per capita* in 2020. Material demand grew in line with GDP but rose significantly faster than the population. This has resulted in stagnant material efficiency in the global economy and increased consumption and material living standards. It is worth noting that the acceleration of global material extraction since 2000 has coincided with a slowdown in GDP and population growth. One driver of this phenomenon is likely to be the disproportionate concentration of GDP growth in economies transitioning from an agrarian-based to an urban-industrial economic mode, which is particularly intensive in material and energy use (Krausmann *et al.*, 2008).

Biomass growing and harvesting, mineral and fossil resource extraction, and processing of materials, fuels and food accounted for more than 55% of global greenhouse gas emissions in 2022 and more than 60% if land-use change impacts are considered. This is a further increase compared to 2015 (reference year GRO 2019), demonstrating that climate mitigation efforts have neglected material-resource-related impacts. Growing and harvesting biomass (crops and forestry) contributed over 90% to global biodiversity loss and water stress. Few industrial sectors – food-related sectors (agriculture, retailers, and food services), wood-related industries (forestry, construction) and increasingly biochemicals – are responsible for the bulk of biodiversity loss and should be primarily targeted by policy. The extraction of resources and processing for food, materials, and fuels emitted many times more CO_2 emissions than the target would allow for all human activities combined and greatly exceeds targets for biodiversity loss. A transition to a circular and sustainable bioeconomy is critical, given the growing environmental impacts of biomass resources for all impacts. Reducing overconsumption, animal-based food, and food waste would bring co-benefits for all environmental impacts. Conversion (and strong intensification) of biodiversity and carbon-rich natural systems should be avoided and reversed. Since the availability of sustainable biomass is limited, biomass should be used in cascades and in long-term applications with biogenic carbon storage effects, replacing materials with significant impacts. Climate mitigation efforts have so far focused too little on agriculture, resource extraction, and processing and urgently need to be directed to this issue. Otherwise, the Paris Agreement goals cannot be achieved. This includes creating a circular economy to

decrease the impacts of resources, whereby attention needs to be paid to sustainability and clean cycles (UNEP, 2024).

Resource efficiency is argued to be an indispensable element in this context, as earlier development patterns have led to prosperity, but through intensive and often inefficient resource use. Efficient use of available resources emerges as an imperative, not only because of their scarcity and the need to preserve them for future generations but also to reduce environmental impacts. A resource-efficient economy is, therefore, necessary. A resource-efficient economy (particularly a circular one) is an economy where economic development and growth are not achieved at the expense of natural resources' value, diversity, and quality. In developing a resource-efficient economy, the challenge lies in the fact that both the public and businesses perceive the use of ecosystem services as if their supply were unlimited. This challenge is related to the fact that these goods and services are not properly valued in the market (mostly taken for granted and treated as "free" goods) (UNDP, 2014). As a result, ecosystems are often overused, degraded, and polluted, negatively affecting human activities' long-term sustainability and resilience to external shocks.

In the effort to promote resource productivity, all policies must integrate sustainability principles. A policy mix that combines industrial, regulatory, R&D, and innovation instruments should also be developed with environmental, fiscal, and financial policies, public purchases, *etc*. Work is underway to develop specific fiscal and monetary policy instruments. Within this policy mix approach, particular attention will be placed on fiscal policies. Because they affect prices, fiscal policies constitute a potentially effective structural instrument for guiding markets and the behaviour of economic agents. In fact, the extensive literature on environmental policy clearly advocates market instruments based on prices and taxes (Vence & López Pérez, 2021). Economically, policies seek to ensure the sustainable usage of natural resources and manage associated costs. Socially, the aim is to distribute the goods produced through these resources and materials equitably (Abbas, 2024). Nevertheless, policy formulation for resource efficiency is still at a very early stage in EU Member States, with some notable exceptions (Wilts & O'Brien, 2018). Most countries were found to have a relatively long tradition of energy and waste policy. However, regarding material resource efficiency, many and varied institutional arrangements are in place, and several ministries are involved, with overlapping responsibilities and competencies.

Building upon the established understanding of resource productivity within the European context, this paper aims to bridge critical gaps by examining the role of resource taxes. The paper provides a rationale for such policies and develops guidelines for policymaking and managing the transition toward resource-efficient economies. Relying on the established understanding of resource productivity in the European context, this study examines the potential effects of resource taxes on improving resource productivity. Using panel data for EU countries and Bosnia and Herzegovina over the period 2014-2023 and conducting panel regression analysis, this research extends existing frameworks to better understand how resource taxes contribute to environmental quality, thereby offering policymakers valuable insights tailored to this context.

The rest of the paper is structured as follows. The first part of the paper presents previous research and theoretical background on the impact of resource taxes on resource productivity. The second part of the paper outlines the empirical research methodology,

including the selection of variables and data sources, and econometric models used for the analysis. The third part of the paper provides the results and discussion. The last part of the paper provides the conclusions and recommendations, summarising the key research findings and offering policy suggestions.

1.1. Previous research and theoretical background

Many authors have investigated the effects of environmental taxes in various contexts (Piciu & Trică, 2012; Ligthart, 1998; Keen, 2023; Dahmani, 2023; Morley, 2010; Kalaš *et al.*, 2025; Socci *et al.*, 2024; Tchapchet-Tchouto, Koné, & Njoya, 2022; Gyamfi, 2022, *etc.*). However, the literature examining the impact of resource taxes remains limited.

Some authors have explored the influence of resource taxation on the progress of the circular economy. In this context, Deserno and Sterk (2025) examine how resource taxation can promote circular economy development in 30 European countries over the period 1995-2021. They find that resource taxes have a positive effect on resource productivity. Yet the effects differ across countries, indicating that taxation can support circularity but must account for other influencing factors. Further, Bahn-Walkowiak and Wilts (2017) emphasise that designing effective policy mixes for resource efficiency faces conceptual and practical challenges within multi-level governance systems. They argue that contrary to the ideal of a coherent top-down design, real-world policy development is often shaped by *ad hoc* coalitions, fragmented responsibilities, and institutional incoherence among resource, waste, and energy policies. Their findings highlight that policy implementation depends not only on theoretical rationales but also on institutional capacities, coordination mechanisms, and the competences of actors responsible for managing "policy mixes". Moreover, they note that the transition from resource efficiency strategies to circular economy frameworks within the EU has been hindered by limited policy integration and the absence of binding targets. This suggests that the effectiveness of resource taxation and related instruments depends on institutional alignment, cross-sectoral coordination, and credible long-term policy frameworks. Additionally, Mushafiq and Prusak (2023) analyse EU-27 countries and demonstrate that higher resource productivity generally reduces environmental degradation, with effects differing across sub-samples depending on material footprint levels. Boadway and Flatters (1993) discuss the rationale for resource taxation, emphasising that special resource taxes aim to capture resource rents for the public sector, justified by efficiency and equity considerations. Building on this rationale, Amundsen (2024) provides an overview of Norway's resource rent taxation system, showing how such taxes have been applied to oil, natural gas, hydropower, wind power, and aquaculture, and highlighting that resource rents vary across sectors and over time, with future rents from fossil fuels expected to decline as renewable energy expands. This sectoral perspective is complemented by the broader cross-country evidence of Abbas *et al.* (2024), who analyse 39 resource-rich economies over the period 2000-2022. Their findings indicate that resource-based environmental taxation and green innovation significantly reduce the ecological footprint, while mineral trade and natural resource rents increase it. Taken together, these studies suggest that resource taxation not only captures rents for redistribution but can also serve as a tool to promote ecological sustainability when combined with innovation-driven strategies. However, studies examining the effects of resource taxes on resource productivity as an indicator of sustainability are lacking. To address this gap in the research literature, the present study

investigates how resource taxes improve resource productivity in European Union countries, as well as Bosnia and Herzegovina.

Natural resources (biomass, fossil fuels, metals, non-metallic minerals, land, and water) are directly or indirectly linked to all 17 Sustainable Development Goals (SDGs). The way societies use natural resources through linear consumption and production patterns determines the trajectories of environmental impacts and human well-being. Unsustainable consumption and production patterns are identified as the common thread of the triple planetary crisis. The triple planetary crisis is a science-based framework adopted by the United Nations system that refers to three interlinked global environmental crises: climate change, biodiversity loss, and pollution (UNEP, 2024). The imperative for sustainable growth has become increasingly evident due to global resource constraints and environmental pressures (Malatyinszki, Zéman & Géza-Kálmán, 2025). For the contexts where resource use is expected to grow to enable dignified living, the aim should be relative decoupling (where resource use increases more slowly than human well-being outcomes). For all contexts, impact decoupling is a precondition for any resource use trajectory to be considered sustainable (limiting environmental and health impacts to levels agreed in MEAs). Domestic Material Consumption has been selected by the Inter Agency Expert Group (IEAG) for Sustainable Development Goals indicators as the basis for monitoring progress towards SDG 12.2, which calls for the sustainable management of natural resources. This role has both strengths and weaknesses. Its role as an indicator of the total waste potential that must ultimately be sunk back into the environment within a nation's territory is valuable, and it cannot be replaced by consumption-based measures such as material footprint. On the other hand, it is currently used for the SDGs in a highly aggregated form (typically one or at least four individual material categories), lumping together materials with radically different environmental impacts per tonne. Finally, it is crucial to use DMC with a consumption-based measure (UNEP, 2024). The ratio of GDP to DMC, resource productivity, oversimplifies sustainability analysis since its numerator and denominator are not independent. Fossil fuels belong to the four main material categories used to calculate the resource use and the global and national resource productivities, and for example, construction activities, cement production and the use of buildings are not only material but also energy-intensive. Measures to increase resource efficiency or reduce resource use often directly impact energy use and CO2 emissions in many ways.

Time is of the essence when it comes to finding new renewable energy sources, cutting down on energy usage, and making efficient use of the limited resources available. Achieving maximum resource efficiency is necessary for sustainable growth on a worldwide level in the long run (Kirikkaleli & Agyemang, 2025). The general motivation behind resource policies is primarily twofold: firstly, to address the risks associated with environmental damages occurring throughout the entire life cycle of resource use (negative externalities); and secondly, to capitalise on opportunities arising from potential eco-innovation, provided that material purchasing costs can be reduced and redirected into new processes, products, and system innovations. Such eco-innovation may involve material flow innovation (Bleischwitz, 2010).

Improvements in resource productivity can be achieved through structural change in the economy away from resource-intensive primary and manufacturing sectors to service-sector activities or outsourcing of material-intensive processes to countries abroad. Many policy

instruments are available to regulate natural resource management and promote resource efficiency. In Europe, market-based instruments that reinforce the polluter-pays principle, such as environmental taxes, are increasingly favoured as tools for pollution control and sustainable resource management. These instruments create price differentials, making secondary or recycled resources more competitive (Deserno & Sterk, 2024).

The rationale for conventional environmental taxation is optimal taxation theory. In this theory, the principles of a "good tax system" are equity (vertical and horizontal), economic efficiency (does not distort the allocation of free market resources), and easy administration (management efficiency). The social planner's goal is to choose the tax system that maximises the representative consumer's welfare, knowing that the consumer will respond to whatever incentives the tax system provides. Absent any market imperfection, such as a pre-existing externality, it is best not to distort the choices of that consumer at all. This theory involves a narrow focus on individual consumer welfare and very unrealistic assumptions. It is challenging, if not impossible, to calculate the taxes and rates necessary to guarantee optimality in resource allocation and equity. On the contrary, it can be argued that any tax introduces a distortion in equity and allocation of resources; the question is how much and in which direction (Vence & López Pérez, 2021). The existing taxation system penalises labour-intensive activities, including many circular activities (*e.g.*, repair, maintenance, reuse, recycling, and remediation services), in contrast with the resource-intensive activities of the linear economy or the (robotised) manufacture of new products. Waste and resource use could be significantly reduced by decreasing the consumption of new material and energy resources, increasing the offer and consumer demand for circular activities (*e.g.*, reuse, repair, and maintenance) and, of course, recycling waste and returning it to the processing cycle (Vence & López Pérez, 2021). In the definition of Eurostat (2013), environmental taxes, *i.e.*, tax[es] whose tax base is a physical unit (or a proxy of a physical unit) of something that has proven, specific negative impact on the environment, can be divided into energy, transport, pollution, and resource taxes.

Natural resources are typically subject to taxation under the income tax system and special resource taxes. Properly designed income taxes attempt to include capital income on a uniform basis. However, in most countries, the income tax treats resource industries more favorably than most other industries through favourable treatment of such capital expenses as depletion, exploration and development, and the cost of acquiring resource properties (Boadway & Flatters, 1993). Over the past decade, resource taxation has received growing attention, with implementation advocated by various stakeholders. At EU level, the Commission emphasises the need to revise taxes and subsidies that distort the real costs of resource use. Resource taxation is also frequently debated at national and sectoral levels, like in Germany. Some European countries have already implemented resource taxes for specific materials, such as natural aggregates in Sweden, Denmark, and the UK (Deserno & Sterk, 2024).

2. METHODOLOGY OF THE EMPIRICAL RESEARCH

2.1. Selection of variables and data sources

This paper investigates the effects of resource taxes on resource productivity, using data from EU countries and Bosnia and Herzegovina for the period 2014-2023, sourced from Eurostat

and national statistical reports. The selected independent variable is resource taxes, while the dependent variable is resource productivity. Resource taxes constitute the core explanatory variable. They include taxes linked to the extraction or use of natural resources, such as water, forests, wild flora and fauna, since these activities contribute to the depletion of natural resources. All taxes designed to capture the resource rent from the extraction of natural resources are excluded. Similarly, land taxes are excluded from the scope, except for specific levies related to the conversion of landscapes (*e.g.*, deforestation). Most land taxes are classified as property taxes and belong to the ESA category D.51 (taxes on income). Data are expressed in million EUR.

Resource productivity, expressed in euros per kilogram (EUR/kg), measures the gross domestic product (GDP) generated per kilogram of material consumed. It serves as an indicator of resource efficiency, with higher values reflecting the ability to generate greater economic value with lower material input. Domestic Material Consumption (DMC) reflects the material consumption within the national economy, covering biomass, fossil fuels, minerals, and metal ores (domestic extraction and imports), excluding exported materials (including materials embodied in exported products). The DMC variable is based on the Economy-wide Material Flow Accounts (EW-MFA) methodology, in line with Regulation (EU) No. 691/2011 of the European Parliament and of the Council on European environmental economic accounts, particularly Annex III – Module for EW-MFA.

In addition to these key variables, the study incorporates several control variables to enhance the reliability of the model estimation results. The selected control variables are GDP *per capita* and the share of energy from renewable sources. The volume index of GDP *per capita* in Purchasing Power Standards (PPS) is expressed relative to the EU average, which is set equal to 100. An index value above 100 indicates that a country's GDP per capita is higher than the EU average, while a value below 100 indicates the opposite. This index is frequently used to compare the economic well-being of populations. However, GDP includes components and transactions that may be less relevant for assessing households' current material well-being. PPS is the technical term used by Eurostat to denote a common currency that eliminates differences in price levels between countries, enabling meaningful comparisons. PPS values are derived by dividing a country's economic aggregates in national currency by the respective purchasing power parities (PPPs). These data are primarily designed for cross-country comparisons, rather than time-series analyses.

Gross final renewable energy consumption refers to the amount of renewable energy used for electricity, heating, cooling, and transport in EU Member States. It is expressed as a share of gross final energy consumption. The Renewable Energy Directive (2009/28/EC) defines gross final energy consumption as the energy commodities delivered for energy purposes to final consumers (industry, transport, households, services, agriculture, forestry, and fisheries), including the consumption of electricity and heat by the energy sector for electricity and heat production, as well as transmission and distribution losses. This indicator is a headline metric for monitoring progress towards the objectives of the Eighth Environment Action Programme (8th EAP). In particular, it contributes to monitoring progress towards the sustainable energy goals of Article 2.f of the 8th EAP, which requires the promotion of environmental aspects of sustainability and the significant reduction of key environmental and climate pressures associated with the Union's production and

consumption patterns, especially in energy, industry, buildings and infrastructure, mobility, tourism, international trade, and the food system (EEA, 2025).

2.2. Econometric model

Three panel models were employed to evaluate the relationship between resource taxes and resource productivity. Specifically, pooled OLS, fixed effects, and random effects models were estimated to assess which regression specification best fits the data. Model adequacy was examined using the Hausman test, and the Breusch–Pagan test will be applied if conditions require it.

The following regression equation represents the general model for static panels:

$$RESPROD_{i,t} = \alpha_{i,t} + \beta_0 RESTAX_{i,t} + \beta_j Control_{i,t} + \varepsilon_{i,t} \quad (1)$$

where i and t are the individual and the year, respectively, α is a constant term, β is a parameter to be estimated, ε is a random error term, RESPROD is the resource productivity, *RESTAX* is the resource taxes, and *control* denotes the control variables. Control variables are the GDP *per capita* and the share of energy from renewable sources.

3. RESULTS AND DISCUSSION

As previously stated, the primary purpose of this study was to investigate the relationship between resource taxes and resource productivity in EU countries and Bosnia and Herzegovina. The standard measures of resource taxation were considered at the country level and were enhanced by incorporating indicators relevant to sustainable economic growth. Furthermore, the broader impact of national-level resource tax policies on improving resource productivity was examined. This section presents the empirical results of the research. The following table provides descriptive statistics for the observed variables.

Table 1. Descriptive statistics

Variable	Obs.	Mean	Std. dev.	Min.	Max.
RESPROD	228	1.9617	1.3384	0.2995	7.4285
RESTAX	226	77.8844	119.7934	0	450.0000
GDPPC	228	101.6579	47.8016	31.0000	280.0000
RENEWAB	227	24.6770	12.5755	4.4710	66.3930

Source: Authors' calculations using StataMP 17 software

The table presents descriptive statistics for the key variables used in the study. RESPROD (resource productivity) has an average value of 1.96, with a minimum of 0.30 and a maximum of 7.43, indicating substantial variation across countries. RESTAX (resource taxes) shows a mean of 77.88 and a wide dispersion (standard deviation 119.79), reflecting differences in tax policies among the observed countries. GDPPC (GDP *per capita*) averages 101.66, ranging from 31 to 280, capturing economic heterogeneity. Finally, RENEWAB (share of renewable energy) has a mean of 24.68%, with values ranging from 4.47% to 66.39%, illustrating varying levels of renewable energy adoption.

As shown in Table 2, RESPROD positively correlates with resource taxes (r = 0.3666) and GDPPC (r = 0.7030). These results suggest that higher resource taxation and income levels increase resource productivity.

Table 2. Correlations between the variables

Variable	RESPROD	RESTAX	GDPPC	RENEWAB
RESPROD	1.0000	0.3666	0.7030	-0.3694
RESTAX	0.3666	1.0000	-0.0013	-0.1160
GDPPC	0.7030	-0.0013	1.0000	-0.2598
RENEWAB	-0.3694	-0.1160	-0.2598	1.0000

Source: Authors' calculations using StataMP 17 software

Gujarati (2003) noted that if the correlation between the independent variables is larger than ± 0.8, we can conclude that severe multicollinearity problems exist. As shown in the correlation matrix, such a level of correlation does not exist in the model, and the variance inflation factor (VIF) test presented in Table 3 results confirm that model (1) does not suffer from the multicollinearity problem.

Table 3. Multicollinearity diagnostics (VIFs test)

Variable	VIF	1/VIF
RENEWAB	1.09	0.91896
GDPPC	1.07	0.93148
RESTAX	1.01	0.98549
Average	1.06	–

Source: Authors' calculations using StataMP 17 software

Table 4 presents the results of the panel regression analysis using OLS, FE, and RE models. RESTAX and GDPPC have positive and statistically significant coefficients across all models, indicating that higher resource taxation and *income per capita* are associated with higher resource productivity.

Table 4. Results of panel regression analysis

Variable	OLS model (a)	Fixed-effect model (b)	Random-effect model (c)
RESTAX	0.0038893 (0.0004452)***	0.0057466 (0.0011603)***	0.0054415 (0.0009432)***
GDPPC	0.0186683 (0.0011585)***	0.0111141 (0.0025506)***	0.0158311 (0.0021810)***
RENEWAB	-0.0165781 (0.0043799)***	0.0589841 (0.0057881)***	0.0455128 (0.0056429)***
Constant	0.1713142 (0.1941725)	-1.062676 (0.2924499)***	-1.20131 (0.3175861)***
Observations	225	225	225
Number of IDs	–	23	23
Adj. R^2	0.6471	0.4710	0.4501

Note: Significance levels of 1%, 5% and 10% are denoted by ***, ** and *, respectively.

Source: Authors' calculations using StataMP 17 software

The coefficient for RENEWAB is negative in the OLS model but positive in both FE and RE models, suggesting that accounting for country-specific effects changes the estimated impact of renewable energy on RESPROD.

Table 5 shows the Hausman test results comparing FE and RE models. The results indicate that the FE model is preferred. This implies that unobserved country-specific effects are correlated with the regressors, and the FE model provides consistent estimates.

Table 5. Hausman test (FE vs. RE)

Variable	FE Coef. (b)	RE Coef. (B)	Difference (b-B)	Std. err. of difference
RESTAX	0.0057466	0.0054415	0.0003052	0.0008165
GDPPC	0.0111141	0.0158311	-0.004717	0.0016625
RENEWAB	0.0589841	0.0455128	0.0134712	0.0026249

Source: Authors' calculations using StataMP 17 software

The estimated FE model can be expressed as follows:

$$RESPROD_{i,t} = -1.0627 + 0.00575RESTAX_{i,t} + 0.01111GDPPC_{i,t} + 0.05898RENEWAB_{i,t} + \varepsilon_{i,t}$$

According to this specification, a one-unit increase in RESTAX or GDPPC is associated with an increase in RESPROD, and the share of renewable energy contributes positively to resource productivity after controlling for country-specific effects. These results are consistent with the findings of Deserno and Sterk (2025), who also report that resource taxation can be an effective policy instrument in enhancing circular economy progress. Furthermore, both studies highlight that the effectiveness of resource taxation may depend on complementary policy measures, such as renewable energy incentives, waste management regulations, or broader environmental tax reforms. This could explain why RENEWAB shows a positive and significant association with resource productivity in our fixed-effects model, suggesting potential policy synergy between fiscal and energy transition measures.

4. CONCLUSIONS AND POLICY RECOMMENDATIONS

This study provided insights into the potential of resource taxes as a fiscal instrument to enhance resource productivity. However, as Bleischwitz (2010) emphasises, the complexity of addressing the various barriers and drivers associated with sustainable resource management, the likelihood of trade-offs among competing policy objectives, and the involvement of multiple actors suggest that no single instrument is sufficient; instead, a comprehensive policy mix is required. Despite the currently low levels of resource taxation, the findings indicate that resource taxes positively affect resource productivity, at least in the short term, and therefore appear to support the transition towards a circular economy. Nevertheless, the results demonstrate that other influencing factors must be considered while designing economic and environmental policy. These findings are consistent with Deserno and Sterk (2025), highlighting that resource taxation can contribute to circularity. Furthermore, in line with Abbas *et al.* (2024), integrating resource taxation with green

innovation can significantly mitigate the negative environmental impacts associated with resource dependence, enhancing ecological sustainability.

One limitation of this study lies in the measurement of resource productivity, which has several dimensions. Firstly, resource use is measured only in terms of physical weight, which does not adequately capture resource value, scarcity, or environmental impacts. Secondly, only domestic resource consumption is considered, while global resource flows, imports, and exports may significantly influence actual resource efficiency and sustainability. Thirdly, the analysis does not incorporate all possible socio-economic and institutional factors across countries, which may also affect the effectiveness of resource taxation.

In the context of these findings, effective policy design should integrate resource taxes within a broader fiscal framework that promotes green innovation and circular processes to maximise resource productivity and reduce environmental footprints. Resource taxation should be coupled with measures that incentivise research and development in sectors that utilise natural resources and differentiated based on resource type, scarcity, and ecological impact to ensure efficient and equitable allocation. Additionally, international resource flows should be monitored and incorporated into policy planning to accurately assess resource productivity, particularly within a global circular economy. In contrast, harmonisation with international policies should be considered. Resource taxes must be implemented alongside complementary regulatory measures, public investments in sustainable infrastructure, consumer education, and incentives for circular business models. A gradual implementation approach with continuous monitoring and adjustment is recommended, as abrupt or excessive taxation could lead to unintended socio-economic consequences.

In summary, resource taxation demonstrates significant potential to enhance resource productivity and facilitate the transition towards a circular economy. Its effectiveness, however, depends on strategic integration with policies promoting green innovation, sustainable production, and careful consideration of global resource flows. Effective resource policy must address multiple dimensions of sustainability – ecological, economic, and social – to ensure long-term resource sustainability and contribute meaningfully to achieving the SDGs.

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THE ROLE OF GREEN PUBLIC SPENDING IN REDUCING GREENHOUSE GAS EMISSIONS IN SELECTED EUROPEAN COUNTRIES: ALIGNING REGIONAL AND LOCAL BUDGETS WITH GREEN OBJECTIVES

ABSTRACT

Rising environmental degradation and increasing public awareness have prompted countries to adopt policies to reduce ecological damage. Global warming, climate change, and biodiversity loss pose serious economic and social challenges. At the same time, CO_2 emissions continue to rise, particularly in developing countries like Bosnia and Herzegovina, which faces limited institutional capacity.

Transitioning toward net-zero emissions by mid-century is essential to prevent irreversible climate risks. Energy efficiency improvements in energy-intensive sectors are central to mitigation efforts. However, financial constraints limit the widespread adoption of sustainable practices. Private initiatives alone are insufficient, highlighting the importance of public investment in green infrastructure at regional and local levels, filling gaps in private capital and stimulating further private-sector engagement.

This paper examines the impact of public spending on environmental protection activities – including waste and wastewater management, pollution abatement, biodiversity and landscape preservation, and ecological R&D - on greenhouse gas (GHG) emissions. Using panel data for EU member states and Bosnia and Herzegovina over 2014-2022, we employ regression models, specifically pooled Ordinary Least Squares (OLS), Fixed Effects (FE), and Random Effects (RE). Lagged effects are also considered, recognising that the benefits of public spending may materialise over time.

The findings provide empirical evidence on the effectiveness of fiscal instruments in mitigating environmental degradation and offer insights for aligning regional and local budgets with the EU's and the Western Balkans' long-term climate neutrality objectives. This

research further contributes to the limited empirical literature on the role of fiscal policy in reducing GHG emissions.

Keywords: *green public spending, fiscal policy, greenhouse gas emissions, environmental protection, climate neutrality.*
JEL: H30, H61, H72, H76, C23, Q53

1. INTRODUCTION

Since the Second Industrial Revolution, humankind has relied on technological change for societal betterment (Muchiri et al., 2025). Bhuiyan et al. (2022) note that fossil fuels have played a central role in enabling rapid economic growth globally. However, these developments have come at the cost of unabated long-term fossil fuel consumption, leading to significant greenhouse gas (GHG) emissions and, consequently, global warming (Chen & Chen, 2021). Considering that various economic activities increasingly exert pressure on the environment, recent decades have been marked by growing concern over the state of the natural environment. This concern has led to fundamental shifts in thinking about environmental management and public policy design (Nikolajev, 2024). Environmental pollution, including global warming, climate change, and biodiversity loss, has a profound and multidimensional impact on the economy. Air quality and environmental protection represent classic examples of public goods, characterised by non-rival consumption and non-excludability (He et al., 2018). Air pollution, among other factors, is linked to numerous health problems. For instance, $PM_{2.5}$ (particulate matter) can penetrate deep into the respiratory system and enter the bloodstream, being recognised as a primary contributor to various chronic and acute diseases. Climate change is now considered one of the most severe ecological challenges facing humanity, with the past thirty years witnessing a continuous rise in Earth's surface temperature, producing far-reaching consequences for human health, property security, economic system stability, and environmental preservation (Savranlar et al., 2024).

A key component of greenhouse gas emissions is CO_2, whose emissions, predominantly from the combustion of fossil fuels and other non-renewable energy sources, are a primary driver of global warming (Soytas & Sari, 2009; Savranlar et al., 2024). Particularly concerning is the growing trend of CO_2 emissions in developing countries due to rapid industrialisation and urbanisation. Such countries, owing to structural vulnerabilities and limited institutional capacities, may experience significantly more severe ecological and social consequences compared to developed nations. In this context, the gradual transition to net-zero GHG emissions by the mid-21st century is essential to limit the risks of dangerous and irreversible climate change (IMF/OECD, 2021). Achieving this goal requires technological innovation and international cooperation and comprehensive utilisation of fiscal instruments that can shape consumer and producer behaviour toward sustainability.

Reducing pollution and improving air quality can be conceptualized as national public goods, given their non-excludable and non-rival nature. Given the public dimension of environmental protection, governments bear the responsibility to develop policies that regulate negative externalities and preserve natural resources. In line with sustainable development principles, environmental policy is defined as a systemic approach to

environmental management, encompassing the establishment of regulatory frameworks followed by the implementation of appropriate measures and instruments necessary for effective enforcement. To address global warming challenges, joint international initiatives have been established, such as the Paris Agreement of 2015 and the United Nations Conference of the Parties on Climate Change (COP26 and COP27) (UNFCCC, 2015, 2021, 2022). In alignment with these global efforts, the European Union, through the European Green Deal and the latest Communication on Strengthening Climate Ambitions by 2030, has set a goal to become the first climate-neutral continent in terms of carbon dioxide (CO_2) emissions by 2050 (European Commission, 2021). In light of these European and global efforts, Western Balkan countries, including Bosnia and Herzegovina, have demonstrated their commitment to a green transition by signing the Sofia Declaration on the Green Agenda for the Western Balkans on 10 November 2020. Specifically, Bosnia and Herzegovina, as a signatory, has expressed readiness to align its national policies with European legislation. This approach is further justified by the fact that, as a consequence of past and current greenhouse gas emissions, Bosnia and Herzegovina is already experiencing the negative impacts of climate change. To achieve internationally set targets for mitigating the harmful effects of climate change (Regional Cooperation Council, 2020), the main driver — CO_2 emissions — must be significantly reduced. Considering global efforts to protect the environment, particularly regarding CO_2 emission reductions, the effectiveness of economic policies in environmental protection has become increasingly prominent in political and scientific discussions (Silajdžić & Mehić, 2018).

In pursuit of sustainable practices to curb CO_2 emissions, Sohail et al. (2024) note that several policy options have been proposed, including the promotion of green finance and increasing the share of modern renewables. According to Lei et al. (2021), the development of green, clean, and renewable energy, as well as its effects on economic development and ecosystems, has been a major topic of debate over the past two decades. Increased renewable energy consumption has been found globally to positively influence environmental sustainability by reducing GHG emissions (Muchiri et al., 2025). Green finance encompasses investments in environmentally friendly projects to conserve and protect the environment (Zhang et al., 2022). The UN Environmental Programme defines green financing as the increase of financial flows from private, public, and non-profit sectors toward sustainable development priorities that help manage social and environmental risks (UNEP, 2018; Muchiri et al., 2025). Gu et al. (2021) add that green financing can involve transferring resources from high-carbon-intensive industries to less polluting sectors through structural effects. Similarly, Sun (2022) notes that investments promoting a green industrial structure qualify as green investments. Given the crucial role of CO_2 emission reductions for Bosnia and Herzegovina's European integration, it is critical to investigate this issue. This forms the primary motivation for analysing the efficiency of public spending in reducing CO_2 emissions in Bosnia and Herzegovina relative to EU countries.

Building upon the established understanding of green public spending (environmental protection public expenditures) within the European context, this paper aims to bridge critical gaps by examining the role of green public spending in reducing CO_2 emissions. Specifically, the study investigates how the scale of green public spending affects CO_2 emission reductions, as well as how the structure of public spending — i.e., the composition of different categories of green public spending — influences emission levels. Using panel data for EU countries and Bosnia and Herzegovina over the period 2014–2022 and

employing panel regression analysis, this research extends existing frameworks to understand better how public spending contributes to climate goals. Furthermore, a robustness analysis will be conducted to examine whether introducing one and two-period lags in green public spending affects the consistency and significance of the estimated results, thereby offering policymakers valuable insights tailored to this context.

The rest of the paper is structured as follows. The first part of the paper presents previous research and theoretical background on the impact of green public spending on GHG emissions. The second part of the paper outlines the empirical design, including the selection of variables and data sources, and econometric model construction. The third part of the paper provides the results and discussion. The last part of the paper provides the conclusions and recommendations, summarising the key research findings and offering policy suggestions.

2. PREVIOUS RESEARCH AND THEORETICAL BACKGROUND

Green government spending has emerged by integrating green development principles into fiscal policy frameworks. In a narrow sense, environmental protection public expenditure encompasses government spending on energy conservation and environmental protection aimed at supporting environmental sustainability, stimulating technological innovation, and promoting energy efficiency and emissions reduction (Fang et al., 2024). Increasing green public spending signifies that governments are allocating more financial resources toward environmental management, thereby reinforcing national commitments to environmental governance. Strengthening environmental management enhances public trust in governmental efficiency, fosters the development of positive societal attitudes, and encourages collective environmental responsibility (Niu, 2024).

Environmental protection public expenditure thus represents an essential indicator of society's response to ecological pressures. It consists of both capital and current expenditures directed toward environmental protection activities, which may include investments in equipment, labour, production techniques, information systems, and products whose primary objective is to collect, treat, prevent, or mitigate pollutants and environmental degradation. Moreover, environmental protection public expenditure can generate marketable by-products and financial savings or be subsidised through government programs. In such cases, environmental protection public expenditure should be reported on a gross basis, without deducting any cost offsets (Eurostat, 2005). Governments allocate environmental protection public expenditure through pollution control, biodiversity preservation, environmental research and development, regulatory enforcement, and investments in green infrastructure.

Theoretically, environmental protection public expenditure can enhance the effectiveness of green finance through several channels. Environmental protection public expenditure first establishes the institutional infrastructure required to design and implement green projects effectively (Muchiri et al., 2025), while Zhang and Zhao (2024) argue that budget allocations to environmental protection can signal policy stability, potentially reducing the risk premium on green investments. López et al. (2011) further explored the broader environmental impact of fiscal spending through scale, composition, and technique effects, showing that while increased government spending does not automatically reduce air and water pollution, a

strategic reallocation toward social and public goods can yield positive environmental outcomes. Empirical evidence supports these theoretical arguments. Several studies, including Sharma (2011), Morley (2012), Miceikienė et al. (2021), and Yilmaz (2025), consistently demonstrate that green public spending contributes to reductions in air pollutants such as nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), and carbon dioxide (CO_2). Adewuyi (2016) complements these findings by showing that, in the long run, the negative direct impact of government expenditure on environmental quality is mitigated by positive indirect effects, leading to an overall beneficial effect on aggregate carbon emissions. In contrast, in the short run, negative direct and indirect effects reinforce reductions in emissions. Other studies emphasise the importance of the interaction between public spending and institutional quality. Halkos and Paizanos (2013) and Bernauer and Koubi (2013) found that indirect effects of public spending are often more consequential than direct effects, with higher spending reducing sulfur and nitric oxide emissions, though not always affecting CO_2 emissions. Similarly, Abid (2017) highlighted that public spending in EU countries contributes to reductions in GHG emissions. In contrast, the impact is negligible in MENA (Middle East and North Africa) countries, pointing to the mediating role of governance and institutional frameworks. Bernauer and Koubi (2013) also suggest that larger government sizes can, under certain conditions, exacerbate pollution due to bureaucratic inefficiencies and the influence of special interests. Efficiency considerations are also crucial. Barrell et al. (2021) found diminishing returns to environmental protection public expenditures in EU countries between 2005 and 2015, indicating that higher spending does not necessarily yield proportional environmental benefits beyond a certain level. In contrast, Akdag et al. (2024) demonstrated that in European countries from 1995 to 2019, even marginal increases in EPE were associated with substantial reductions in GHG emissions, highlighting the potential effectiveness of well-targeted environmental expenditure.

Based on the reviewed theoretical perspectives and empirical findings, the relationship between environmental protection public expenditures and environmental outcomes is complex and context-dependent. While some studies highlight the efficiency and long-term benefits of such spending, others point to potential inefficiencies, diminishing returns, or the mediating role of institutional quality and governance. Overall, the evidence suggests that well-targeted and efficiently managed environmental protection public expenditures can contribute to reducing greenhouse gas emissions and promoting sustainable growth.

3. EMPIRICAL DESIGN

3.1. Selection of variables and data sources

This paper investigates the effects of green public spending on CO_2 emissions, using data from EU countries and Bosnia and Herzegovina for the period 2014–2022, sourced from Eurostat and national statistical reports. The dependent variable in this study is CO_2 emissions, while the independent variable is environmental protection public expenditures, with urbanisation included as a control variable.

Table 1 presents the definitions and explanations of all variables used in the analysis.

Table 1. Selection of variables – definition and explanation

Variable	Symbol	Definition
Carbon dioxide emissions	CO_2	Amount of CO_2 emissions (in thousand tonnes)
Environmental public protection expenditure	EPEA	Government expenditure on environmental protection for the total economy (mil EUR)
Waste management expenditure	WME	Government expenditure on waste management (mil EUR)
Wastewater management expenditure	WWME	Government expenditure on wastewater management (mil EUR)
Pollution abatement expenditure	PAE	Government expenditure on pollution abatement activities (mil EUR)
Biodiversity and landscape protection expenditure	BLP	Government expenditure on the protection of biodiversity and landscape (mil EUR)
Research and development for environmental protection expenditure	RDEP	Government expenditure on research and development in the field of environmental protection (mil EUR)
Urbanisation	URBAN	Number of households by degree of urbanisation (thousand households)

Source: Compiled by authors

CO_2 emissions. To measure CO_2 emissions, data on total annual emissions from four key sectors —energy, industry, agriculture, and waste management — are used. The land use, land-use change, and forestry (LULUCF) sector is excluded from the analysis due to its specific methodological characteristics and different impacts on emissions. Emission values are expressed in thousand tonnes, using the Global Warming Potential (GWP) factor defined in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR5), representing the most relevant scientific framework for quantifying greenhouse gases.

Environmental protection public expenditures. Environmental protection public expenditures represent the sum of both capital and current expenditures directed toward environmental protection activities. These activities include the use of equipment, labour, production techniques, information networks, and products whose primary purpose is the collection, treatment, reduction, prevention, or elimination of pollutants and environmental degradation resulting from economic activities. Environmental protection public expenditures may also relate to activities that generate marketable by-products, result in cost savings, or are financed through government subsidies or tax incentives. In such cases, expenditures are reported on a gross basis, without deducting these offsets. In this study, environmental protection public expenditures are measured as total annual general government spending in millions of euros, covering areas such as waste management, wastewater management, pollution abatement, biodiversity and landscape protection, as well as research and development in environmental protection.

Urbanisation. Urbanisation is included as a control variable and captures the level of urban development across countries.

3.2. Econometric model construction

According to Yilmaz (2025), three panel models were employed to evaluate the relationship between environmental protection public expenditures and CO_2 emissions. Specifically,

pooled OLS, fixed effects, and random effects models were estimated to assess which regression specification best fits the data. In line with Muchiri et al. (2025), model adequacy was examined using the Hausman test, and the Breusch–Pagan test will be applied if conditions require it.

The following regression equation represents the model to examine the impact of scale environmental protection public expenditures on CO_2 emissions:

$$CO2_{i,t} = \alpha_{i,t} + \beta_0 EPPE_{i,t} + \beta_j Control_{i,t} + \varepsilon_{i,t} \quad (1)$$

where i and t are the individual and the year, respectively, α is a constant term, β is a parameter to be estimated, ε is a random error term, EPE is the environmental protection public expenditures, and *control* denotes the control variable. The control variable is urbanisation.

Not all components of environmental protection public expenditures have an equal effect on CO_2 emissions. To explore the influence of various components of environmental protection public expenditures related to environmental protection, the following model is developed:

$$CO2_{i,t} = \alpha_{i,t} + \beta_0 WME_{i,t} + \beta_1 WWME_{i,t} + \beta_2 PAE_{i,t} + \beta_3 BLP_{i,t} + \beta_4 RDEP_{i,t} + \beta_j Control_{i,t} + \varepsilon_{i,t} \quad (2)$$

where i and t are the country and year, respectively, WME_{it} is the waste management expenditures, $WWME_{it}$ is the wastewater management expenditures, PAE_{it} represents pollution abatement expenditures, BLP_{it} stands for biodiversity and landscape protection expenditures, and $RDEP_{it}$ refers to research and development for environmental protection expenditures.

4. RESULTS AND DISCUSSION

4.1. Descriptive statistics

The descriptive statistics of the main variables are presented in Table 2. As shown, the mean value of CO_2 emissions is 88,130.30 (thousand tonnes), with a standard deviation of 126,787.80, indicating substantial variation in carbon emissions across the observed countries.

Table 2. Descriptive statistics

Variable	Obs.	Mean	Std. dev.	Min.	Max.
CO2	253	88,130.300	126,787.800	1,345.031	666,026.500
EPPE	252	3,849.211	6,259.906	7.874	28,612.000
WME	243	1,765.691	3,205.528	14.300	14,061.000
WWME	243	733.532	1,255.372	0.000	5,493.000
PAE	234	656.604	1,168.253	1.900	7,528.000
BLP	242	387.822	623.711	0.000	2,568.000
RDEP	234	190.528	389.089	0.000	1,765.000
URBAN	243	7,181.644	9,960.512	164.100	41,355.100

Source: Authors' calculations using StataMP 17 software

The table also presents descriptive statistics for the structure of environmental protection public expenditures across the countries under study. Finally, urbanisation has a mean of 7,181.64 and a standard deviation of 9,960.51, reflecting the diverse levels of urban development across the sample.

4.2. Baseline results

The baseline analysis investigates the relationship between the scale of environmental protection public expenditures and CO_2 emissions. Table 3 presents the estimated coefficients and statistical significance for each specification.

Table 3. Panel regression results – environmental protection public expenditures (scale)

Variable	OLS model (a)	Fixed-effect model (b)	Random-effect model (c)
EPPE	-9.792*** (p = 0.000)	-14.861*** (p = 0.000)	-11.567*** (p = 0.000)
URBAN	17.638*** (p = 0.000)	27.345** (p = 0.013)	18.684*** (p = 0.000)
Constant	3,194.455 (p = 0.279)	-46,291.940 (p = 0.503)	2,764.813 (p = 0.744)
Observations	243	243	243
Number of countries (ID)	—	27	27
Adj. R^2 / R^2 (Overall)	0.887	0.887 (overall)	0.886 (overall)

Note: Significance levels of 1%, 5% and 10% are denoted by ***, ** and *, respectively.
Source: Authors' calculations using StataMP 17 software

As observed in the table, environmental protection public expenditures consistently show a negative impact on CO_2 emissions across all model specifications, confirming its potential to reduce carbon intensity. Urbanisation has a positive effect, although the level of statistical significance differs depending on the model.

Table 4. Hausman test (FE vs. RE)

Variable	FE Coef. (b)	RE Coef. (B)	Difference (b-B)	Std. err. of difference
CO2	—	—	—	—
EPPE	-18.034	-11.567	-6.467	25.556
URBAN	21.626	18.684	2.942	10.545

b = consistent under H_0 and H_a; obtained from xtreg, fe
B = inconsistent under H_a, efficient under H_0; obtained from xtreg, re
Test of H_0: Difference in coefficients not systematic
$\chi^2(2) = 0.13$
Prob > $\chi^2 = 0.9366$

Source: Authors' calculations using StataMP 17 software

The Hausman test was employed to determine the appropriate model specification between the fixed effects (FE) and random effects (RE) estimators. The null hypothesis of the Hausman test assumes that the random effects model is appropriate, implying no systematic difference in the coefficients between the FE and RE estimators (Bell et al., 2019; Muchiri et al., 2025). If the p-value is below 0.05, the null hypothesis is rejected in favour of the

fixed effects model. As shown in Table 4, the Hausman test produced a chi-square statistic of $\chi^2(2) = 0.13$ with a p-value of 0.9366, indicating that the difference in coefficients between the FE and RE models is not statistically significant. Therefore, the null hypothesis could not be rejected, suggesting that the random effects model is the more appropriate empirical specification for this study.

The authors ran the Breusch-Pagan Lagrange Multiplier (LM) test to assess whether the random effect model was more appropriate compared to the pooled OLS model. This test is used to determine which empirical model is more suitable for the panel data: the pooled OLS model or the random effects model (Bobbitt, 2020; Muchiri et al., 2025).

The null hypothesis of this test is that the pooled OLS model is appropriate, while the alternative hypothesis states that the random effects model provides a better fit for the sampled data. The null hypothesis is rejected if the probability of chi² is less than 0.05 at a 5% significance level. The results of the LM test are presented in Table 5.

Table 5. Breusch-Pagan Lagrange Multiplier test (RE vs. OLS)

Variable	Var	SD = sqrt(Var)
CO2	2.5332	1.5916
e (residual)	0.0034	0.0585
u (random effect)	0.3329	0.5769

Test: Var(u) = 0
Chibar² (01): 164.74
Prob > Chibar²: 0.0000

Source: Authors' calculations using StataMP 17 software

As shown, the variance of the random effects component (u) is 0.3329, with a standard deviation of 0.5770. The test statistic Chibar² (01) is 164.74 with a p-value of 0.0000, which is below the 0.05 threshold. This indicates that the null hypothesis is rejected and that the random effects model is more suitable than the pooled OLS model for the given panel data.

The previous results indicated that an increase in green public spending reduces CO_2 emissions. However, assuming that not all categories of environmental protection public expenditures have the same impact on CO_2 emissions, the analysis further examines the heterogeneity of public spending effects across these categories.

The results of the panel regression analysis assessing the heterogeneity of effects are presented in Table 6.

Table 6. Panel regression results by categories of environmental protection public expenditures (structure)

Variable / Model	OLS model (a)	Fixed-effect model (b)	Random-effect model (c)
WME	-26.427*** (p = 0.000)	31.252** (p = 0.007)	-19.771*** (p = 0.000)
WWME	-4.858 (p = 0.233)	-66.607*** (p = 0.001)	-11.438** (p = 0.049)
PAE	11.251** (p = 0.002)	-15.255* (p = 0.048)	6.201 (p = 0.298)
BLP	84.688*** (p = 0.000)	-5.992 (p = 0.928)	58.915 (p = 0.179)
RDEP	-94.455** (p = 0.001)	-148.457 (p = 0.053)	-139.727* (p = 0.047)
URBAN	17.287*** (p = 0.000)	21.702 (p = 0.255)	19.615*** (p = 0.000)
Constant	-5,900.676* (p = 0.037)	-32,283 (p = 0.796)	-7,836 (p = 0.280)
Observations	234	234	234
Number of IDs	—	26	26
Adj. R^2 / R^2 (Overall)	0.927	0.617 (overall)	0.918 (overall)

Note: Significance levels of 1%, 5% and 10% are denoted by ***, ** and *, respectively.
Source: Authors' calculations using StataMP 17 software

The Hausman test shown in Table 7 indicates that the null hypothesis is rejected, suggesting that there is a systematic difference between FE and RE coefficients. Therefore, the fixed effects model is preferred for this specification.

Table 7. Hausman test (FE vs. RE)

Variable	FE Coef. (b)	RE Coef. (B)	Difference (b-B)	Std. err. of diff.
WME	31.2516	-19.7708	51.0224	9.8449
WWME	-66.6068	-11.438	-55.1688	16.7623
PAE	-15.2546	6.2012	-21.4558	6.9196
BLP	-5.9920	58.9148	-64.9068	26.6736
RDEP	-148.4571	-139.7265	-8.7306	31.7655
URBAN	21.7021	19.6148	2.0873	11.5815

b = consistent under H_0 and H_a; obtained from xtreg, fe

B = inconsistent under H_a, efficient under H_0; obtained from xtreg, re

Test of H_0: Difference in coefficients not systematic

$Chi^2(6) = 43.22$, $Prob > Chi^2 = 0.0000$

Source: Authors' calculations using StataMP 17 software

The results indicate that the effects of different categories of green public spending on CO_2 emissions are heterogeneous. Specifically, the panel regression suggests that some

categories, such as waste management, pollution abatement, and wastewater management, have statistically significant effects. In contrast, others, including biodiversity and landscape protection and research and development for environmental protection, are not statistically significant in the fixed effects model.

4.3. Robustness checks

As part of the robustness analysis, we introduce lagged explanatory variables to account for potential delayed effects of green finance on CO_2 emissions. Following the approach of Liu and Zhu (2024), green finance may not produce immediate effects on carbon emission intensity, and the impact could manifest with a time lag.

Therefore, we include environmental protection public expenditures lagged by one period in Model (1), reconstructing the model as follows:

$$CO2_{i,t} = \alpha_{i,t} + \beta_0 EPPE_{i,t-1} + \beta_j Control_{i,t} + \varepsilon_{i,t} \quad (3)$$

Where:

- $EPPE_{i,t-1}$ represents environmental protection public expenditures lagged by one period.

Regression results for the lag-one-period specification are reported in Table 8, columns (a)–(c). The OLS, fixed-effect, and random-effect models all indicate a negative and statistically significant coefficient of lagged green finance, confirming that green finance continues to reduce CO_2 emission intensity when accounting for delayed effects.

Table 8. Panel regression results with lagged effects

	Lag by one period			**Lag by two periods**		
Variable / Model	**OLS model (a)**	**Fixed-effect model (b)**	**Random-effect model (c)**	**OLS model (a)**	**Fixed-effect model (b)**	**Random-effect model (c)**
CO_2	—	—	—	—	—	—
L.EPPE	-10.018*** (p = 0.000)	-21.411*** (p = 0.000)	-20.341*** (p = 0.000)	-5.958 (p = 0.572)	-15.532*** (p = 0.000)	-14.959*** (p = 0.000)
L2.EPPE	—	—	—	-3.988 (p = 0.702)	-7.402*** (p = 0.001)	-5.692** (p = 0.012)
URBAN	17.678*** (p = 0.000)	21.362*** (p = 0.000)	23.300*** (p = 0.000)	17.456*** (p = 0.000)	23.308*** (p = 0.000)	23.415*** (p = 0.000)
Constant	2,291.878 (p = 0.409)	20,039.800 (p = 0.380)	1,917.752 (p = 0.833)	2,729.254 (p = 0.350)	11,081.200 (p = 0.658)	1,543.721 (p = 0.859)
Obs.	216	216	216	189	189	189
No. of countries (ID)	—	27	27	—	27	27

Note: Significance levels of 1%, 5% and 10% are denoted by ***, ** and *, respectively.
Source: Authors' calculations using StataMP 17 software

To further test the temporal persistence of public spending effects, we include environmental protection public expenditures lagged by two periods in the model, yielding the following specification:

$$CO2_{i,t} = \alpha_{i,t} + \beta_0 EPPE_{i,t-1} + \beta_0 EPE_{i,t-2} + \beta_j\, Control_{i,t} + \varepsilon_{i,t} \quad (4)$$

Where:

- $EPE_{i,t-2}$ represents environmental protection public expenditures lagged by two periods.

Table 8 also reports regression results for the lag-two-period specification. Both lagged terms of green finance maintain negative coefficients, and all coefficients are statistically significant at conventional levels in the fixed effects and random effects models. In contrast, the OLS model shows some coefficients that are not statistically significant. According to the Hausman test, the fixed effects model is the appropriate specification, confirming that green public spending has a persistent effect on reducing CO_2 emission intensity over time.

5. CONCLUSIONS

The findings of this paper confirm the significant role of green public spending in reducing CO_2 emissions, which aligns with the broader theoretical and empirical literature on green fiscal policy. Consistent with Muchiri et al. (2025), this research highlights that government environmental expenditures create the necessary institutional and fiscal framework to implement effective green projects. Our analysis also complements the scale, composition, and technique effects discussed by López et al. (2011). While they noted that increased spending alone does not automatically reduce pollution, strategic allocation toward specific environmental activities can yield measurable benefits. This is mirrored in our results, where different environmental protection public expenditures categories show heterogeneous effects. Specifically, the panel regression suggests that some categories, such as waste management, pollution abatement, and wastewater management, have statistically significant effects. In contrast, others, including biodiversity and landscape protection and research and development for environmental protection, are not statistically significant in the fixed effects model. Empirical evidence from Sharma (2011), Morley (2012), Miceikienė et al. (2021), and Yilmaz (2025) supports our findings by demonstrating that public spending on environmental services contributes to reductions in key air pollutants, including CO_2. Furthermore, Adewuyi (2016) emphasises that, in the long run, the negative direct effects of government expenditure on environmental quality are mitigated by positive indirect effects, resulting in overall emission reductions, which resonates with our lagged-effects analysis showing persistent CO_2 reduction over time.

As noted by Halkos and Paizanos (2013), Bernauer and Koubi (2013), and Abid (2017), countries with stronger institutional frameworks tend to achieve more significant reductions in GHG emissions from public spending. Our results from EU countries and Bosnia and Herzegovina are in line with this, indicating that well-targeted and efficiently managed environmental expenditures can reduce CO_2 emissions. Efficiency considerations are also relevant. While Barrell et al. (2021) found diminishing returns to environmental protection expenditures in EU countries, suggesting that excessive spending may not proportionally

reduce emissions, Akdag et al. (2024) highlight that even marginal increases in well-targeted expenditures can lead to substantial emission reductions. Our study confirms this nuance, showing that the overall scale of green public spending is important, but the composition of expenditures across specific categories determines the magnitude of their environmental impact.

In summary, this study corroborates the theoretical and empirical literature by demonstrating that green public spending can be an effective policy instrument for mitigating CO_2 emissions. The scale and structure of expenditures play critical roles, and the institutional and governance context influences their effectiveness.

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STRENGTHENING FINANCIAL LITERACY OF MANAGERS IN PRIVATE HOSPITALS: STRATEGIES, CHALLENGES AND PRACTICAL IMPLICATIONS

ABSTRACT

Financial literacy among managers is a key factor in making informed business decisions and achieving sustainable competitive advantage. It plays a crucial role in navigating complex markets, preventing errors, and supporting the attainment of financial objectives. The contemporary business environment is characterized by dynamic market changes, increasing complexity, and heightened risks, all of which require managers to possess advanced financial management knowledge. With societal development, the demand for medical services continues to grow. Consequently, an efficient financial management system and the professional competencies of staff are essential for the successful functioning of private hospitals.

This paper examines the challenges that private hospitals face in financial management, emphasizing the importance of financial literacy among managers for effective resource allocation.

The study identifies key weaknesses in financial information management and proposes strategic measures to strengthen hospital managers' financial competencies, thereby enhancing overall operational efficiency. The findings may assist policymakers and organizational leaders in developing strategies aimed at improving financial competencies.

Keywords: *financial literacy, managers, private hospitals, resource allocation, efficiency.*
JEL: M41, I1, G30

1. INTRODUCTION

Management is a fundamental and essential element of the success of any organization, regardless of the nature of its activities. This is particularly important considering that the achievement of organizational goals depends on managerial knowledge and experience in ensuring the efficiency and effectiveness of organizational activities. Performance measurement is crucial for objectively assessing results and reducing the risk of subjective

judgments. In addition, this activity is necessary for transparency, accountability, and the decision-making process, serving as a tool for improvement through the adoption of best practices (Kourtis *et al*., 2021). Given the specific characteristics of hospitals as healthcare institutions, it is emphasized that performance evaluation encompasses both the efficiency and effectiveness of hospitals to ensure sustainable financing. This ultimately contributes to optimizing resource allocation in the critical healthcare sector, thereby promoting economic and social well-being.

The primary function of financial managers and chief executive officers (CEOs) is the financial management of hospitals. In this context, the important role of nurse managers is also highlighted, as their work extends to performance and participation in various activities related to the financial functioning of the hospital. This includes activities such as financial planning, financial monitoring, financial decision-making, and financial control. In a turbulent environment, managers of healthcare organizations must develop skills and knowledge that go beyond the comfort zone of their clinical competencies (Gačić *et al*., 2023).

Hospital management is a complex process, especially when considering the turbulent environment in which today's healthcare organizations operate in accordance with their founding purpose. One of the key questions is what hospital management actually entails, which can be understood as a set of structures and processes that define the strategic direction of the hospital. In this sense, it is emphasized that the development of hospital governance structures, shaped by both internal and external dynamics, is a complex issue worldwide.

Various factors shape this internal and external environment. The internal environment is influenced by the professional nature of hospitals, which includes independent yet interdependent groups such as physicians, nurses, and administrators. Clinicians and administrators, as leading actors, operate within different decision-making structures. The main challenge in designing hospital governance structures is aligning these two spheres of authority to achieve hospital goals. Successful management largely depends on adequate synchronization. The external environment of hospitals, meanwhile, is under pressure from governments and communities to change hospital structures and ensure accountability in both clinical and administrative aspects.

Private hospitals, as part of the healthcare system, significantly depend on the orientation of health policy and on how regulators perceive the role of private ownership in providing healthcare services to citizens. One of the important questions in this regard is the potential partnership between the private and public sectors. The expansion of the private sector in healthcare provision is a constantly relevant issue for regulators and other stakeholders (the public). Private healthcare actors are known to demonstrate considerable heterogeneity in their organization and invest significant efforts in expanding universal health coverage. Generally, healthcare provision in the private sector encompasses many different realities. It includes profit-oriented commercial companies and nonprofit actors and institutions; faith-based and other nongovernmental nonprofit organizations, as well as individual entrepreneurs in healthcare and private for-profit firms and corporations (Montagu & Chakraborty, 2021).

Performance measurement is not an end in itself but a valuable tool for effective management and control. Measuring performance through the selection of output factors should direct management attention to dimensions that must be preserved and further improved to ensure the sustainability of hospitals and other healthcare organizations. Despite certain inherent obstacles to its unanimous and undisputed acceptance by all stakeholders, performance assessment, when properly implemented and applied with awareness of its limitations, represents a valuable mechanism that promotes transparency, keeps management accountable, and provides the necessary data to improve organizational efficiency and effectiveness for the benefit of all stakeholders.

Financial management helps hospital administrators make rational financial and administrative decisions and select efficient methods for spending money (A'aqoulah, 2021). It enables them, on the one hand, to ensure the provision of high-quality healthcare services and, on the other, the financial sustainability of the hospital, which has become an increasingly significant challenge for managers. Good financial management and quality healthcare are inseparably linked and represent tangible indicators (if not evidence) of optimal resource allocation. Strict adherence to these factors, which relate to the performance of both public and private organizations, indicates that investments in the healthcare sector are on the right path. Hospitals use a wide range of specialized equipment, devices, and pharmaceutical products to provide better care to their patients; therefore, maintaining equipment efficiency is one of the vital issues for hospital management, as it is crucial for providing quality care and reducing costs. Careful planning of capital expenditures is particularly important for hospital management.

Essentially, the achievement of organizational goals depends on the efficiency of administrators, but managerial efficiency largely depends on the knowledge and skills of managers. Due to dynamic changes in the healthcare market, health systems are required to implement significant changes in their operational models, including aggressive efforts to reduce costs while continuously improving patient outcomes. Increasing awareness of financial competence is emerging among healthcare professionals, with doctors and nurses at the center of attention; however, many healthcare organizations still identify financial management as one of the major deficiencies within these groups. Financial skills are increasingly becoming a key component of healthcare management.

2. CHALLENGES IN THE FINANCIAL MANAGEMENT OF PRIVATE HOSPITALS

Hospitals use a wide range of specialized equipment, devices, and pharmaceutical products to provide better care to their patients; therefore, maintaining equipment efficiency is one of the vital issues for hospital management, as it is crucial for providing quality care and reducing costs. Careful planning of capital expenditures is particularly important for hospital management. Essentially, the achievement of organizational goals depends on the efficiency of administrators, but managerial efficiency largely depends on the knowledge and skills of managers. Due to dynamic changes in the healthcare market, health systems are required to implement significant changes in their operational models, including aggressive efforts to reduce costs while continuously improving patient outcomes.

Increasing awareness of financial competence is emerging among healthcare professionals, with doctors and nurses at the center of attention; however, many healthcare organizations still identify financial management as one of the major deficiencies within these groups. Financial skills are increasingly becoming a key component of healthcare management. Digital financial literacy is extremely important for hospital managers because it enables efficient resource management, cost control, and accurate financial decision-making in a complex healthcare environment. That complex business environments are not in the future; they are occurring now. Managing hospitals is challenging. Namely, hospitals face financial pressures, staffing shortages, and the complexities of healthcare reform and regulation.

Sustainable revenues are essential for a competitive private sector. Effective management of the revenue cycle, from scheduling appointments and registering patients at the beginning of the cycle to billing and cash collection at the end, plays a key role in hospitals' efforts to improve their financial performance. The absence of adequate competencies in financial management hinders progress in improving public health financing and prevents the professionalization of the workforce in this sector (Honoré & Costich, 2009). Financial managers are expected to play a crucial role by providing information relevant to decision-making. Most nurses acquire financial knowledge and skills primarily through experience, trial, and error. In general, managers at all levels in hospitals are involved to some extent in financial planning.

Revenues represent the culmination of a successful strategy that leads to competitive advantage and sustainability of hospital institutions. The reliability of revenues can be tested by calculating the ratio of receivables to sales each year and comparing it with the corresponding amount from the previous year. This allows us to determine whether revenues are merely artificially increasing. Value creation requires a profit and a return on capital that exceeds the cost. Profit requires actual revenues and actual expenses. Various accounting models may distort accounting profit if hospital management is determined to do so and circumstances allow it. For this reason, the indicator known as cash flow from operations (CFO) is favored. This indicator and others like it are less prone to manipulation (Kourtis *et al*., 2021). Moreover, they provide a necessary guide for testing the validity of profit and serve as a safeguard for hospitals, as they ensure the liquidity needed for operations and for financing revenue growth that is essential for organizational expansion.

Performance measurement based on the CFO excludes deliberately unjustified increases in receivables (which increase revenue) or inventory (which reduces the cost of goods sold and increases profit). For managing the risk of fraudulent activities, this is crucial, as it prevents malicious attempts to conduct financial fraud aimed at misleading stakeholders.

Suppose hospital management and financial teams effectively monitor cash flows (inflows and outflows) and carefully manage operating cash flow. In that case, the hospital can better respond to expenses (an efficient approach), reduce potential liquidity risk, and maintain the quality of healthcare services at an adequate level. In the context of financial literacy in healthcare organizations, it is emphasized that CFO analysis can be extremely useful as an indicator of efficiency in hospital management and in any other private-sector healthcare organization. The revenue from hospitals represents the efficiency of their operations, which is a result of the healthcare services provided to society, while the CFO is derived from the

efficiency achieved (Vlasiadis *et al*., 2022). Both ensure financial sustainability through financing from operations and achieving an adequate return on invested capital.

A healthy financial position is a prerequisite for the quality and long-term provision of healthcare services. Strategies for mitigating financial risk are essential to expose hospitals to the "right" level of financial risk, maximizing incentives for value creation without undesirable consequences such as financial distress. It is unreasonable to treat private hospitals as philanthropic organizations simply because they operate in a sector highly sensitive to public welfare.

While this sensitivity is undeniable, sustainability without adequate financing is impossible. Furthermore, private investment in hospital institutions requires a return on investment. For this reason, the importance of proactive planning and monitoring of cash flows, optimized management of receivables, and prudent debt management is emphasised. Given all the aforementioned factors, data from financial statements, expressed in monetary values, are used to measure the resources utilized and the profit generated during the year, monitor the actual financial position, and forecast the sustainability of healthcare units (hospitals). The key financial statements include the balance sheet, the income statement, and the cash flow statement.

3. FINANCIAL LITERACY OF MANAGERS IN HOSPITALS

According to OECD (2017, p. 49), financial literacy is defined as "knowledge and understanding of financial concepts and risks, and the skills, motivation and confidence to apply such knowledge and understanding in order to make effective decisions across a range of financial contexts, to improve the financial well-being of individuals and society, and to enable participation in economic life.

Financial literacy depends on several factors, such as age, gender, qualifications, and overall income. As the role of healthcare leaders expands to include their effectiveness and participation in activities related to financial management, there is a need for financial planning, financial monitoring, financial decision-making, and financial control. Further research is required to longitudinally examine the competencies of healthcare leaders in the area of financial literacy (Pakos & Mpogiatzidis, 2025). The term 'financial literacy' seems to imply that the 'financial' is readable. Understanding financial literacy involves examining both cognitive and practical dimensions that affect how healthcare managers engage with increasingly complex financial environments (Özyeşil et al., 2024).

Financial literacy is suboptimal among medical students and healthcare workers, even though it is of utmost importance for senior healthcare professionals. Although senior clinicians or nurse managers may possess moderate financial literacy, they are required to develop skills and knowledge that go beyond their clinical expertise. Currently, the role of healthcare leaders increasingly involves their effectiveness and engagement in activities related to financial management within their hospital duties; therefore, as previously mentioned, there is a clearly articulated need for financial planning, financial monitoring, financial decision-making, and financial control, while additional research is necessary to examine the financial literacy competencies of healthcare leaders longitudinally.

The inclusion of financial management in the curriculum of health-related courses is necessary to enable them to make effective financial decisions to achieve organizational financial goals (Özyeşil *et al*., 2024). Although financial literacy improves with advanced clinical experience, medical professionals are encouraged to develop skills and knowledge beyond their clinical competence. To address these issues, it may be suggested that medical institutions provide financial education and training through seminars, workshops, and online courses offered by healthcare organizations and associations, as well as financial planning services. Given that today's focus is increasingly on digital financial skills, traditional financial knowledge may be solid, but digital literacy remains weaker among many (Pakos & Mpogiatzidis, 2025). To ensure that medical professionals have a strong foundation in financial management skills before beginning their careers or practice, medical schools should integrate financial literacy into medical training and curricula, and finally, foster a culture of financial literacy by supporting financial literacy initiatives and promoting open discussions about finance among healthcare professionals (Bhattacharya *et al*., 2023).

4. MANAGING THE FINANCIAL PERFORMANCE OF HOSPITALS IN A REAL ENVIRONMENT

Many common managerial practices in healthcare organizations, including strategic planning, have not been widely evaluated empirically. If managerial practices are to be evidence-based, evaluations of such routine practices must be conducted. Traditionally, financial analysis of hospitals has primarily relied on information from financial accounting, which generates data through financial statements based on the hospital's accounting records. Early work in this field used the same financial ratios applied to retail and manufacturing firms, even though the market structure and service delivery systems in the hospital industry differed significantly from these industries (Kaissi & Begun, 2008).

Internal control systems must be managed in a highly efficient manner, and all financial procedures must be clear and achievable within a reasonable time frame. Financial managers must have a clear vision for developing hospital operations, and hospital administrators must understand functions such as processes, procedures, and budget allocation. Furthermore, most supervisory decisions in hospitals carry financial implications, which should compel hospital administrators to have sufficient information about financial management functions to rely on financial considerations when making decisions. Managers of for-profit hospitals tend to base their financial decisions more on the need to achieve operational efficiency and profitability compared to managers of voluntary hospitals. Milojević *et al*. (2024) have found that a deeper understanding of the essence of measurement significantly contributes to identifying problems in its application in the healthcare sector.

Structural factors outside managerial control (organizational and community characteristics) appear to be less significant in influencing profitability. Hospital administrators may view these findings positively, as profitability does not seem dictated by organizational or market factors but is more strongly influenced by elements that hospital policies and practices can, to some extent, affect. Hospitals under financial pressure may struggle to maintain patient quality and safety and may experience poorer patient outcomes compared to well-resourced hospitals.

When assessing the financial health of hospital institutions, various financial indicators measuring profitability, liquidity, and solvency represent important markers. However, determining financial health is complex among hospitals, and ranking numerous indicators by importance or predictive power is difficult. Moreover, individual indicators do not necessarily capture all aspects of hospital financial health. A single institution can significantly affect extreme levels of financial performance, and the use of gross metrics such as operating margin and total margin can be misleading. Poor financial health may worsen outcomes for certain publicly reported metrics but not others.

Ambiguous findings are difficult to interpret because hospital margins may be misleading indicators of financial well-being, and a negative margin or net loss is not the only predictor of financial problems. For example, despite positive margins, some hospitals may lack sufficient liquid assets to meet immediate or future quality improvement obligations. Therefore, it is important to consider a range of financial dimensions, including measures related to liquidity, financial leverage, and physical facilities. A broader set of financial data that better represents hospital financial health is publicly reported and available to state and federal agencies (Akinleye *et al.*, 2019).

Several measures can be mentioned for reducing hospital costs, such as workforce and equipment management, the use of centralized information systems as management dashboards, modifying spending patterns, outsourcing, and adopting new management methods. With proper monitoring, management, and attention to hospital-specific objectives, these measures can be effective steps toward improving cost control, evaluating hospital efficiency, and forming a basis for informed decision-making. By adopting this approach, hospitals can avoid charging excessive fees to clients merely to cover costs and confirm their presence in the hospital. Given that this study is qualitative and measures managers' perceptions of hospital costs, future studies are encouraged to use evidence-based research to identify cost-saving measures applicable in hospitals (Naranjee *et al*., 2019).

Every hospital needs financial resources to maintain standard healthcare facilities and remain operational (CAPEX, OPEX). However, the involvement of the board of directors enhances the financial management of the hospital and improves overall performance. Corporate governance mechanisms influence the behavior of healthcare systems in ways that are connected to financial performance (Afriyie *et al*., 2020).

For example, Cleverley and Nutt (1984, p. 626) examined eight nonfinancial measures and found that the number of initial beds, cost per patient-day, and percentage of Medicaid revenue were significantly correlated with hospital bond ratings. This suggests that investors, when assessing hospitals, go beyond traditional financial metrics and place considerable importance on operational and organizational performance factors. Likewise, Lawrence and Kurtenbach (1995, pp. 175–176) found that 10 nonfinancial measures were significantly correlated with several measures of market risk, and Gardiner *et al*. (1996, p. 454) reported that two nonfinancial variables, county market share and length of stay, significantly predicted failure in both nonprofit and private hospitals.

Below is a list of selected hospitals in Serbia registered under code 8610 – hospital activity, for the year 2023.

Table 1. Overview of Hospital Financial Performance, 2023

Hospital	Revenues (000)	Gross Margin (%)	Net Income	Equity (000)	Total Assets (000)	Current Ratio	Number of Employees
Global Care Surgery	364.685	**36,07**	**38.275**	190.028	564.096	**2,64**	25
"Sveti Nikola"	45.843	22,13	-2.608	40.061	84.695	0,93	13
"Boc"	170.792	27,73	22.433	76.117	101.104	2,11	21
"Optotip"	58.808	12,74	3.502	5.758	24.137	0,50	13
"Parks - Dr Dragi"	143.993	-0,99	-23.239	47.869	214.531	0,10	33
Impuls	8.577.000	12,42	7.000	19.014	42.572	1,36	5
"Sretenović"	22.848	7,17	198.000	2.125	4.454	1,55	8
"SAISEI"	8.619	0,85	-846.000	-	444	0,34	4
"Sava Surgery"	44.354	-5,02	-10.914	24.617	43.441	1,93	21

Source: Authors' calculations based on published financial statements, www.apr.gov

As can be seen from the previous table, for the selected sample of hospitals, Global Care Surgery has the highest revenues (364,7 million) and high profitability (net profit of 38,3 million and Gross Margin of 36,07%), with a good current ratio of 2,64. This indicates a strong market position and effective cost management.

Shareholders almost always use financial indicators to measure the return on invested financial capital. However, some financial indicators may provide valuable information about an organization's ability to combine and integrate different dimensions of performance (economic, social, and environmental). A core financial KPI that integrates economic and socio-environmental perspectives is value added. Alternative financial indicators that integrate economic and non-economic valuation perspectives are effort measures (Vitolla *et al*., 2017). Ultimately, financial indicators, although commercial in nature, also offer useful insights into the social and environmental orientation of management, integrating different informational perspectives (both financial and nonfinancial).

With increasing global competition among organizations, strategic managerial skills have become essential prerequisites for achieving growth and development within any organization. As a result, employers seek qualified managers skilled enough to address organizational threats and weaknesses. Today, healthcare managers increasingly improve their skills by attending courses that enhance their knowledge, techniques, and decision-making abilities in planning, budgeting, management, accounting, and more, to maintain their professional standing (Javani *et al*., 2017). Nurse managers hold financial management responsibilities in public healthcare organizations but often lack the necessary skills, knowledge, and competencies to function effectively in this role and require additional training. Recommendations include developing a competency framework to enhance the financial management capabilities of nurse managers.

5. CONCLUSION

The private healthcare sector represents one segment of the overall health system. The use of healthcare services in private hospitals as healthcare organizations varies significantly depending on the context. Thoughtful management of these organizations is crucial for ensuring the quality of care and patient safety. Despite numerous reforms in hospital governance structures, certain challenges persist.

Streamlining the management of the hospital patient revenue cycle can enhance the financial sustainability of the organization by improving profitability and enabling capital growth. The complementary role of the private healthcare sector in our country is expected to continue improving. Therefore, its performance in terms of the efficiency and effectiveness of existing resources is of vital importance for the well-being of society as a whole. It is particularly important to highlight the growing attention to digital financial skills across many professions, including healthcare workers. In this sense, the integration of financial education into professional development within healthcare organizations providing services in Serbia is strongly encouraged.

Successful financial outcomes in the healthcare industry are expected to become increasingly challenging in the coming years. Given the magnitude of changes in the domain of healthcare service delivery, many health systems recognize the need to invest in the development of their leaders in order to maximize their effectiveness in a changing healthcare environment. The absence of formal training in financial literacy within healthcare can limit physicians' ability to understand the financial aspects of the healthcare system, which may ultimately affect decision-making and efficiency both in individual healthcare organizations and in hospitals, which are highly complex organizational systems.

It is important to examine the relationship between leadership development practices and financial outcomes. Additional research is also needed to determine which specific arrangements influence hospital financial performance, as well as their impact on the quality of patient care.

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FISCAL SUSTAINABILITY OF HEALTHCARE SYSTEMS IN BOSNIA AND HERZEGOVINA: CHALLENGES AND POLICY RECOMMENDATIONS

ABSTRACT

This paper examines the fiscal sustainability of healthcare systems in Bosnia and Herzegovina (BiH), focusing on the interplay between financing, expenditure patterns, and care quality. The system is highly fragmented (14 ministries, 13 funds, three legal frameworks). Despite spending over 9% of GDP, BiH records suboptimal outcomes with per-capita health expenditure of 1,477 PPP USD, near the bottom of European rankings.

Using National Health Accounts, fund reports, and WHO data (2008-2020), we trace trends and fiscal space. Key challenges include accumulating fund deficits; large regional coverage disparities (56.2% in Canton 10 to 109.3% in Bosnian-Podrinje Canton); high out-of-pocket payments (29.4% of total health expenditure vs 20.9% EU average); hospital bed-occupancy below 60%; and a threefold variation in per-capita insurance outlays across cantons. Revenues are concentrated: 91.7% of Federation HIF income comes from payroll while employees are only 28% of the insured, leaving the model pro-cyclical and vulnerable to demographic and labour-market shocks.

Findings show that relatively high spending-to-GDP coexists with low per-capita resources, fragmentation, inefficient allocation, and weak incentives. In response, priority interventions are directed toward spending quality and allocative efficiency rather than simple revenue expansion: rebalancing toward primary and ambulatory care with strengthened strategic purchasing and solidarity-based risk pooling; expenditure rationalisation through higher capacity utilisation, stronger financial management, and performance-based payment; and targeted revenue diversification, most notably VAT differentiation on reimbursable medicines (estimated annual savings €8.5-€29.2 million), together with improved budget transparency and health-motivated excises, all underpinned by reforms to reduce fragmented governance.

Keywords: *Healthcare financing, fiscal sustainability, Bosnia and Herzegovina, health insurance, healthcare reform, fragmentation.*
JEL: I18, H51, I13, H75, H77

1. INTRODUCTION

Health systems everywhere are trying to square a familiar circle: keeping spending sustainable while delivering timely, high-quality care. Bosnia and Herzegovina (BiH) confronts it under unusually tight constraints. Ageing, chronic disease and technology raise costs while a narrow, cyclical revenue base and fragmented governance dilute pooling. Sustainability thus concerns not only how much BiH spends but how resources are raised, pooled and used.

As Table 1 shows, BiH combines a moderate health-to-GDP share with very low per-capita resources, high out-of-pocket exposure, incomplete coverage, and marked fragmentation relative to European Union (EU) and South Easter Europe (SEE) averages.

Table 1: Summary of Key Healthcare System Indicators - EU and SEE benchmarks for BiH

Indicator	BiH	EU Average	Regional Average (SEE)	Interpretation
Total health expenditure (% GDP)	9.1%	9.9%	8.2%	Moderate spending
Health expenditure per capita (PPP USD)	1,477	3,269	2,207	Very low absolute spending
Public share of total health expenditure	71%	79%	73%	Below EU, similar to region
Out-of-pocket payments (% THE)	29.4%	20.9%	30.7%	High financial burden
Health insurance coverage (FBiH)	86.9%	99%+	~85%	Significant gaps
Hospital bed occupancy rate	<60%	75-80%	65-70%	Major inefficiency
Life expectancy at birth (years)	76.3	78.3	76.7	Below benchmarks
UHC[2] service coverage index	65	77	71	Limited access
Number of health insurance funds	13	1-5	1-3	Extreme fragmentation

Source: Authors' compilation based on Agency for Statistics of Bosnia and Herzegovina (2020), World Health Organization (2022), Eurostat (2020), Federation Health Insurance and Reinsurance Institute (2020), and Health Insurance Fund of Republika Srpska (2020).

Institutional design drives these outcomes. Constitutionally, responsibilities are split among 14 ministries/departments and 13 health-insurance funds under three legal frameworks. In the Federation (FBiH), ten cantonal funds manage entitlement and purchasing. Republika Srpska (RS) runs a single entity-level fund and Brčko District (BD) has its own scheme. This dispersion thins risk pools, duplicates administration/IT, complicates cross-boundary care, and weakens purchasing leverage.

[2] Universal Health Coverage (UHC)

Household exposure compounds the risk. Out-of-pocket (OOP) payments absorb about one-third of total health spending, well above EU levels, and are concentrated in medicines and diagnostics leading patients to delay or forgo care and shifting fiscal pressure onto households rather than being smoothed through pooling. A system can look solvent in aggregate yet remain vulnerable to arrears and rationing, with inequities that widen when incomes fall. The burden is uneven: poorer households and cantons with narrower benefit packages face steeper trade-offs, undermining trust in coverage.

In the last two decades, health spending in Europe has often outpaced GDP and BiH is no exception. Thus, sustainability is both a level problem (limited resources per person) and a trend problem (spending outpaces the economy). GDP growth alone will not ease pressures so financing composition and spending efficiency must carry the adjustment. Where payroll contributions dominate and bases are narrow, downturns hit fund ledgers fast. Fragmented small pools also absorb shocks poorly. BiH has both, so liquidity stress and cross-arrears persist even when headline balances hover near zero.

The pandemic exposed these weaknesses and the limits of stand-alone pools for logistics and information; as temporary supports unwind, arrears and liquidity pressures re-emerge.

This study offers an integrated assessment of fiscal sustainability in BiH's health system, linking solvency with financial protection, efficiency, and outcomes. The contribution is threefold: *First*, a consolidated profile using cross-country and entity/cantonal evidence, tracking a compact metric set: revenue mix and contributor density; OOP; operating balances/arrears; spending composition; capacity use; outcomes; coverage. *Second*, a link from financing (payroll reliance, high OOP) to delivery patterns (hospital-centred care, low bed occupancy, limited prevention) to identify efficiency gains without higher aggregate spending. Priorities are shifting routine care to primary and ambulatory settings, tightening procurement and formulary discipline, and using purchasing tools that reward value over volume. *Third*, assessment of a near-term, administratively feasible lever, VAT differentiation on reimbursable medicines, sequenced with purchasing and primary-care reforms and monitored for pass-through and household relief.

The analysis proceeds through a set of linked questions: (*i*) has health spending outpaced GDP in BiH relative to peers and what does this imply; (*ii*) how do the insured mix and 13 funds shape risk-sharing, volatility, and equity; (*iii*) how exposed are revenues to labour-market shocks and what does the OOP burden imply for who bears adjustment; (*iv*) where are the largest efficiency margins, especially in hospital use and prevention, and how do these relate to outcomes and service coverage; and (*v*) what fiscal space is achievable via VAT differentiation on medicines, with what distributional effects and governance to secure pass-through and support purchasing reform.

2. LITERATURE REVIEW

Classic public-finance literature anchors fiscal sustainability in intertemporal budget constraints - spending must align with revenues and stable debt (Bohn, 1995; Buiter, 1985). For health systems, that lens is necessary but insufficient. European frameworks adopt a three-pillar view (fiscal sustainability, adequate access, and quality) to avoid "balanced" budgets that erode outcomes (European Commission, 2014). OECD guidance likewise

assesses macro-efficiency (how much to spend) and micro-efficiency (how care is purchased/produced) alongside equity (Docteur & Oxley, 2003). Recent contributions add quality and resilience as intrinsic to sustainability: high-quality care underpins durable health and trust, while the ability to absorb shocks proved decisive during COVID-19 (Kruk et al., 2018; Haldane *et al*., 2021). Seen through this wider lens, BiH faces both hard fiscal limits and coverage/quality gaps that shape value for money.

Bismarck-type systems rely on payroll contributions, transparent and entitlement-linked, but pro-cyclical and vulnerable to informality and ageing (Kutzin, 2008). Countries relying on payroll show sharper revenue swings in downturns (Anderson & Hussey, 2001). Diversification through budget transfers, earmarked consumption taxes, and judicious use of general revenues, can smooth cyclicality without abandoning risk pooling (Thomson et al., 2009). For BiH's narrow contributor base and modest automatic stabilisers, employment shocks transmit quickly to fund ledgers.

Financial protection, avoiding catastrophic or impoverishing health spending, is tracked by catastrophic-expenditure measures (outlays exceeding a share of household resources; Xu et al., 2003) and the out-of-pocket (OOP) share, with the World Health Organization and World Bank flagging sustained OOP above ~20% of total health spending as a warning (World Health Organization & World Bank, 2019). Persistently high OOP reflects weak purchasing, narrow or unevenly enforced benefits, and point-of-sale drug financing. In BiH, reducing OOP requires shifting costs into prepaid pools and strengthening purchasing so pooled funds buy needed services.

Fragmented pooling with many small purchasers, duplicated administration and weak cross-subsidy undermines efficiency and equity (Hurst & Jee-Hughes, 2001). In federal settings, clearer responsibilities and risk-equalisation mechanisms raise performance and ex-ante risk adjustment prevents cream-skimming and aligns incentives to cover high-need groups (Gerkens & Merkur, 2010; van de Ven & Ellis, 2000). European experience shows that consolidation and coordination can reduce overheads, strengthen purchasing and improve risk sharing. Estonia's 2001 merger of county funds into a national fund cut administrative costs and made coverage more uniform (Lai et al., 2013) and Denmark reduced regional authorities improving coordination despite transition costs (Olejaz et al., 2012).

Across OECD/EU countries, health spending typically outpaces GDP, driven by ageing, technology diffusion, income effects, and relative prices (Lorenzoni et al., 2019), with further pressure projected for health and long-term care (European Commission, 2018). Blunt budget caps or higher patient charges erode access without reliably curbing low-value use. More durable containment is supply-side reform. Evidence on DRGs and related payments shows that moving from budgets/fee-for-service to case/bundle-based payment shortens stays and curbs low-value inpatient activity when paired with quality safeguards (Busse *et al*., 2011). Practical guidance stresses coupling payment change with service redesign so activity shifts to lower-cost, higher-value settings (Cashin, 2017). For BiH, low bed-occupancy and hospital-centred spending indicate sizeable efficiency gains if purchasing is used to rebalance care.

Pharmaceuticals are typically the most OOP-intensive item and a major budget line. European evidence shows retail prices reflect policy-set components (taxes, wholesale/retail

margins, procurement and formularies) and, when enforced, policy changes pass through to retail (Vogler et al., 2013). Where OOP is high and fiscal space tight, differentiating VAT on reimbursable medicines is a practical lever. It yields recurring budget impact and immediate household relief, conditional on aligned lists, point-of-sale application, and monitoring to verify pass-through. Also, it complements, rather than replaces, competitive procurement and rational use.

Most assessments converge on BiH's profile: payroll-heavy revenues, fragmented pooling, high OOP, and hospital-centred use (World Bank, 2020; Vončina et al., 2022). BiH's sustainability problem is both trend (spending outpaces GDP) and structural (fragmentation, a narrow contribution base, and an expenditure mix that underweights prevention/primary care). The literature outlines a feasible reform sequence, which this study applies to BiH: (*i*) strengthen purchasing and payment (DRG/bundled) with referral management to shift routine care to primary/ambulatory settings; (*ii*) expand pooled benefits and curb point-of-service exposure, especially for medicines; (*iii*) cut fragmentation via coordination, harmonised entitlements, and risk equalisation; and (*iv*) diversify revenues prudently to temper payroll cyclicality while preserving progressivity (Busse et al., 2011; Thomson et al., 2009; van de Ven & Ellis, 2000; World Health Organization & World Bank, 2019).

3. METHODS AND DATA

This study builds a baseline diagnostic of health-system sustainability in BiH. We integrate comparable quantitative indicators with institutional evidence to show how financing, pooling and purchasing, spending composition, efficiency, financial protection, and outcomes fit together, prioritising measures that are robust across sources and transparent in construction.

The design combines comparative benchmarking with a focused policy simulation. *System-level* tracking covers trends and composition of health expenditure, the public-revenue mix, OOP burden, and headline outcomes. At the *institutional level*, it examines fund structures, contributor density, operating balances and liquidity (payables/receivables), and dispersion in per-capita outlays and utilisation across jurisdictions. At the *policy-lever level*, it sizes a static, first-round fiscal-space option, VAT differentiation on reimbursable medicines, and outlines the administrative steps for pass-through to retail prices.

A pragmatic stance is adopted: where levels are noisy, ratios and shares are used; vintages are harmonised before comparison; quantitative patterns are triangulated with statutes, fund rules, and official reports. Where precision is limited, ranges are reported to indicate direction rather than overstate point estimates.

Core series span 2008-2020, covering post Global Financial Crisis recovery, a stable pre-pandemic baseline, and the initial COVID-19 shock. Long-run trends are ended at 2020 to preserve comparability and avoid pandemic-era distortions: post-2020 data include exceptional items (off-budget transfers, donor inflows, emergency procurement, hazard pay), heterogeneous recording across funds, utilization swings from deferred care and catch-up, and temporary price/stock effects (tests, PPE, vaccines). Reporting after 2020 is also incomplete and asynchronous across 13 funds, with revised SHA/SNA mappings introducing series breaks. Early-pandemic utilization fell by a median 37%, therefore, 2020-

2022 are excluded from slope estimation (Moynihan et al., 2021). Later observations are cited qualitatively but excluded from trend slopes.

For the Results trend map (Figure 1), we use WHO constant-PPP series for per-capita health expenditure and GDP to compute average annual growth over 2000–2019, placing BiH among selected European comparators.

A consolidated dataset is constructed from BiH National Health Accounts/System of Health Accounts (latest harmonised vintages), administrative records from health-insurance funds and entity/Brčko authorities, and aligned with international comparators to form a coherent spine of measures. NHA/SHA tables provide financing schemes, functions, and providers, from which public/private and OOP shares, per-capita and %-of-GDP levels, and the pharmaceutical component are derived. Fund reports (entity, cantonal, Brčko) supply revenue structure and contributor counts, operating balances, receivables/payables, and notes on formularies/procurement, inputs that reveal fragmentation, dependency ratios, and liquidity. International repositories (WHO; European statistical series, including European Observatory/OECD) support cross-country benchmarking and definitional harmonization (e.g., UHC coverage, financial-protection concepts). Legal/policy documents (constitutional and health-law assignments, fund statutes, procurement/price rules, VAT provisions) anchor institutional interpretation and scenario assumptions. Where sources diverge, vintages with clearer metadata are privileged, and reconciliations are recorded to preserve transparency and comparability.

Analytically, trends and levels are benchmarked, then coverage composition and the presence of small, parallel pools are linked to revenue cyclicality and arrears. Spending composition, especially pharmaceuticals, is related to financial protection and capacity/efficiency metrics, indicating scope to reallocate toward primary/community care and day surgery. The VAT scenario assumes static volumes and the observed ATC mix, with sensitivity bands for scope and pass-through and an implementation checklist (list alignment, point-of-sale updates, price monitoring).

Limitations are addressed in evidence assembly and interpretation. Sub-national reporting can be uneven and lagged, so overlapping sources are used, indicators with the strongest completeness are prioritised, and ranges are reported where needed. Because SHA/NHA remappings and fund templates change in some years, shares and ratios are emphasised, vintages are harmonised, and definitional shifts are noted. Household surveys and fund accounts under-capture informal payments; OOP indicators are therefore treated as lower bounds and interpreted comparatively. Outcomes reflect determinants beyond the health system and are used as contextual benchmarks, not causal endpoints. VAT modelling is a first-round static estimate intended to size a feasible lever and it is paired with procurement and rational-use measures and explicit pass-through monitoring to secure durable gains. All estimates rely on harmonized 2008-2020 series and where evidence is thin, ranges are used and reconciliations documented to keep inferences cautious.

4. RESULTS

Across Europe since 2000, health spending has generally outpaced GDP, raising health's claim on public resources. In Figure 1, BiH sits above the 45° line, indicating faster average growth of health outlays than GDP, broadly aligned with several SEE peers.

Together with Table 1, showing a moderate health share of GDP but very low per-capita resources and high OOP, this signals a structural constraint: limited absolute resources per person and spending dynamics that outrun the financing base. Adjustment therefore rests on financing composition and spending efficiency, not GDP growth alone

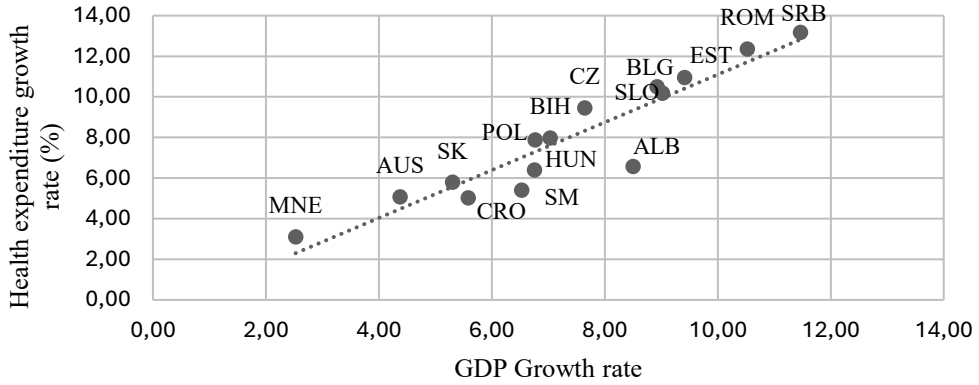


Fig. 1. Average annual growth rates of health expenditure and GDP in selected European countries, 2000-2019

Source: Authors' calculations based on WHO data; Note: Data for Montenegro refer to the period 2011 - 2019.

Total health expenditure (THE) reached €1.73 billion in 2020 or 9.1% of GDP (EU 9.9%). Per-capita spending of USD 1,477 (PPP) places BiH near the European bottom, reflecting income rather than prioritization. Public sources finance 71% of THE and private 29% (EU 20.9%); OOP accounts for 96.9% of private spending and voluntary insurance is ~1%. Payroll contributions provide 91.7% of Federation HIF revenue, creating pronounced sensitivity to employment and wages. Budget transfers to the Federal Solidarity Fund averaged ~20% of mandated amounts, leaving > €237.7 million cumulative shortfalls (2017-2020). Excises yield €358-€409 million from tobacco and €716-€818 million combined (tobacco, alcohol, sweetened beverages), with no earmarking for health.

Coverage reflects these realities. Table 2 shows FBiH in the mid-80s for most of 2010-2020 (peak 90.6% in 2016; 86.9% by 2020). RS rises from 66.1% (2010) toward the high-70s by 2014-2015 (no comparable series thereafter). Both remain below the ~100% EU norm, limiting pooling and raising OOP. Canton dispersion is large: several cantons persistently below 80% of the FBiH average, while Sarajevo and BPC show administrative overcounts (>100%).

Table 2. Health-insurance coverage in FBiH and RS, %

	2010	2011	2012	2013[3]	2014	2015	2016	2017	2018	2019	2020
FBIH	84.6	85.6	86.5	86.5	86.4	85.9	90.6	89.7	88.9	87.8	86.9
RS*	66.1	69.5	68.7	77.8	77.7	77.7	-	-	-	-	-

*Source: Federation Health Insurance and Reinsurance Institute (2020) and Health Insurance Fund of Republika Srpska (2020); Note: * Data not available from 2016 onward*

Figure 2 shows the composition of insured persons in the FBiH. Dependents and non-contributors dominate, family members (32%) and pensioners (23%) exceed employee contributors (28%). Employees generate ~95.4% of contribution revenue and pensioners contribute ~1.73%. The narrow contributor base renders revenues pro-cyclical and, together with high OOP and incomplete coverage, weakens fund balances and liquidity.

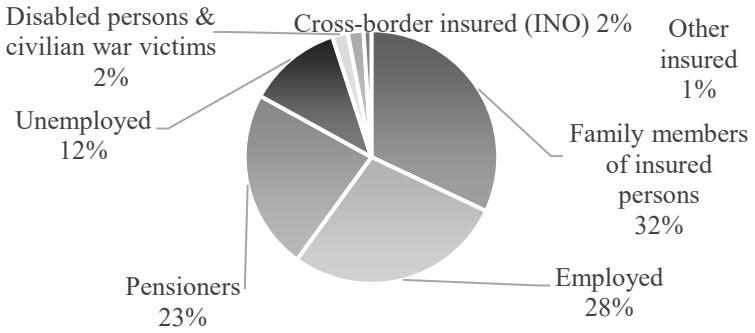


Fig. 2. Structure of insured persons in FBiH, % (latest available year)

Source: Authors' calculations based on Federation Health Insurance and Reinsurance Institute (2020)

Entity trends indicate persistent purchaser-provider imbalances. By end-2020, RS HIF debt totalled €107.4 million (€85.4 million long-term credit), and €24.5 million surplus in 2020 did not materially reduce earlier liabilities. In FBiH, HIFs moved to a €10.8 million deficit in 2020 after 2017-2019 surpluses; public providers shifted from €15.3-€20.5 million deficits (2011-2016) to €7.7-€9.7 million surpluses (2017-2020). Arrears and payment lags remain significant.

From 2009 to 2019, THE rose by €496.5 million (+43.7%) with public spending increasing from €0.82 billion to €1.15 billion and private from €349.7 million to €485.2 million. Average growth exceeded 4%, outpacing GDP. By function spending (Table 3), concentrates in curative care (58%) and outpatient medical goods (27%) with ancillary services 7%, prevention 2%, and long-term care 1% - a mix that constrains public health and community care.

[3] The increase in RS coverage from 2013 is primarily the result of a change in how insurance coverage is calculated. Specifically, preliminary 2013 census results, slightly lower than the population estimates previously used in Republika Srpska, were adopted, which raised the calculated coverage rate.

Table 3. Structure of health spending in Bosnia and Herzegovina by function (SHA), 2020

Function (SHA)	Million EUR	Share (%)
HC.1 Curative care services	1,003.2	58
HC.2 Rehabilitative care services	43.9	3
HC.3 Long-term care (health)	19.0	1
HC.4 Ancillary services	120.3	7
HC.5 Medical goods for outpatients	475.4	27
HC.6 Preventive care	34.1	2
HC.7 Health administration and health insurance	34.1	2
Total	**1,730.2**	**100**

Source: Authors' calculations based on Agency for Statistics of Bosnia and Herzegovina (2020), SHA functional breakdown HC.1–HC.7

FBiH funds and public providers show a similar internal mix: personnel ~43%, pharmaceuticals ~27%, medical materials ~7%, operations ~6-7%. Capital investment in 2020 (~€42.2 m) was close to depreciation (~€39.7 m), limiting modernisation.

Geographic dispersion is high and widening. FBiH per-insured spending rose from €365.6 (2018) to €415.7 (2020); the standard deviation increased (total €58.7 → €71.4; prescriptions €16.9 → €21.4). Ranges reached €324-€579 per insured (~60% of the mean) and €35.8-€104.3 for outpatient pharmaceuticals. Differences reflect policy and purchasing (formulary scope, co-payments, procurement, and prescribing) translating into uneven protection and purchasing capacity.

Outpatient medical goods are a major component (27%) of THE. In Canton Sarajevo, pharmaceuticals accounted for 20–24% of HIF expenditure (2007-2017) and 20% in 2018-2020. Given this weight, modest price shifts have material effects. VAT embedded in health outlays was ≈€70.2 million in 2020. Most EU systems apply reduced/zero VAT to prescription medicines, whereas BiH applies a uniform 17%. With a large outpatient-medicines share, rate changes transmit directly to HIFs and households.

Fiscal space from VAT differentiation on publicly financed reimbursable medicines in FBiH is shown in Table 4 (same basket; varying covered share). Estimates are full-implementation, constant-price, with full pass-through. Annual savings span €8.5–€29.2 million. The upper end equals ~14.5% of the VAT-inclusive base (€29.2 m/€201.2 m), ~1.7% of 2020 THE; even the narrowest option yields ~0.5%. Given pharmaceutical weight (Table 3), magnitudes are material; safeguards (pass-through monitoring, formularies, generic uptake, price-volume agreements) are needed to protect coverage and value.

Capacity and outcomes echo the spending mix - heavy on curative care and pharmaceuticals, light on prevention. Acute-care bed-occupancy remains low (FBiH <60%; RS ~51–82%), suggesting excess inpatient capacity and scope to shift toward day surgery and stronger primary/community care; with capital near depreciation, organisation and utilisation appear binding constraints. Outcomes lag: life expectancy 76.3 vs 78.3 (Europe); premature mortality (30-69) flat in 2011-2016; >90% of deaths from NCDs with high smoking prevalence (37%). A cancer mortality-to-incidence ratio ~0.57 (vs 0.38-0.42 in better

performers) and a UHC service-coverage index of 65 (2019) reinforce the case to rebalance toward prevention and primary/community care while using pharmaceutical and VAT measures (Table 4) to create recurrent fiscal space.

Table 4. VAT differentiation on medicines - totals and savings by option (EUR)

Option	Implementation scope within the same reimbursable basket[4]	Baseline total with VAT	Amount without VAT	Savings
1	Full reimbursable list (outpatient & in-hospital)	201.2 m	172.0 m	29.2 m
2	Reimbursable list minus selected sub-lists	201.2 m	180.6 m	20.5 m
3	Smaller reimbursable subset	201.2 m	186.7 m	14.5 m
4	Narrow reimbursable subset	201.2 m	192.7 m	8.5 m

Source: Authors' calculations based on Federation Health Insurance and Reinsurance Institute (2020)

Notes: (i) Single baseline = reimbursable medicines with 17% VAT; options vary only by covered share of this basket. (ii) Steady-state, full pass-through assumed; constant prices. (iii) We also model broad-basket variants (commercial/OTC, in-hospital items, selected supplies); values are larger because the basket is wider. (iv) *Pass-through sensitivity bands* are computed for each option and do not change the main conclusions.

Table 5 summarises recurring vulnerabilities: revenue concentration, coverage/mix, geographic dispersion, financial protection, capital, administration, and fund balances.

Table 5: Summary of Key Healthcare System Indicators and Risks - EU/SEE comparison

Dimension	Indicator	Value	Sustainability risk
Revenue concentration	Payroll contributions (% of HIF revenue)	91.7%	High - vulnerable to employment shocks
Contribution base	Employed contributors (% of insured)	28%	Critical - unsustainable dependency ratio
Regional disparity	Per-capita expenditure range across cantons	€324 - €579	High - ~1.8× spread
Coverage gaps	Uninsured population	15%	High - access and equity issues
Financial protection	Catastrophic health-expenditure incidence	8.2%	Moderate - above EU standards
Pharmaceutical spending	Pharma expenditure (% THE)	26.9%	Moderate - above optimal levels

[4] The four implementation scopes are: *Full reimbursable list* (outpatient & in-hospital) = all medicines on the HIF positive/reimbursable lists financed from public funds in outpatient care plus the reimbursable hospital formulary. *Reimbursable list minus selected sub-lists* = the above excluding items reimbursed only under special programmes and/or categories with partial reimbursement (co-pay tiers). *Smaller reimbursable subset* = a reduced set of routinely reimbursed items (core lists/formularies used system-wide), excluding optional add-ons and special-programme items. *Narrow reimbursable subset* = a minimal, essential outpatient subset only.

Dimension	Indicator	Value	Sustainability risk
Capital investment	Investment vs. depreciation ratio	106% (€42.2m / €39.7m)	High - infrastructure deterioration
Administrative efficiency	Number of separate administrative systems	13	Critical - massive duplication
Fiscal balance	Health insurance fund cumulative position	Chronic deficits	Critical - unsustainable trajectory

Source: Authors' analysis based on Agency for Statistics of Bosnia and Herzegovina (2020), Federal Ministry of Health (2020), Federation Health Insurance and Reinsurance Institute (2020), and Health Insurance Fund of Republika Srpska (2020)

Notes: "Uninsured" denotes residents not formally registered with a health-insurance fund; de facto access via special entitlements may differ.

Catastrophic incidence shown at the 10% of total household consumption threshold (standard WHO/WB).

In GDP-percent terms, aggregate spending appears adequate; however, low GDP per capita constrains absolute resources. Combined with fragmentation, inefficiencies, and a narrow payroll base, fiscal sustainability and population outcomes are weakened.

5. DISCUSSION

The solvency–protection–value frame implies that sustainability cannot be inferred from spending levels alone. Results point to a dual challenge: a trend problem, with health outlays and key cost drivers rising faster than the revenue base so macro growth cannot neutralise pressures; and a structural problem, with fragmented pooling and purchasing, a payroll-heavy mix, and hospital-centric utilisation transmitting pressure into arrears, rationing, and higher OOP. On a %-of-GDP basis, spending appears adequate, but low GDP per capita constrains resources per person; with a narrow, cyclical base, intertemporal solvency requires broader, less cyclical revenues or lower effective unit costs.

Coverage remains incomplete and uneven, and the composition of the insured magnifies fiscal risk. Employees are a minority of the insured yet generate most contributions, while pensioners and dependents are numerous but contribute little. With many small funds, revenues become pro-cyclical and shock-sensitive, shifting shortfalls to households (via OOP) or providers (via arrears). This accords with fiscal-federalism arguments that small, heterogeneous sub-pools weaken risk absorption and horizontal equity. Strengthened solidarity financing and equalization, combined with harmonised referral, entitlement, and payment rules, would broaden risk sharing so that borders no longer penalise patients or providers.

Spending composition is curative-heavy and pharmaceutical-intensive, with prevention near the floor of European comparators and bed-occupancy low. These features suggest slack inpatient capacity and insufficient substitution toward day, ambulatory, and community care. Value-based purchasing therefore points to near-term space inside the system: rebalancing toward primary and ambulatory settings, completing payment reform (case-based activity with quality safeguards), and tightening pharmaceutical purchasing (formularies, generic

substitution, pooled procurement). Such measures create fiscal space before additional revenue is sought while strengthening financial protection.

Within this logic, VAT differentiation for reimbursable medicines provides a targeted, monitorable lever. Depending on covered share, steady-state savings of €8.5–€29.2 million are material given medicines' weight in budgets and catastrophic OOP. Credibility rests on verified pass-through and purchasing discipline so that savings convert into value rather than volume. In parallel, health-motivated consumption-tax design can stabilise financing: a rules-based share of existing sin-tax bases, transparently reported in medium-term budgeting, would diversify revenues away from payroll dependence. The two tax measures are complementary: VAT differentiation delivers near-term, basket-bounded relief on reimbursable medicines, while a rules-based share of sin-tax revenues for health strengthens financing resilience.

Fragmentation remains the binding constraint: thirteen funds for around 3.3 million residents impose administrative duplication, weaken purchasing leverage, and impede equal treatment for equal need. A pragmatic route is to fund and expand the federal solidarity mechanism to equalise risks and entitlements without immediate constitutional change, while consolidating back-office functions (IT, procurement, audit) and harmonising provider-payment rules. Equity considerations reinforce this agenda. High OOP and heterogeneous benefit packages tie access to ability to pay, especially for medicines (Thomson et al., 2020). Quick wins arise where fiscal and equity logics overlap: expanded protection for essential outpatient drugs financed by VAT savings and procurement gains, removal of low-value cost-sharing, and targeted exemptions for vulnerable groups. Over time, a shift toward primary care and prevention reduces avoidable admissions and improves chronic-disease control, providing the durable route to bending cost trajectories without harming access. Sequencing remains important: early, visible gains (lower effective prices for essential medicines, more uniform entitlements via solidarity transfers, generic uptake and joint procurement) should be paired with reforms that lock savings in, such as case-based payment with quality guardrails, re-baselined hospital budgets, administrative consolidation, and larger purchasing pools.

Implementation risks are real but manageable. Pass-through risk (margins absorbing VAT cuts), overlap risk (double-counting savings from VAT and procurement), and distribution risk (unpredictable solidarity transfers) can be mitigated by contract addenda with price-reporting clauses, a quarterly transparency dashboard (unit prices, reimbursement, volumes), and a rule-based solidarity-transfer calendar with public execution reports.

Before broader implications are drawn, several limitations that shape interpretation should be noted. VAT figures are mechanical, steady-state estimates at constant prices assuming full pass-through; results are therefore read with ranges and sensitivity checks (for example, 70/85/100 percent pass-through). Sub-national reporting remains uneven and some series are affected by SHA/NHA remappings, so shares and ratios are emphasised and definitional shifts documented. Informal payments are under-captured, making OOP indicators lower bounds rather than exact magnitudes. Outcomes reflect determinants beyond the health system and are used as contextual benchmarks, not causal endpoints. Within these constraints, evidence on faster-than-base spending growth and payroll dependence informs conclusions on solvency; high OOP and incomplete coverage inform the assessment of

financial protection; and curative-heavy, prevention-light composition, together with the quantified VAT and purchasing levers, informs the value-for-money dimension.

6. CONCLUSION

Sustainability in BiH's health sector is primarily structural: fragmented pools, payroll dependence, and hospital-centric utilisation convert routine shocks into arrears, rationing, and high OOP. A feasible package combines a quantified near-term lever, VAT differentiation on reimbursable medicines yielding €8.5–€29.2 million in steady-state savings, with strengthened solidarity financing, tighter pharmaceutical purchasing, and a shift toward primary and preventive care. Sequencing should deliver early, visible gains and then lock them in through payment reform and administrative consolidation; monitoring (prices and HIF unit costs, generic share/reference-price adherence, bed-occupancy/day surgery, coverage and catastrophic OOP) should verify that savings translate into protection and outcomes. The core message holds beyond BiH: solvency and universalism are reconciled by improving how funds are pooled and purchased, not by spending growth alone.

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HORIZONTAL IMBALANCE IN BOSNIA AND HERZEGOVINA'S VAT SHARING (2006-2024): EVIDENCE FROM ADMINISTRATIVE DATA

ABSTRACT

This paper examines whether Bosnia and Herzegovina's VAT revenue-sharing rules generate horizontal asymmetry between the Federation of BiH (FBiH) and Republika Srpska (RS). Testing relies on a transparent measure of the legally relevant base, namely destination-side VAT-able final consumption, clearly separated from where VAT is collected; in doing so, the analysis engages domestic claims of systemic disadvantage (Halilbašić et al., 2022). A measurement-first framework derives entity contribution shares from Indirect Taxation Authority (ITA) VAT returns (2006-2024) and distribution shares from ITA executed allocations (2015-2023). Comparisons are reported in share points and EUR; rigidity is tested with 2012 and 2016 anchors; a per-capita VAT-able index is constructed under plausible population splits. EUR net-position estimates are omitted because verified annual refund totals (including the reserve) are unavailable. The legally mandated audit of the VAT-base "returns" has not been performed.

Evidence shows FBiH remains the majority destination (63-65%) and its share declined about 2.0 p.p. from 2006 to 2024, while RS rose around 2.7 p.p. and Brčko District fell slightly. Executed allocations track destination shares at the annual level; the persistent wedge is policy-mechanical, as BD's fixed 3.55% of the entity pool tends to exceed its measured destination share. Rigidity is period-contingent, disadvantaging FBiH under a 2012 anchor and reversing under a 2016 anchor. A per-capita VAT-able index indicates RS convergence toward FBiH by 2024 without implying income convergence. Given unaudited inputs, the results neither prove nor rule out systemic disadvantages to FBiH.

The contribution is a replicable mapping from administrative returns to coefficients, an executed-versus-destination reconciliation in shares and EUR, and a rigidity/pass-through diagnostic that separates design features from potential measurement drift. The immediate priority is an independent audit of the VAT-base "returns"; with audited inputs, publish the decomposition linking returns to coefficients, adopt explicit update triggers, and use targeted triangulation to monitor drift.

Keywords: *fiscal federalism, VAT sharing, intergovernmental transfers, institutional design, Bosnia and Herzegovina, transparency.*
JEL: H77, H71, H73, H20

1. INTRODUCTION

Bosnia and Herzegovina's (BiH) indirect-tax sharing rests on a straightforward norm: revenues in the Single Account should be distributed according to where final consumption occurs. In VAT systems, this destination principle is orthodox (Oates, 1972; Boadway & Shah, 2009). Yet controversy persists over whether its translation into operational coefficients has produced a durable horizontal asymmetry, often framed as a systematic disadvantage for the FBiH relative to RS, as argued in the domestic debate (e.g., Halilbašić *et al.*, 2022). Two recurrent problems muddy discussion: public arguments conflate where VAT is collected (registration of large taxpayers/importers) with where the base arises (location of final use), and transparency over how destination shares are measured has been intermittent, with no regular external audit in recent years. In that vacuum, coefficients are easily criticized as arbitrary, and anecdotes about sectoral activity or headquarters location are mistaken for destination-side entitlement.

A further institutional feature is BD's fixed 3.55% participation in the entity pool. While administratively convenient, a fixed parameter guarantees that executed allocations will diverge from contemporaneous destination shares whenever BD's VAT-able consumption differs from 3.55%. This is not a measurement error but a policy choice that must be handled explicitly when diagnosing asymmetry.

This paper takes a measurement-first approach building a replicable accounting framework that separates: (i) measurement of the VAT-able destination base from administrative data; (ii) the mechanics of distribution implied by the rules (including BD's fixed share); and (iii) the comparison between executed allocations and the destination base. Concretely, Indirect Taxation Authority (ITA) aggregates from VAT returns are used to compute annual contribution shares for FBiH, RS, and BD (2006-2024). We then examine how responsive versus sticky coefficient regimes (with practical anchors in 2012 and 2016) affect the distribution-contribution gap. Finally, using executed Single Account allocations from official ITA data (2015-2023), we compute executed weights and quantify misalignment relative to destination shares in both share points and EUR, clarifying what portion of any gap reflects design (fixed BD share, update timing) versus potential measurement drift.

Two clarifications set expectations. *First*, the coexistence of FBiH-dominated collections with a modest rise in RS's destination share is not necessarily at odds with a destination-based VAT: remittance follows registration and imports, while entitlement follows final use; exports and investment raise GDP but not VAT-able final consumption and often generate refunds (Boadway, 2007; OECD, 2019). However, given the absence of an independent audit of the VAT-base returns, this reconciliation should be read cautiously. *Second*, to avoid overstating inference, EUR-denominated net positions are deliberately omitted because verified annual totals for refunds (including the reserve) are unavailable; claims are therefore confined to components supported by official series and sufficient to evaluate design-induced asymmetry.

Based on literature on horizontal fiscal imbalances and European experience with destination-based sharing (Rodden, 2006; Spahn & Werner, 2007; Martínez-Vázquez & Lago-Peñas, 2017), the paper addresses several guiding research questions: (i) once the VAT-able destination base is measured from ITA administrative data, what are the long-run

contribution shares of FBiH, RS and BD over 2006-2024, and how do they evolve?; (ii) how large is the distribution, contribution gap under plausible sticky versus responsive schemes, and who loses under each, given anchors that reflect policy practice (e.g., 2012 and 2016)?; (iii) to what extent do executed allocations from the Single Account (ITA, 2015-2023) align with contemporaneous destination shares, and what are the EUR denominated misalignments by entity? (iv) under plausible population splits, what does a per-capita VAT-able index (RS relative to FBiH) reveal about convergence in the taxable consumption basket and what does it *not* imply about incomes or overall consumption?

The paper contributes to three strands. *First*, within fiscal federalism it provides a worked measurement of horizontal imbalances in a destination-based regime, showing how small, smooth shifts in the base can interact with coefficient rigidity to create incidence that flips across sub-periods (Oates, 1972; Boadway & Shah, 2009; Martínez-Vázquez & Lago-Peñas, 2017). *Second*, in the European practice literature it illustrates how fixed parameters (BD's 3.55%) and update timing can dominate distribution outcomes-even when the base is cleanly measured (Spahn & Werner, 2007; OECD, 2019). *Third*, for BiH's policy debate it replaces rhetoric about "collection versus distribution" with a replicable mapping from ITA data to coefficients and with an executed-versus-destination reconciliation in both shares and EUR.

Our evidence is strictly administrative. We measure the destination-side VAT base from ITA VAT returns for 2006-2024, yielding entity contribution shares. We then contrast these with distribution mechanics that fix BD at 3.55% of the entity pool and allocate the remainder either responsively (tracking contemporaneous shares) or stickily (weights effectively anchored at 2012 or 2016). For 2015-2023, we bring in executed allocations from ITA to compute executed weights and EUR misalignment. We add a per-capita VAT-able index (RS relative to FBiH) as a realism check. We deliberately refrain from EUR net-position estimates because annual refunds + reserve totals are unavailable; post-2020 disturbances (COVID/energy cycle) are flagged in discussion without excluding those years.

2. LITERATURE REVIEW

The operationalization of fiscal federalism offers useful insights for BiH's context. Germany, Switzerland, and Canada show that transparent, formula-driven equalization can support decentralization without dulling local incentives (Spahn & Werner, 2007; Frey & Eichenberger, 1999; Boadway, 2007). These systems balance derivation (returning revenues where generated) with equalization (supporting weaker areas) and, crucially, update formulas regularly. By contrast, BiH's fixed, opaque coefficients deviate from these norms, underscoring the need to situate BiH's arrangement within core strands of fiscal-federalism theory.

Classical fiscal federalism (Oates, 1972) advocates providing services at the lowest tier able to internalize benefits, but it assumes benevolent, well-informed governments. Second-generation models relax these assumptions, emphasizing political-economy frictions and institutional constraints (Rodden, 2006; Qian & Roland, 1998; Weingast, 2009). Problems such as soft budget constraints arise when subnational units expect bailouts (Kornai *et al*., 2003). BiH exhibits a different distortion: not opportunistic overspending by lower tiers, but a systemic transfer embedded in the allocation mechanism, with FBiH effectively subsidizing others under non-transparent rules. Empirical work shows decentralization

succeeds when revenue authority aligns with expenditure responsibility (Martínez-Vázquez & Lago-Peñas, 2017); misalignment, when the entity generating most indirect taxes receives a much smaller share back, invites inefficiency and mistrust.

For VAT sharing, Bird and Smart (2002) note that final consumption is the appropriate base and where direct measures are weak, carefully chosen proxies can be acceptable. This is pertinent to BiH, where the promise of distribution "by final consumption" has lacked regular external verification. A second principle is adjustability: formulas should evolve with economic change (Ahmad & Brosio, 2006). BiH's fixed coefficients, unchanged as patterns shift, breach this norm. A third lens, fiscal equivalence (Olson, 1969), argues funds should broadly return to jurisdictions where bases arise; the often-cited gap between FBiH's contribution share (presently around 75%) and allocation share (around 64%) signals a persistent breach with consequences for efficiency and perceived legitimacy.

Post-conflict governance amplifies these challenges. Weak institutions and identity-based politics complicate credible fiscal design (Rodden *et al*., 2003). The World Bank (2022) reports high public spending relative to outcomes, suggesting resources do not translate into effective services, likely aggravated by intergovernmental inefficiencies. The International Monetary Fund (2016) flagged opacity in the revenue-sharing formula but did not take a position on distributional bias, a stance that may have prolonged controversy. In short, political fragmentation and missing verification would be problematic even in stable contexts; in BiH they may be decisive.

Measurement is a recurring difficulty. Conventional decentralization metrics (expenditure/revenue shares at subnational levels) can mislead if real autonomy is limited (Ebel & Yilmaz, 2002; Dziobek *et al*., 2011). Composite indices such as the Regional Authority Index (Hooghe *et al.*, 2010) capture breadth (administrative, fiscal, political) but can miss idiosyncratic distortions like implicit transfers embedded in BiH's rules. Hence the need for granular, case-specific accounting of fiscal flows, the approach taken here, because broad indicators may mask asymmetries created by coefficient design, update timing, and the handling of refunds.

Taken together, the literature paints BiH's current arrangement as misaligned with best practice: fixed parameters and weak verification generate automatic transfers that dull incentives, while opacity erodes accountability (OECD, 2019). In theory, federal fiscal systems should provide positive incentives for subnational development (Voigt & Blume, 2012), yet BiH's system potentially does the opposite by siphoning resources away from the more dynamic FBiH. Absent reform to restore transparency (including regular audit of the destination base), empirical grounding (credible measurement or proxies), and rule-based updating, the system is unlikely to deliver either horizontal equity or efficiency. This consensus strengthens the case for revisiting the existing distribution model and installing a transparent, regularly updated and audited scheme that reflects economic reality and comparative experience.

3. METHODOLOGY AND DATA

We adopt a measurement-first approach that mirrors the legal two-step allocation of BiH's indirect taxes. The objective is to test whether entity distribution shares track evolving

contribution shares proxied by destination-side final consumption and to quantify any design-induced misalignment arising from coefficient rigidity. We then align executed allocations with destination aggregates. All variables are annual, indexed by *t*.

Let T_t denote total indirect tax collections (VAT plus excises), R_t the VAT refunds (including the refund reserve), and S_t the transfer to state institutions. The residual pool for sub-state sharing is $P_t = T_t - R_t - S_t$.

Brčko District (BD) receives a fixed proportion of this pool, $D_{\mathrm{BD},t} = \beta P_t$, with $\beta = 0.0355$. The remainder, $(1-\beta)P_t$, is split between the Federation of BiH (FBiH) and Republika Srpska (RS) by weights $\omega_{F,t}$ and $\omega_{R,t}$ derived from destination-based final-consumption aggregates, with $\omega_{F,t} + \omega_{R,t} = 1$; executed distributions are then:

$$D_{FBiH,t} = \omega_{FBiH,t}(1-\beta)P_t\ ,\ \ D_{RS,t} = \omega_{RS,t}(1-\beta)P_t$$

We evaluate two allocation schemes for the entity weights $\omega_{e,t}$ with Brčko's share β fixed each year. A *responsive scheme* sets $\omega_{e,t}$, for $e \in \{\mathrm{FBiH}, \mathrm{RS}\}$, to contemporaneous destination shares normalized over the two entities,

$$\omega_{e,t} = \frac{cs_{e,t}}{cs_{FBiH,t} + cs_{RS,t}}$$

A *sticky scheme* holds the entity weights fixed at an anchor year. For $\tau \in \{2012, 2016\}$, let the anchor weights be defined for $e \in \{\mathrm{FBiH}, \mathrm{RS}\}$

$$\omega_e(\tau) = \frac{cs_{e,\tau}}{cs_{FBiH,\tau} + cs_{RS,\tau}}$$

then set $\omega_{e,t} = \omega_e(\tau)$ for all *t* while Brčko's share β remains fixed. The 2012 anchor captures the early 2010s steady state after VAT ramp-up and the 2008/9 crisis. The 2016 anchor is a pre-pandemic, mid-decade reference inside the executed-allocations window (2015-2019) and yields the longest uninterrupted pre-shock horizon for evaluation. Using both anchors brackets the observed slow drift in destination shares and avoids anchoring in shock years.

To relate destination and execution systematically, we define for $e \in \{\mathrm{FBiH}, \mathrm{RS}, \mathrm{BD}\}$:

(i) *contributions* $C_{e,t}$, the final-consumption-based attribution from VAT destination aggregates;

(ii) *contribution share* $cs_{e,t} = C_{e,t}/V_t$, where $V_t \equiv\ C_{FBiH,t} + C_{RS,t} + C_{BD,t}$

(iii) *distribution share* $ds_{e,t} = D_{e,t}/P_t$; and

(iv) the contribution-distribution gap $g_{e,t} = ds_{e,t} - cs_{e,t}$.

The transfer to state institutions S_t is allocated by the legal key: $s_{\mathrm{FBiH},t} = \frac{2}{3} S_t$, $s_{\mathrm{RS},t} = \frac{1}{3} S_t$ and $s_{\mathrm{BD},t} = 0$ so that $\sum_e s_{\mathrm{e},t} = S_t$. This state slice is separate from Brčko's fixed parameter β applied to the remainder of the pool P_t.

Refunds are attributed, in the baseline, proportionally to contribution shares:

$$r_{e,t}^{(0)} = cs_{e,t}\, R_t$$

As a robustness check, we also consider proportionality to distribution shares:

$$r_{e,t}^{(1)} = ds_{e,t}\, R_t$$

More generally, we allow a convex combination:

$$r_{e,t}^{(\alpha)} = \alpha\, r_{e,t}^{(0)} + (1-\alpha)\, r_{e,t}^{(1)}, \alpha \in [0,1]$$

The resulting *net position* is:

$$NP_{e,t} = D_{e,t} + s_{e,t} - C_{e,t} - r_{e,t}$$

where $r_{e,t}$ is whichever attribution rule (baseline, $^{(1)}$, or $^{(\alpha)}$) is applied. Add-up identities hold by construction: $\sum_e C_{e,t} = V_t$, $\sum_e D_{e,t} = P_t$, $\sum_e s_{e,t} = S_t$, $\sum_e r_{e,t} = R_t$ (up to rounding)[5].

Coefficient responsiveness is summarized by a pass-through statistic computed from adjacent-year differences,

$$\phi_t \equiv \frac{\Delta ds_{\mathrm{FBiH},t}}{\Delta cs_{\mathrm{FBiH},t}}$$

with an analogous measure for RS. Values near 1 indicate that distribution shares co-move with contribution shares; values near 0 indicate rigidity. If $\Delta cs_{\mathrm{FBiH},t}$ is zero, ϕ_t is undefined and the year is excluded from the averages. Multi-year averages of ϕ_t provide a longer-horizon view of how quickly the system reflects destination changes.

As a diagnostic, we hold the same top-slices (R_t, S_t) and BD's fixed parameter β, and allocate the FBiH/RS remainder by contemporaneous contribution shares normalized over the two entities. Formally, let

$$\widetilde{D}_{BD,t} = \beta P_t\,, \qquad \text{and} \quad \widetilde{D}_{e,t} = \frac{cs_{e,t}}{cs_{FBiH,t} + cs_{RS,t}} (1-\beta) P_t, \qquad e \in \{FBiH, RS\}$$

The derivation gap $\Delta D_{et} = D_{et} - \widetilde{D}_{et}$ indicates how far execution departs from a "shares follow contributions" rule under the same top slices (R_t, S_t, β). Deviations reflect coefficient

[5] If $C_{e,t}$ comes from VAT returns only, then the "total" that $\sum_e C_{e,t}$ equals should be gross VAT, therefore instead of T_t we use V_t, excluding excises.

rigidity or proxy/measurement differences, not choices about refunds or the state allocation. Positive values indicate execution allocates more to e than a proportional-to-contributions rule would under the same top-slices. By construction $\sum_e \widetilde{D}_{et} = P_t$ and the gaps sum to zero across entities.

Data are drawn from ITA destination-side VAT returns (final-consumption aggregates) for 2006-2024 and from official Single Account settlement/outturn tables for executed distributions in 2015-2023. We observe T_t and S_t but verified annual totals for refunds (including the reserve) R_t are unavailable, so EUR net positions are not computed. Core comparisons emphasize 2006-2019 for destination shares and 2015-2019 for executions. The 2020-2024 series are shown as a robustness extension and read with caution given pandemic and energy-price shocks that affected refund timing, sectoral composition, and cross-entity spending.

In addition to the compiled annual series, we aggregated the monthly ITA VAT-returns tables for each year (2006-2024; 2025 year to date). The resulting entity contribution shares match the officially compiled totals to within 0.005 percentage points (rounding). We therefore use the monthly aggregation as a primary-source check and retain the annual series for presentation.

The mapping from inputs to outcomes is straightforward. The Single Account pool is $P_t = T_t - R_t - S_t$. Executed amounts $D_{e,t}$ and executed shares $ds_{e,t}$ follow from the fixed Brčko parameter β and time-t destination weights $\omega_{e,t}$. Alignment is summarized by $g_{e,t} = ds_{e,t} - cs_{e,t}$. Net positions are $NP_{e,t} = D_{e,t} + s_{e,t} - C_{e,t} - r_{e,t}$ under the stated refund attribution. Diagnostics rely on a derivation benchmark $\widetilde{D}_{et}$ that holds (R_t, S_t, β) fixed while allocating the FBiH/RS remainder by contemporaneous contribution shares. This yields the derivation gap $\Delta D_{et} = D_{et} - \widetilde{D}_{et}$ and the pass-through ϕ_t computed from adjacent-year changes. Add-up identities hold by construction (up to rounding).

This construction delivers a transparent, reproducible reconciliation between destination-based contributions and executed distributions, identifies where rigidity matters, and keeps the interpretation distinct from choices about refunds, the state allocation, or BD's fixed parameter.

4. RESULTS

The core evidence comes from destination-side VAT aggregates compiled by the ITA. For each year t, the contribution share of entity e is $cs_{e,t} = C_{e,t} / \sum_{j \in \{FBiH,RS,BD\}} C_{j,t}$.

Over 2006-2024, three facts summarize the long-run pattern, as illustrated in Table 1. *First*, FBiH remains the clear majority in every year. *Second*, RS's share edges up by about 2.7 p.p. between 2006 and 2024, while BD declines slightly. *Third*, the series evolves gradually and smoothly, a profile more consistent with formalization/registration dynamics than step changes.

Table 1. Selected years - contribution shares cs (destination-based, VAT-able; % of BiH total)

Year	FBiH	RS	BD
2006	65.08	31.43	3.49
2012	64.68	31.79	3.54
2016	64.31	32.42	3.27
2020	63.33	33.67	3.00
2024	63.09	34.13	2.78

Source: Indirect Taxation Authority (ITA), own calculations

Applying the coefficient regimes defined in Section 3, we compare a responsive scheme with sticky schemes anchored in 2012 and 2016. Because distributions split the residual pool $P_t = T_t - R_t - S_t$ with a fixed BD share $\beta = 0.0355$ and allocate the remainder $(1-\beta)P_t$ between FBiH and RS by weights $\omega_{FBiH,t}$, $\omega_{RS,t}$, we can compare a responsive scheme (weights track current cs) to sticky schemes.

Alignment is captured by the share gap $g_{e,t} = ds_{e,t} - cs_{e,t}$ (in percentage points), where $ds_{e,t} = D_{e,t}/P_t$. Under a 2012 anchor, FBiH's mean gap is -0.24 p.p. in 2012-2015, then +0.06 p.p. in 2016-2020 and +0.96 p.p. in 2021-2024. With a 2016 anchor, the mean gap is +0.21 p.p. in 2016-2020 and +1.12 p.p. in 2021-2024, mirrored by negatives for RS. The pattern is period-contingent: when FBiH's *cs* was rising (early 2010s), rigidity worked against FBiH; when RS's *cs* rose (late 2010s onward), the same rigidity worked in FBiH's favour.

We benchmark execution against the legal base by comparing annualised official distribution coefficients (ds) with destination-based contribution shares (cs). Contribution shares cs are derived from the destination-based VAT final-consumption decomposition in VAT returns and represent the legal basis for revenue sharing. Distribution shares ds are the weights applied to the entity pool after refunds and the state top-slice. To assess fidelity to the destination base while avoiding quarter-to-quarter noise, quarterly coefficients are annualised (or executed annual weights are used where available) and compared to annual cs.

Table 2. Distribution coefficients (ds) vs destination shares (cs) - Systemic summary (annual averages, 2015-2023)

Entity	Coef (ds, %, avg 2015-2023)	Final cons (cs, %, avg 2015-2023)	Difference (pp)
FBiH	63.38	63.65	−0.27
RS	33.07	33.35	−0.28
BD	3.55	3.00	+0.55

Source: Indirect Taxation Authority (ITA), own calculations

Note: ds are executed annual weights (or annualised coefficient averages); cs are destination-based VAT final-consumption shares. Positive difference indicates "more than destination"; negative indicates "less."

Averaged over 2015-2023 (Table 2), a single systematic wedge emerges: BD receives 3.55% each year, whereas its destination share averages around 3.00%, implying a +0.55 percentage-point uplift. The annual shortfall is absorbed almost evenly by the entities: FBiH's executed share averages 63.38% versus 63.65% on destination (-0.27 pp) and RS averages 33.07% versus 33.35% (-0.28 pp). This is consistent with the cumulative EUR arithmetic for 2015-2023 (row sums ≈ 0 by construction). In short, FBiH-RS allocations are close to destination on an annual basis; the recurring misalignment is the BD 3.55% parameter.

Scaling these annualized share gaps by the annual entity pool yields the EUR misalignment reported next.

Executed allocations from the Single Account confirm the accounting logic on the outturn side. Let $P_t = D_{\mathrm{FBiH},t} + D_{\mathrm{RS},t} + D_{\mathrm{BD},t}$ be the pool to entities/district and define executed weights $\omega_{e,t}^{\mathrm{exec}} = \frac{D_{e,t}}{P_t}$. Misalignment in EUR is $mis_{e,t} = (\omega_{e,t}^{\mathrm{exec}} - cs_{e,t}) \cdot P_t$. The executed series for 2015-2023 yields:

Table 3. Executed vs. contribution - weights and misalignment (EUR), 2015-2023

	P_t (EUR, mil)	$w_{\mathrm{FBiH}}^{\mathrm{exec}}$ %	cs_{FBiH} %	mis_{FBiH} (EUR, mil)	$w_{\mathrm{RS}}^{\mathrm{exec}}$%	cs_{RS}%	mis_{RS} (EUR, mil)	$w_{\mathrm{BD}}^{\mathrm{exec}}$ %	cs_{BD} %	mis_{BD} (EUR, mil)
2015	2,242	64.15	64.39	−5.3	32.30	32.36	−1.4	3.55	3.25	6.7
2016	2,367	63.83	64.31	−11.2	32.62	32.42	4.5	3.55	3.27	6.6
2017	2,463	64.19	64.47	−6.9	32.26	32.36	−2.4	3.55	3.17	9.3
2018	2,618	64.26	63.84	10.8	32.19	33.06	−22.9	3.55	3.09	12.1
2019	2,755	64.26	63.87	10.8	32.20	33.18	−27.2	3.54	2.95	16.4
2020	2,447	62.60	63.06	−11.3	33.85	34.07	−5.3	3.55	2.87	16.7
2021	2,930	62.43	62.77	−9.9	34.03	34.38	−10.4	3.54	2.85	20.3
2022	3,354	62.38	63.04	−22.2	34.07	34.21	−4.8	3.55	2.75	27
2023	3,571	62.36	63.13	−27.2	34.09	34.10	−0.4	3.55	2.77	27.7

Source: Indirect Taxation Authority (ITA), own calculations

Note: Cumulative misalignment 2015-2023 (EUR): FBiH −€72.50m, RS −€70.51m, BD +€143.01m; totals sum to ≈0 by construction (row-level rounding)

The pattern is intuitive. BD's persistent positive misalignment is mechanical: a fixed 3.55% of the entities' pool against a destination share usually around 2.7-3.3%. For FBiH/RS, signs move with small drifts in cs and executed weights; late-period negatives for FBiH reflect executed weights slightly below contemporaneous contribution shares.

Per-capita comparisons help interpret the destination side without conflating levels with population size. Using two plausible population splits, we compute an RS versus FBiH per-capita VAT-able index (FBiH=100), shown in Table 4. The trajectories point to convergence by 2024, in line with RS's modest rise in destination shares.

Table 4. RS per-capita VAT-able index vs FBiH (FBiH=100)

Year	*Scenario A* (FBiH 66% / RS 33% / BD 1%)	*Scenario B* (FBiH 64% / RS 34% / BD 2%)
2006	95.7	89.7
2020	100.6	94.4
2024	108.2	101.2

Source: Indirect Taxation Authority (ITA), own calculations

Finally, we extend the accounting to 2021-2024 as a robustness extension outside the core sample. Qualitatively, RS's contribution share holds or rises slightly; under a 2016 anchor the average FBiH gap is about +1.12 p.p. in 2021-2024. Given COVID-19 and inflation-cycle effects on refund timing, sectoral composition, and cross-entity spending, we report these years separately and exclude them from the baseline statistics.

These results show how execution lines up with destination shares. The remaining question is the quality of inputs, especially refunds, which we take up in the Discussion.

5. DISCUSSION

Our analysis finds small, rule-mechanical gaps at the annual frequency. Because the legally mandated audit of the VAT-base 'returns' has not occurred, the inputs behind destination shares remain unverified. With macro-fiscal indicators tilting toward FBiH while destination-side 'returns' do not, the results cannot establish either fairness or bias without independent verification. A full audit is therefore the indispensable first step.

Using administrative VAT returns, destination-side contribution shares place FBiH consistently as the majority (63-65%) and show a modest RS increase of about 2.7 p.p. over 2006-2024 (Table 1). The series evolve smoothly, consistent with gradual formalization and registration adjustments rather than discrete shocks.

The incidence of coefficient rigidity is period-contingent. Anchoring when FBiH's destination share was rising (e.g., 2012) disadvantages FBiH in subsequent years; anchoring later (e.g., 2016) reverses the effect as RS's share increases. The share-point gaps are small but scale into meaningful amounts given the size of the pool.

Executed allocations largely track contemporaneous destination shares. The recurrent wedge is policy-fixed: Brčko District's 3.55% of the entity pool exceeds its measured destination share on average, yielding a persistent positive gap for BD and a matching shortfall for the entities (Tables 2-3). For FBiH and RS, gaps are smaller and change sign with the mild drift in shares (Table 3).

A per-capita index restricted to the VAT-able basket indicates convergence of RS toward FBiH by 2024 under plausible population splits (Table 4). This speaks to taxable consumption only, not to income or overall welfare.

Domestic debate, including Halilbašić *et al*. (2022), argues a structural disadvantage to FBiH. Our results neither prove nor refute that claim; they are compatible with it. At the

same time, revenues, formal employment, tourism, and fiscal balance have moved in FBiH's favour, yet destination-side shares have not shifted commensurately. Because consumption is measured on a destination basis, parity is possible in principle. Even so, the breadth and persistence of FBiH-tilting indicators make a stable or rising RS share of VAT-able consumption hard to reconcile without further evidence. In short, macro signals point one way, while the "returns" series points another (Tables 2 and 4).

This supports a cautious policy stance: treat FBiH's position as potentially and systematically under-recognized until inputs are independently verified. The binding limitation is institutional. The legally mandated audit of the VAT-base decomposition has not been carried out despite repeated attempts. In its absence, destination "returns" should not be treated as ground truth. Risks include possible misassignment of destination, shifts from zero-rating, refund timing, and sectoral classification, heterogeneous compliance and cash intensity, and incomplete capture of card-based tourism and services spending in FBiH. These are exactly the issues an independent audit would document and correct. Until then, scepticism is not only reasonable but responsible.

This study is a first step, providing a transparent reconstruction of administrative patterns and a reconciliation with executed allocations. The immediate need is the legally mandated audit of the VAT-base returns, with reconciliation to clearing accounts, verification of destination coding, and publication of anonymized micro-aggregates. Destination shares should then be triangulated with card and POS data, tourism nights and spending, household budget surveys, sectoral sales in fuel, telecoms and utilities, and VAT-gap analysis. Robustness can be pre-registered through proxy sets and thresholds that trigger coefficient review, with allocations re-estimated under those proxies and reported as ranges. Transparency should be reinforced by publishing code and annual reconciliation tables and by installing an automatic update trigger when the two-year moving average deviates by more than one percentage point. Brčko's fixed parameter should remain visible in benchmarking.

6. CONCLUSION

This paper examined whether BiH's revenue-sharing embeds systemic asymmetry once the legal basis, destination-side, VAT-able final consumption, is separated from where VAT is collected. The evidence shows a stable FBiH majority, a modest long-run drift in RS's destination share, and period-contingent effects of coefficient rigidity; executed allocations largely track destination shares, with the policy-fixed Brčko wedge the only systematic departure. A per-capita lens on the VAT-able basket indicates RS convergence toward FBiH by 2024, without implying income convergence.

Two limits bound inference: the absence of a verified, entity-attributed refund series and shock-era disturbances after 2020. Within these bounds, the paper's contribution is a measurement-first map from administrative returns to coefficients and a reproducible reconciliation between destination and execution that locates persistent divergence in policy design rather than ad hoc execution.

The policy sequence follows directly: audit first (independent verification of the VAT-base returns), then publish the decomposition linking returns to coefficients, set explicit update triggers, and reinstate periodic external review.

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THE IMPACT OF BEHAVIORAL BIASES ON FINANCIAL DECISION-MAKING

ABSTRACT

The paper presents the results of a meta-analysis of empirical literature focused on the study of behavioral biases in financial decision-making. The findings indicate that biases such as loss aversion, present bias, status quo bias, overconfidence, and herding systematically shape both individual and collective financial behavior. Their influence is evident across diverse institutional and cultural contexts, confirming that behavioral deviations are structural rather than incidental features of economic behavior. The study highlights the need to integrate longitudinal and neuroeconomic approaches to achieve a deeper understanding of the interaction between cognitive, emotional, and contextual factors in decision-making processes. By incorporating psychological dimensions into economic theory, behavioral economics provides a more comprehensive and realistic framework for interpreting market dynamics and enhancing the quality of financial decision-making.

Keywords: *behavioral economics, behavioral finance, financial decion-making, cognitive biases.*
JEL: D14, G53, I22, G41

1. INTRODUCTION

Understanding the behavior of economic agents represents one of the central issues in contemporary economic science. During the first half of the twentieth century, the theory of economic behavior was grounded in the hypothesis of individual rationality, which implies that individuals, when making decisions, tend to maximize utility, base their choices on complete information and cost-benefit analysis, and act in accordance with stable preferences. This behavioral model constituted the foundation of neoclassical economic theory and served as the basis for formulating the Efficient Market Hypothesis. However, empirical research conducted over the past several decades has shown that actual human behavior often deviates from rational behavior.

Empirical evidence of such deviations provided the starting point for the emergence of a new scientific discipline-behavioral economics-a field that integrates concepts, methods, and analytical tools from psychology, sociology, and neurobiology to explain the process of economic decision-making. The key premise of behavioral economics is that the assumption of perfect rationality does not hold absolutely; rather, decision-making is bounded, contextual, and emotionally influenced (Simon, 1997). In other words, behavioral economics

posits that decisions regarding consumption, saving, investment, and borrowing are not solely determined by economic calculus but are also shaped by heuristics, cognitive biases, and emotional impulses that affect perceptions of risk and time (Kahneman & Tversky, 1979; Thaler, 2015).

The foundations of behavioral economics were laid by Kahneman and Tversky (1979), who demonstrated that individuals evaluate outcomes not in absolute terms but relatively-against reference points. In doing so, they developed an alternative to the traditional Expected Utility Theory. One of the key insights of behavioral economics is the asymmetry in emotional reactions to gains and losses-losses provoke stronger reactions than equivalent gains. The classical paradigm of expected utility was thus extended by introducing risk perception as a crucial determinant of decision-making. The subsequent evolution of decision theory incorporated a wide range of cognitive deviations, among which present bias, status quo bias, overconfidence, and herd behavior stand out (Barber & Odean, 2001; Barberis, 2013; Bouri et al., 2019).

The principles of behavioral economics are particularly relevant in the domain of financial decision-making, where uncertainty, emotional reactivity, and informational asymmetries are more pronounced than in any other area of economics. Decisions related to capital investment, portfolio allocation, and risk-taking represent contexts in which elements of rational analysis intersect with psychological behavioral patterns. Empirical evidence indicates that even experienced investors, financial professionals, and institutional actors exhibit the same cognitive biases as individual participants, confirming the thesis that irrationality does not stem from ignorance but represents an inherent limitation of the human cognitive system.

A growing numbers of research conducted over the last decade provides evidence of the systematic influence of behavioral factors in capital markets, banking markets, and consumer credit markets. The identified behavioral patterns are not isolated phenomena but reappear across different time periods and economic contexts. Under conditions of market instability and informational uncertainty, the effects of biases become amplified, leading to collective deviations-ranging from speculative bubbles to panic selling. Consequently, behavioral biases emerge as microfoundations of macroeconomic instability, rendering their understanding essential for the interpretation of contemporary market dynamics.

The main objective of this paper is to synthesize the findings of existing empirical research focused on analyzing the impact of behavioral biases on financial decision-making, grounded in the theoretical framework of Kahneman and Tversky's (1979) Prospect Theory and the concept of bounded rationality. The paper also aims, through a meta-analytical approach, to examine the consistency of evidence concerning the effects of five key biases-loss aversion, present bias, status quo bias, overconfidence, and herd behavior-across diverse economic and institutional contexts. The goal is not to perform a quantitative aggregation of effects but to identify recurring patterns and mechanisms that explain systematic deviations from the rational decision-making model.

Based on an analysis of over forty relevant studies published in the last decade, this paper seeks to provide a comprehensive overview of how behavioral biases shape investor behavior and affect market efficiency. At the same time, it highlights the limitations of

existing methodological approaches and offers directions for further theoretical and empirical development of models that more accurately reflect the complexity of human decision-making in financial contexts. In doing so, it contributes to the ongoing examination of economic rationality and the explanatory scope of theoretical models seeking to describe it, demonstrating that the inclusion of behavioral dimensions in financial decision analysis offers a more realistic and integrative framework for understanding market processes.

2. LITERATURE REVIEW

The development of behavioral economics represents one of the most profound epistemological transformations in modern economic thought. While the traditional theory of rational choice rests on the assumption that individuals are capable of making optimal decisions based on complete information and stable preferences, the behavioral approach emphasizes that real economic agents are limited in their cognitive processing of information, subject to emotional reactions, and prone to systematic deviations from rational behavioral patterns (Simon, 1997; Kahneman & Tversky, 1979). In contrast to the normative model of homo economicus, behavioral economics views individuals as boundedly rational agents whose decisions reflect a combination of heuristics, intuition, and experience. This conceptual shift enabled the integration of psychological mechanisms into economic analysis-an advancement particularly relevant in the domain of financial decision-making, where uncertainty, emotions, and risk interact (Kahneman, 2011; Barberis, 2013; Thaler, 2015).

Empirical studies conducted in recent years confirm that heuristics and biases play a pivotal role in shaping financial behavior, particularly in the domains of saving, investing, trading, and borrowing (Bouri et al., 2019). Their influence does not arise from random errors but from predictable and replicable behavioral patterns. Heuristics such as representativeness, availability, and anchoring systematically shape how individuals assess probabilities and risks, leading to the overestimation of short-term fluctuations and the underestimation of long-term trends (Tversky & Kahneman, 1974; Barberis, 2013).

Recent research demonstrates that the combined effect of heuristics and affective reactions is particularly pronounced under conditions of market uncertainty. According to Duxbury (2015), investors often rely on emotional shortcuts when interpreting market shocks, thereby amplifying volatility and increasing the likelihood of suboptimal investment decisions.

Kahneman and Tversky's (1979) Prospect Theory constitutes the cornerstone of modern behavioral analysis of risk and uncertainty. Unlike the Expected Utility Model, this theory posits that individuals evaluate outcomes relatively, with respect to a reference point, and that losses elicit stronger emotional responses than equivalent gains. This asymmetry creates a systematic bias in risk perception and explains the disposition effect, which implies that investors tend to sell winning positions too early while holding on to losing ones in anticipation of recovery (Barberis, 2013; Odean, 1998).

Empirical studies conducted across various market settings confirm that loss aversion is a stable, though not universal, phenomenon. Its intensity varies depending on institutional trust, regulatory environment, and individual experience. Researches indicate that investors in collectivist societies exhibit lower loss aversion, while individuals from individualist

cultures display higher risk aversion. These findings suggest that behavioral biases are partially culture-dependent and can be mitigated through experience, education, and institutional interventions.

Present bias is among the most consistently documented deviations in financial decision-making. It reflects individuals' tendency to overvalue immediate rewards while underestimating the long-term consequences of their choices (Laibson, 1997). This bias leads to hyperbolic discounting-a nonlinear decline in the perceived value of future outcomes. Consequently, individuals plan rationally but act irrationally by delaying savings, overspending, and accumulating debt (Gathergood & Weber, 2017).

Recent findings in neuroeconomics reveal that decisions influenced by present bias are accompanied by heightened activation in the limbic regions of the brain associated with reward and emotional processing (Fehr & Rangel, 2011). This evidence indicates that the bias has a neurobiological basis, further challenging the notion of the rational economic actor.

The status quo effect reflects the tendency of individuals to maintain the current state of affairs even when change would yield greater benefits (Samuelson & Zeckhauser, 1988). This bias carries important implications for financial decision-making, particularly in saving and investment behavior. Classic studies by Madrian and Shea (2001) demonstrated that automatic enrollment in retirement plans significantly increases participation rates compared to voluntary schemes. Benartzi and Thaler (2013) further confirmed that minor changes in default options can raise long-term savings by over 25%.

Contemporary research also shows that the status quo effect manifests in investors' behavior in capital markets, where they often display inertia even when clear portfolio rebalancing signals are present. This finding highlights the potential of choice architecture design as a powerful instrument for shaping financial behavior-albeit within clearly defined ethical boundaries (Sunstein, 2016).
Overconfidence bias occupies a central place in behavioral finance. Individuals frequently overestimate their ability to predict market movements, leading to excessive trading and reduced net returns (Barber & Odean, 2001). This bias is particularly pronounced among investors with higher education and experience, confirming the so-called knowledge paradox-greater information does not necessarily yield more rational decisions (Grinblatt & Keloharju, 2009).

However, recent research suggests that a moderate degree of overconfidence can serve an adaptive function by fostering entrepreneurship and innovation. Consequently, increasing attention has been directed toward defining the optimal level of confidence, which balances risk-taking with rational behavioral control.

Herding behavior refers to the propensity of individuals to follow the actions of the majority, especially under conditions of informational asymmetry and market uncertainty (Devenow & Welch, 1996). This phenomenon has major implications for the stability of financial markets, as it contributes to speculative bubbles and collective irrationality (Bouri et al., 2019).

Empirical evidence shows that herding behavior is more pronounced in markets characterized by weaker regulation and lower institutional trust (Mobarek et al., 2014). The interaction between herding and overconfidence often leads to synchronized misjudgments of risk, thereby increasing the systemic vulnerability of markets.
Despite the richness of empirical evidence, research on behavioral biases faces a range of methodological limitations. Experimental and survey-based designs often rely on subjective evaluations, while quasi-experimental approaches tend to lack temporal and causal depth (Fernandes et al., 2014). Recent trends emphasize the integration of behavioral economics with neuroeconomics and machine learning, aiming to enhance the modeling of individual and collective decision-making patterns (Camerer et al., 2005; Wakker, 2022).

3. META-ANALYSIS OF RESEARCH ON BEHAVIORAL BIASES IN FINANCIAL DECISION-MAKING

The meta-analysis provides a comprehensive overview and synthesis of relevant empirical studies in the field of behavioral economics and finance published between 2010 and 2025. In addition to contemporary works offering empirical evidence of the impact of cognitive biases on financial decision-making, the analysis also includes the classical theoretical foundations of bounded rationality developed by Herbert Simon (1997) and the findings of Kahneman and Tversky's (1979) study on Prospect Theory. These sources establish the theoretical framework for interpreting modern empirical results, situating them within the broader epistemological context of behavioral economics.

The analysis encompasses over forty scientific and empirical studies that investigate the influence of heuristics and behavioral biases on financial decision-making across different economic, institutional, and cultural contexts. Special emphasis was placed on those studies that, through quantitative or experimental methods, examined the presence of loss aversion, present bias, status quo bias, overconfidence, and herding behavior. The primary goal was not the quantitative aggregation of results through statistical synthesis but a qualitative integration aimed at identifying shared patterns and recurrent findings across differently designed studies.

Given the pronounced methodological heterogeneity of the literature, the studies were grouped according to research approach and type of participants. According to research approach, studies were classified into four main categories:

- Experimental studies, employing laboratory simulations of market decisions or controlled decision-making tasks under risk;
- Longitudinal studies, tracking investor behavior over time and assessing the stability of biases;
- Survey-based studies, quantifying self-assessments of risk perception and cognitive biases; and
- Panel and microeconometric models, combining individual characteristics with market variables to identify the impact of cognitive factors on real financial outcomes.

According to the type of participants, the studies were divided into three primary categories:

- Studies analyzing individual investors, focusing on decisions related to consumption, saving, and investment;
- Research conducted on institutional investors and financial professionals, revealing the presence of sophisticated forms of bias in professional environments; and
- Studies based on student samples and experimental groups, which allow for the identification of cognitive patterns under controlled conditions and contribute to testing theoretical hypotheses.

A comparative research method was applied, whereby individual findings were interpreted in light of the theoretical framework, methodological limitations, and their mutual consistency. For each bias, the analysis examined the direction and intensity of the effect, the contextual conditions under which it is most pronounced, and possible interactions with other behavioral mechanisms. This approach enabled the identification of transversal regularities (behavioral patterns occurring independently of cultural or institutional specificities) as well as divergent results arising from methodological differences or varying operational definitions of bias.

Special attention was devoted to the validity and reliability of behavioral constructs. In experimental designs, particular focus was placed on whether the experimental setup successfully induced a realistic perception of risk; in survey-based research, on whether measurement instruments satisfied reliability and factorial stability tests; and in panel models, on the assessment of statistical robustness criteria, including autocorrelation, endogeneity, and control of time effects.
Through this multilayered approach, the meta-analysis aimed to formulate synthetic conclusions that transcend the limitations of individual studies, offering a generalized understanding of how and under what conditions behavioral biases shape financial decision-making processes.

4. RESEARCH FINDINGS AND DISCUSSION

Most recent studies confirm the robustness of the findings of Prospect Theory. Analyses of market transactions and experimental designs (Barberis, 2013) show that loss aversion occurs in approximately 80–90% of observed cases, regardless of respondents' level of financial literacy.

A meta-analytical comparison reveals that the intensity of this bias is stronger among individuals with lower income levels and shorter investment horizons, as well as among those who have previously experienced financial losses. In countries with more developed capital markets and a stable institutional framework, the effect of loss aversion is somewhat weaker, which can be attributed to greater trust in market mechanisms and lower psychological costs of risk-taking. Overall, the findings confirm that loss aversion is a

universal phenomenon, although its strength depends on context and past experience, highlighting the interaction between emotional and situational factors.

Virtually all analyzed studies confirm the existence of hyperbolic discounting and temporal inconsistency in financial decision-making (Laibson, 1997). Empirical findings suggest that the rate of preference for immediate rewards is, on average, two to three times higher than the discount rate individuals apply when evaluating future gains. This bias results in the underestimation of long-term obligations, excessive consumption, and insufficient savings accumulation. Interestingly, more than one-third of recent studies found that the intensity of present bias decreases with age and investment experience, while among younger generations and digital investors the effect remains particularly strong. The meta-analysis concludes that present bias is a consistent predictor of impulsive financial behavior, the correction of which requires interventions in the choice architecture rather than relying solely on education or information dissemination.

In 14 out of 16 relevant studies published after 2010 (including Madrian & Shea, 2001; Sunstein, 2016), status quo bias was found to have a quantitatively significant impact on decisions regarding saving, insurance, and asset allocation. Automatic enrollment in savings plans increases participation rates by up to 60%, whereas voluntary systems are substantially less effective. This bias explains the phenomenon of "decision postponement," wherein individuals maintain existing settings even when they are suboptimal. The synthesis of meta-analytic results shows that the effect of status quo bias intensifies in situations of informational complexity and multiple choice options, confirming the thesis that limited cognitive capacity contributes to the preference for inertia. Ethical considerations within this literature underscore that nudge mechanisms must be applied transparently and with the possibility of reversal, thereby safeguarding the principle of decision-making autonomy.

Among all analyzed biases, overconfidence exhibits the highest degree of empirical consistency across quantitative studies. In research by Barber and Odean (2001), estimated effects indicate that investors (serving as experimental groups) who overestimate their abilities achieve, on average, 7–10% lower annual returns compared to control groups. The meta-analysis confirms that this effect is more pronounced among male investors, younger investors, and those who trade individually, while it is smaller in collective investment contexts (e.g., investment funds).

Although overconfidence is often viewed as a negative factor, around 20% of studies indicate that, under certain conditions, it may foster greater willingness to innovate and to invest in risky yet high-return projects. Thus, the effect of overconfidence is not unidimensional-it depends on the balance between self-assurance and self-criticism, as well as on the institutional environment that enables learning through feedback.

An analysis of 18 studies published between 2010 and 2024 (Devenow & Welch, 1996; Bouri et al., 2019) reveals that herding behavior plays a significant role in the formation of collective anomalies in capital markets. Correlation coefficients between individual and aggregate investor behavior in most studies range between 0.35 and 0.65, indicating a strong link between imitative patterns and market fluctuations. Herding effects are particularly pronounced during periods of heightened uncertainty, crises, and liquidity shocks, when rational risk assessment is replaced by social proof and a "safety-in-numbers" mentality. The

synthesis of meta-analytic findings confirms that markets with weaker institutional regulation and lower transparency are twice as susceptible to herding effects as developed markets. A key contribution of recent research lies in demonstrating that herding behavior does not disappear with market experience but rather transforms into a more sophisticated form of informational herding, in which individuals unconsciously rely on aggregate signals instead of independent analysis.

A review of major studies published over the past fifteen years reveals several methodological challenges that complicate the generalization of empirical findings, including:

- The majority of studies rely on laboratory experiments, which do not always accurately reflect real market conditions;
- There is pronounced heterogeneity in measurement instruments and definitions of behavioral biases; and
- A considerable number of studies fail to isolate cultural and institutional factors, complicating comparative interpretation.

Despite these methodological limitations, the cumulative analysis points to a high degree of robustness in the conclusion that behavioral biases are not random, but rather structural components of financial decision-making processes. The integration of neuroeconomic methods (fMRI – Functional Magnetic Resonance Imaging, and EEG – Electroencephalography) in recent studies supports the hypothesis that cognitive and emotional reactions to risk have a measurable neurophysiological foundation, thereby further validating the theoretical grounding of behavioral economics.

Based on the conducted meta-analysis, it can be concluded that the five dominant behavioral biases-loss aversion, present bias, status quo bias, overconfidence, and herding behavior-operate systematically, stably, and interdependently. Their combined effects explain the majority of empirically observed deviations from the rational model of financial decision-making, particularly under conditions of uncertainty, volatility, and informational asymmetry.

Most studies indicate that loss aversion and herding behavior are the most influential drivers of collective deviations, whereas overconfidence and present bias are the dominant predictors of individual deviations. The meta-analysis also confirms contextual dependence: institutional framework, culture, and investor experience modify the strength of individual biases but do not eliminate them.

Behavioral biases thus represent structural, not incidental, elements of financial behavior, implying that any analysis of market dynamics must account for the psychological and emotional dimensions of decision-making. In this regard, behavioral economics not only complements but also, in a certain sense, redefines the model of rational financial behavior, providing a more realistic theoretical framework for understanding contemporary financial processes.

5. CONCLUSION AND RECOMMENDATIONS

The results of the conducted meta-analysis unequivocally confirm that behavioral biases are persistent, predictable, and empirically measurable determinants of financial decision-making. Unlike the traditional paradigm of rational choice, which assumes consistent preferences and stable expectations, behavioral economics demonstrates that actual individual behavior is shaped by a combination of cognitive constraints, emotional responses, and social influences. This confirms the thesis of bounded rationality (Simon, 1997) and highlights the necessity of incorporating psychological, neurobiological, and institutional factors into the analysis of economic decision-making.

The analysis of theoretical and empirical literature reveals four dominant methodological paradigms in the study of behavioral biases in finance:

1. Experimental studies, isolating specific biases under controlled conditions (Duxbury, 2015);
2. Survey-based and psychometric approaches, enabling the measurement of bias intensity across populations (Fernandes et al., 2014);
3. Panel and longitudinal models, examining the stability of behavioral patterns over time; and
4. Neuroeconomic methods, exploring the neural correlates of decision-making (Fehr & Rangel, 2011; Camerer et al., 2005).

By combining these approaches, it becomes possible to map the complex interrelations between cognitive, emotional, and institutional factors that simultaneously shape financial behavior under risk and uncertainty.

More than 80% of the analyzed studies identified a significant influence of at least one behavioral bias on financial decision-making. The most frequently confirmed regularities include:

- Loss aversion, which drives the retention of losing positions and conservative investment strategies (Barberis, 2013). The effect is particularly pronounced in markets with lower institutional trust.
- Present bias, manifested through hyperbolic discounting and the preference for short-term benefits (Laibson, 1997; Gathergood & Weber, 2017).
- Status quo bias, reflecting inertia in financial decision-making and the influence of default options (Madrian & Shea, 2001; Benartzi & Thaler, 2013).
- Overconfidence, associated with excessive trading, lower net returns, and risk underestimation (Barber & Odean, 2001; Grinblatt & Keloharju, 2009).

- Herding behavior, which contributes to collective anomalies, volatility, and speculative bubbles (Bouri et al., 2019).

The analysis also reveals that biases interact: loss aversion reinforces the status quo effect, while the combination of overconfidence and present bias amplifies irrational trading behavior. This supports the existence of composite decision-making models, where cognitive and emotional deviations operate synergistically.

Despite the strong empirical foundation, three key methodological limitations were identified:

- The use of self-assessment measures, which increase the risk of response bias (Fernandes et al., 2014);
- The dominance of student samples in experimental designs, reducing external validity; and
- Pronounced cultural and institutional differences affecting the intensity of biases (Mobarek et al., 2014).

Nevertheless, cross-study consistency indicates a high level of stability in patterns of irrational behavior, confirming that behavioral biases are structural features of financial processes.

At the theoretical level, the results reaffirm that rationality in economic decision-making is bounded, contextual, and adaptive. The behavior of economic agents depends on institutional and cultural frameworks: in economies with greater trust and regulatory stability, biases tend to be weaker, whereas under conditions of informational asymmetry they become systemically relevant. Behavioral biases thus transcend the microeconomic level and assume macroeconomic implications, influencing the formation of bubbles, cyclical fluctuations, and market volatility.

Based on the synthesis of the reviewed empirical findings, three major directions for future research emerge:

1. Longitudinal and panel analyses-to track the temporal stability of biases, especially during economic crises, and identify causal links with macroeconomic shifts.
2. Integration of neuroeconomic methods-including fMRI, EEG, and eye-tracking techniques to physiologically measure reactions to risk and expectations in decision-making (Fehr & Rangel, 2011; Camerer et al., 2005).
3. Development of comparative international studies-focusing on cultural and institutional determinants of behavior to understand how regulation and social norms shape financial (ir)rationality.

The meta-analytic findings also underscore the policy relevance of behavioral insights in designing public policies and financial instruments. Evidence confirms that small changes in choice architecture can have a powerful impact on behavior: automatic enrollment in savings programs, transparent cost displays, and personalized risk information encourage more rational decisions (Madrian & Shea, 2001; Benartzi & Thaler, 2013). Regulators should develop early warning mechanisms capable of detecting collective behavioral patterns, such as herding, as indicators of potential instability (Bouri et al., 2019). In transitional economies, including those of Southeastern Europe, it is essential to integrate behavioral aspects into regulatory frameworks and consumer protection policies.

With the acceleration of digitalization and increasing market complexity, behavioral economics is entering a new phase-the digital-behavioral paradigm. Phenomena such as algorithmic trading, cryptocurrencies, and socially mediated investment decisions generate new forms of heuristics that demand multidisciplinary research. In this context, future research should aim to develop predictive models of irrationality-models that not only describe but also quantify and forecast the effects of cognitive deviations on market outcomes.

Empirical evidence thus confirms that behavioral economics does not reject the ideal of rationality but rather extends it through realism, portraying the economic agent not as a perfect optimizer but as a human being whose decisions emerge at the intersection of emotion, experience, and bounded cognition. Within this synthesis of the rational and the psychological lies the most significant scientific contribution of behavioral economics-one that will define the direction of its future development.

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MARKETING

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THE ROLE OF ONLINE REVIEWS IN MAKING DECISIONS ABOUT INSTALLING MOBILE APPS FOR PURCHASE

ABSTRACT

The rapid development of information and communication technologies has greatly influenced the increase in the popularity of mobile applications in all spheres of life and business. The ease of installation and use of mobile applications has contributed to their widespread use among users - they are available to users in just a few clicks. More than half of mobile application users use online reviews when searching for information and evaluating alternatives in the process of making a purchase decision. It is evident that online reviews and user evaluations have become an important source of information for modern users.

The described trends motivate us to examine the role of online reviews in making a Decision to install mobile applications for purchase by users in Bosnia and Herzegovina, which is also the main goal of this paper. The research was conducted on a sample of 268 mobile application users from Bosnia and Herzegovina. It was observed whether the role of online reviews in evaluating the application and trust in the review itself shape the Decision to install mobile applications for purchase. The research findings contribute to a better understanding of user behavior in the digital environment and indicate the importance of online reviews.

Keywords: *online review, mobile application, consumer behavior, OLS regression.*
JEL: M37, C4

1. INTRODUCTION

In the current digital age, consumers have moved away from relying solely on conventional advertising to obtain purchasing information (Maslowska et al., 2017). Instead, they actively seek out information that includes ratings and experiences from other consumers when making decisions, primarily through online reviews. As argued by the authors Maslowska et al. (2017) more than fifty percent of consumers perceive online reviews as a critical source of information during the purchasing decision-making process. This fundamental shift in behavior stems from the fact that most consumers place greater trust in peer recommendations than in traditional advertising methods. As a result, online reviews have become one of the primary communication channels for businesses (Lee, Park, & Han, 2011; Bernritter, Verlegh, & Smit, 2016). Given that online reviews have become a key factor in

trust and decision-making in the digital age, businesses must find effective channels to market products and information, especially targeting consumers on the go. Mobile applications, or apps for short, in modern business conditions are defined as an imperative marketing tool and one of the most basic promotional tactics (Watson, McCarthy, & Rowley, 2013) for attracting customers "on the go" (Fang, 2019). Essentially, apps transform every communication effort of a company into an interactive customer experience, while emphasizing cognitive, emotional, and behavioral responses (Kim & Yu, 2016).

The growing academic interest focused on analyzing the correlation between the quality of online reviews and purchase intentions, then the growing trend of popularity of mobile applications when making purchases, the accelerated lifestyle of customers, but also the lack of similar research in Bosnia and Herzegovina motivate to investigate the role of online reviews in the evaluation of mobile applications for online shopping, trust in online reviews, and the influence of these factors on the decision to install applications. The central research question that this study seeks to answer is: *Do online reviews have a statistically significant and positive impact on users' decisions to install mobile applications?* In this regard, the main research aim of this paper is to examine the role of online reviews in making decisions about installing mobile applications for purchase by users in Bosnia and Herzegovina.

2. LITERATURE REVIEW

Mobile applications are an essential tool in various business sectors, including commerce, education, business, healthcare, information and communication technology, shopping and entertainment. Their application is present on all major mobile platforms, tablets, laptops and, most importantly, smartphones. Global statistics show that the total number of smartphone users in 2024 exceeded 6.8 billion globally, with estimates reaching around 6.89 billion. In the same period, around 136 million devices were shipped in Europe, which represents a growth of 5% compared to the previous year. Mobile applications allow customers to actively participate and manage the seller-buyer relationship, at all stages of the purchase decision-making process, from information search to post-purchase behavior. The use of mobile devices for online search, ordering and ultimately payment (Hung et.al., 2012) is crucial, especially in situations where the customer is on the move. The advantages of mobile devices are reflected precisely in their flexibility, convenience, personalization and ubiquity, which meet the needs of customers in an increasingly turbulent lifestyle. Mobility, which is characteristic of mobile devices, required special adaptation in retail interaction processes, data processing and presentation methods. Mobile shopping is defined as "any monetary transaction related to the purchase of goods or services via mobile phones with Internet access or via a wireless telecommunications network" (Wong et al., 2012). This advanced service enables the purchase of products and services regardless of time and place (Hung et al., 2012). Although retail chain apps are considered brand extensions, the area of research dealing with the factors of customer satisfaction with these apps and their impact on repeat purchases is still not sufficiently covered. The results of research by Shankar et al. (2016) confirm that mobile shopping apps enhance the overall shopping experience for the customer by offering them access to reviews, product information and store locations.

The development of Web 2.0 technologies has enabled customers to actively share their experiences, opinions and feedback on services, products and brands through online customer reviews (OCR). These reviews, which represent an electronic version of word of

mouth (e-WOM), are becoming increasingly popular, with customers around the world routinely reading these comments before finalizing their purchase decisions (Senecal and Nantel, 2004). An online rating is defined as a numerical assessment of the overall quality of a product, while an online review is a textual comment describing the qualities and attributes of a product. These mechanisms have become essential in electronic markets (Huang et al., 2015), especially those saturated with numerous competitive alternatives, such as the markets for movies, hotels, books, restaurants and mobile applications. Thus, an online review can be defined as a statement - positive, negative or neutral, created by a current, former or potential customer regarding a good, service or company, and made available to the public via an online platform. Both ratings and reviews have a dual importance, as they help consumers make decisions and provide manufacturers with useful insights for forecasting sales, developing products, and creating marketing campaigns (Li et al., 2019).

Previous academic research has extensively addressed the role of expert reviews (Chen and Xie, 2005) and the impact of online recommendation systems (Gretzel and Fesenmaier, 2006), as well as the positive effect of feedback mechanisms on customer trust (Pavlou & Gefen, 2004). Recently, the scientific focus has shifted to investigating the role of customer-generated online reviews. Customers rely heavily on OCR when making purchases, and research has shown that online reviews are one of the most trusted sources of information, second only to advice from friends (Moon & Sung, 2015). Numerous studies have demonstrated the strong influence of OCRs on customer purchase decisions (Filieri & McLeay, 2014; Senecal & Nantel, 2004; Smith, Menon, & Sivakumar, 2005), as well as on overall product sales in various categories, including books, movie titles, and hotel reservations (Cui, Lui, & Guo, 2012; Ye, Law, & Gu, 2009; Zhu & Zhang, 2010). Some research has also shown that customer reviews can have a positive impact on sales (Chen et.al., 2008; Chevalier & Mayzlin, 2006; Clemons et.al. 2006). Specifically, Clemons et.al. (2006) found that highly positive reviews can contribute to increased product sales. Similarly, Chen et.al. (2008) found that review quality, as measured by the number of votes indicating usefulness, is also positively correlated with sales.

It has been proven that the mere presence of customer reviews on a website significantly improves user perception, specifically increasing the experience of usefulness and social presence of the platform (Kumar & Benbasat, 2006). Reviews therefore serve as a mechanism that has the potential to attract customer visits, extend time spent on the site, and build a sense of community among frequent users. However, it is no longer enough to simply have reviews; it is crucial to enable customers to effectively evaluate and use these reviews. Also, when making purchase decisions, consumers often place greater emphasis on negative information. This asymmetry in information processing is explained by the fact that negative impulses attract significantly more attention and act as stronger stimuli compared to positive information.

The evident role of online reviews, as a key factor in building trust and reducing uncertainty for customers, becomes particularly critical in the dynamic context of mobile shopping. In this regard, while reviews are generally used to evaluate products and services on websites, their importance increases significantly when it comes to the decision to download mobile applications for shopping. However, in practice, it is recognized that the moment of mobile application download is a critical performance variable for both platform providers and application developers.

Furthermore, the results of Ahn and Lee's (2024) study reveal that customers with interdependent self-conceptualism are sensitive to both review ratings and group similarity in terms of their purchase intentions. However, it is important to emphasize that empirical results on the actual impact of online ratings and reviews on customer behavior remain inconsistent across a number of studies (Gottschalk & Mafael, 2017; Li et al., 2019; Sadiq & Adil, 2021), leaving room for further research.

3. RESEARCH METHODOLOGY

Reviewing previous research, it was observed that online reviews largely shape user behavior and influence the Decision to install mobile applications. Research has shown that when making that decision, users often use information from reviews to assess the quality, but also the usefulness of the application itself (Filieri, 2015; Wang & Chaudhry, 2018; Chevalier & Mayzlin, 2006). The results of previous studies indicate that negative reviews have a particularly strong influence on the user's decision, while positive reviews increase trust and the likelihood that the user will install an application (Sen & Lerman, 2007; Mudambi & Schuff, 2010).

This knowledge is very important in the segment of digital surchase and digital marketing. If the decision to install an application is really strongly shaped by the reviews that an application has, online sellers should strive to increase the number of positive reviews and try to adequately respond to possible negative reviews. In their research, the authors examined, in addition to the influence of reviews, the influence of certain demographic factors such as age, level of education and frequency of use of mobile applications also shape consumer behavior in the digital environment (Cheung et al., 2009), in order to determine whether this pattern is characteristic only for certain groups of consumers, with certain characteristics, or whether it is a general trend.

For this reason, the aim of this research was to examine how online reviews shape consumer behavior in Bosnia and Herzegovina, it is particularly important to check the influence of reviews on the Decision to install mobile applications, taking into account selected demographic characteristics.

In order to examine this influence in a scientifically based way, a survey was conducted on a sample of 268 users of mobile surchase applications from Bosnia and Herzegovina. The frequency of using mobile applications for surchase was chosen as a criterion for selecting respondents. The data was collected through an online survey, which was distributed through social networks, which represents convenience sampling. The survey was designed to examine:

- the role of online reviews in evaluating mobile applications for online surchase,
- trust in online reviews,
- the influence of these factors on the Decision to install applications.

In addition, the survey included questions about respondents' demographic characteristics, including age, Education level, and frequency of surchase through mobile apps. All statements related to the perception of reviews, the role of online reviews in the evaluation

of mobile applications for online surchase and the Decision to install the application were measured on a Likert scale from 1 to 5 (1 = do not agree at all, 5 = completely agree), while demographic questions and frequency of purchases were answered with clearly defined categories.

Table 1. Model variables

Variable type	Variable name	Items / Indicators	Measurement / Literature
Dependent	Decision to install application	- Online reviews influence my Decision to install the application - I read reviews before installing a mobile surchase application	Likert 1–5; adapted from Wang & Chaudhry, 2018
Independent	Role of reviews in App evaluation	- Reviews help me evaluate the quality of the mobile surchase app - Reviews shape my opinion about the mobile surchase app - Online reviews help me decide whether to use mobile surchase applications	Likert 1–5; adapted from Filieri, 2015; Chevalier & Mayzlin, 2006
	Trust in reviews	- Positive reviews increase my trust - Negative reviews discourage me from using the app - I trust apps that have positive reviews more	Likert 1–5; adapted from Mudambi & Schuff, 2010; Wang & Chaudhry, 2018
Control	Age	- Respondent's age (categories)	Predefined options / Demographic information
	Education level	- Highest level of education	Predefined options / Demographic information
	Purchase frequency	- How often do you shop using mobile applications	Predefined options / Demographic information

Source: Authors

Based on the data collected through the survey, key research variables, hypotheses, and research model were defined.
Variables were selected to examine the impact of online reviews and Trust in reviews on the Decision to install mobile applications, taking into account the demographic characteristics of the respondents as a control variable.

Based on the defined variables and the research goal, a central research hypothesis and three auxiliary hypotheses were formulated.

Central hypothesis (H_1): *Online reviews have a statistically significant and positive influence on users' Decision to install mobile applications.*

Auxiliary hypotheses:

- *H1a: The role of online reviews in the evaluation of mobile applications is positively related to the Decision to install the application.*
- *H1b: Trust in online reviews is positively related to the Decision to install the application.*
- *H1c: Demographic characteristics (age, level of education and frequency of purchase) are statistically significantly related to the Decision to install the application.*

To examine the impact of online reviews and Trust in reviews on the Decision to install mobile applications, OLS regression is used. This method is suitable because all key variables, including the dependent variable and independent variables, are expressed through Likert scales (1–5) that are treated as interval, which allows for linear analysis. OLS regression allows for a quantitative assessment of the impact of each independent variable on the Decision to install, while controlling for demographic factors (age, Education level, and Purchase frequency) to accurately isolate the effect of reviews.

$$Decision\ to\ install\ = \beta_0 + \beta_1 * Role\ of\ reviews + \beta_1 * Trust\ in\ reviews + \beta_1 * Age + \beta_1 * Education\ level + \beta_1 * Purchase\ frequency\ + \varepsilon \quad (1)$$

Where:

- Decision to install – dependent variable for the respondent, representing the user's Decision to install the application.
- Role of reviews and Trust in reviews – averages of items measuring these dimensions and representing the main independent variables in the model.
- Age, Education level and Purchase frequency – control variables used to control for the influence of demographic characteristics on the Decision to install the application.
- Model Error (ε) – represents the uncertainty and variability in the dependent variable that is not explained by the included independent and control variables.

The planned analysis includes conducting descriptive statistics for all variables, with special attention to demographic characteristics, assessing measurement reliability using Cronbach's alpha for items measuring the Role of reviews and Trust in reviews, preparing data for OLS regression, including checking the normality of the dependent variable, linear relationships, and absence of multicollinearity, conducting OLS regression, and interpreting coefficients, statistical significance, and R^2.

4. RESULTS

A total of 268 respondents participated in the research, filling out a survey that included questions related to demographic characteristics and claims about the influence of online reviews on the Decision to install mobile surchase applications. The sample consists of respondents of different age, education and frequency of online surchase, which enables a comprehensive insight into user behavior in the digital environment.

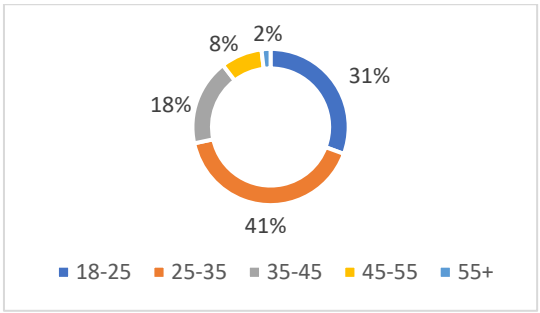


Fig. 1. Age

Source: Authors

The analysis of the age structure of the respondents revealed that the majority are young respondents, especially those between 25 and 35 years old (41%) and 18 to 25 years old (31%). Although older respondents are also represented, they are relatively few, which shows that the results of the research mostly refer to the younger population of mobile application users.

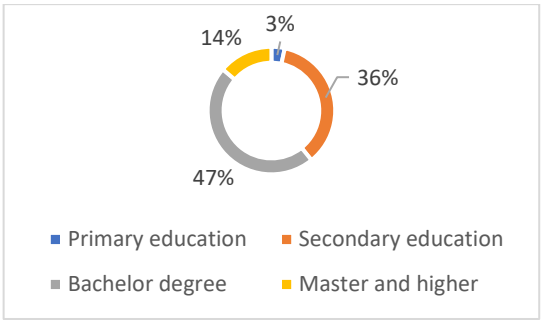


Fig. 2. Education level

Source: Authors

Figure 2 shows the level of education of the respondents. The majority of respondents have completed high school (36%) or a bachelor's degree (47%), while a smaller portion has a master's or higher degree (14%), and only 3% of respondents have primary education. This distribution shows that the sample is mostly highly educated, which is important for the interpretation of attitudes and behavior in the online environment.

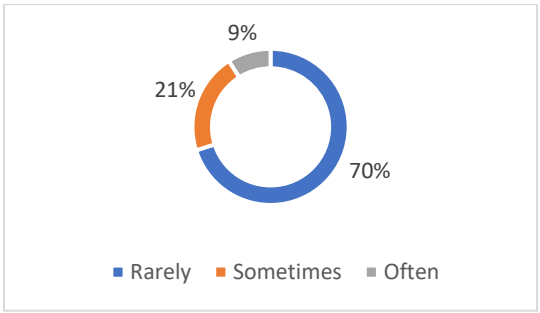


Fig. 3. Frequency of online purchases

Source: Authors

The analysis of the frequency of surchase via mobile applications shows that the majority of respondents rarely shop online (70%), while 21% shop sometimes and only 9% often. These results suggest that although the majority of respondents are non-frequent users, their attitudes about online reviews still provide relevant information about app installation decisions.

Descriptive analysis (Table 2) shows the basic statistical characteristics of the main variables in the research: Decision to install, Role of reviews and Trust in reviews. The average values show that respondents generally positively assess the influence of online reviews on the Decision to install applications (Mean ≈ 4.00–4.16). The standard deviations are moderate, which indicates a moderate variability of responses among respondents. Negative skewness values indicate that the distributions are slightly asymmetric to the left, while kurtosis indicates relatively even distributions, without extremely sharp peaks. All these values suggest that the data set is suitable for further analysis by OLS regression.

Table 2. Descriptive Statistics

Variable	*N*	*Min*	*Max*	*Mean*	*Std. Dev*	*Skewness*	*Std.Err (Skewness)*	*Kurtosis*	*Std.Err (Kurtosis)*
Decision to install	268	1.00	5.00	4.00	1.042	-0.800	0.149	-0.066	0.297
Role of reviews	268	1.75	5.00	4.155	0.778	-0.784	0.149	-0.144	0.297
Trust in reviews	268	1.00	5.00	4.155	0.829	-0.989	0.149	0.803	0.297

Source: Authors

The internal consistency of the items measuring Role of reviews and Trust in reviews was tested using Cronbach's alpha. The results show:

- For Role of reviews $\alpha = 0.787$, indicating good reliability.
- For Trust in reviews $\alpha = 0.641$, which is considered to be of medium reliability, sufficient for further analysis.

The Cronbach's alpha values for the items also show that none of the items are problematic; they all contribute to the overall reliability of the scale.

Correlation analysis shows the association between main variables and control variables. Specifically, the Pearson correlation results show that the dependent variable Decision to install positively correlates with the independent variables Role of reviews ($r = 0.636$, $p < 0.01$) and Trust in reviews ($r = 0.533$, $p < 0.01$), which indicates a strong connection between online reviews and the Decision to install applications. Role of reviews and Trust in reviews are also positively correlated with each other ($r = 0.556$, $p < 0.01$). Control variables (Age, Level of Education) have no significant correlation with Decision to install, while Frequency of purchase is positively and significantly related to the decision ($r = 0.156$, $p = 0.05$).

Table 3. Pearson Correlations

	Decision to install	Role of reviews	Trust in reviews	Age	Education level	Purchase frequency
Decision to install	1.000	0.636**	0.533**	-0.058	-0.082	0.156*
Role of reviews	0.636**	1.000	0.556**	-0.100	-0.121	0.245**
Trust in reviews	0.533**	0.556**	1.000	-0.090	-0.002	0.185**
Age	-0.058	-0.100	-0.090	1.000	0.141	-0.078
Education level	-0.082	-0.121	-0.002	0.141	1.000	0.077
Purchase frequency	0.156*	0.245**	0.185**	-0.078	0.077	1.000

* $p < 0.05$, ** $p < 0.01$

Source: Authors

These results suggest that the main independent variables are suitable for OLS regression analysis without multicollinearity problems, while the control variables have minimal influence. To test the influence of online reviews on the Decision to install mobile applications, an OLS regression analysis was performed in two models.

Table 4. Model Summary

Model	R	R Square	Adjusted R Square	Std. Err.	Durbin-Watson
1	0.672	0.452	0.447	0.775	2.332
2	0.673	0.452	0.442	0.778	2.332

Source: Authors

Only the main independent variables are included in Model 1: Role of reviews and Trust in reviews, while in Model 2 control variables related to the demographic characteristics of the sample are added: Age, Education level and Purchase frequency. The results show that in Model 1 the main independent variables explain 45.2% of the variance of the installation decision, or 44.7% according to the adjusted coefficient of determination (Adjusted R^2). Adding the control variables to Model 2 does not significantly change this indicator, which suggests that the control variables do not have a significant contribution in explaining the Decision to install apps. The Durbin-Watson statistic (2.332) indicates the absence of autocorrelation problems.

ANOVA results show that both models are statistically significant ($p < 0.001$), confirming that the models are suitable for predicting the installation decision.

Table 5. ANOVA

Model	**F**	**Sig.**
1	109.086	0.000
2	43.305	0.000

Source: Authors

By looking at the final results of the regression coefficients and their significance, it can be concluded that in Model 1, both independent variables show a statistically significant positive influence on the Decision to install, Role of reviews: $\beta = 0.492$, $p < 0.001$, Trust in reviews: $\beta = 0.260$, $p < 0.001$. Adding the control variables in Model 2, none of the control variables is statistically significant, while the main variables remain significant with similar coefficients.

Table 6. Regression coefficients

Model	Variable	B	Std. Err.	Beta	t	Sig.
1	(Constant)	-0.095	0.283		-0.336	0.737
	Role of reviews	0.659	0.073	0.492	8.992	0.000
	Trust in reviews	0.326	0.069	0.260	4.744	0.000
2	(Constant)	-0.035	0.363		-0.095	0.924
	Role of reviews	0.658	0.076	0.491	8.681	0.000
	Trust in reviews	0.331	0.070	0.263	4.765	0.000
	Age	0.019	0.049	0.018	0.382	0.703
	Education level	-0.034	0.066	-0.024	-0.517	0.606
	Purchase frequency	-0.016	0.077	-0.010	-0.215	0.830

Source: Authors

These results confirm that the Role of reviews and Trust in reviews are key predictors of the Decision to install an app, while demographic characteristics and frequency of purchase do not contribute additional variance explanation.

Residual analysis shows that predicted values and standardized residuals do not show significant deviations, which confirms that the basic assumptions of OLS regression are met.

5. DISCUSSION

This study was conducted on a sample of 268 respondents, predominantly younger individuals (72% of respondents aged 18 to 35) and with a high level of education (61% of respondents with a bachelor's degree or higher). The sample also includes respondents who rarely shop online, but also those who do so occasionally or frequently, which allows for an overview of the behavior of different types of mobile surchase app users.

The aim of the study was to examine the influence of the role of online reviews and Trust in reviews on the Decision to install mobile apps, taking into account the possible effects of demographic characteristics and the frequency of online surchase. The results of the OLS regression analysis show that the Role of reviews and Trust in reviews are significant predictors of the Decision to install apps in both models. The main independent variables explain 45% of the variance of the decision, and the addition of control variables (age, education level, surchase frequency) did not significantly increase the explanation of the variance, suggesting that demographic characteristics do not play a significant role in this context. These results indicate that the central hypothesis H1, that online reviews have a significant impact on the Decision to install mobile applications, cannot be rejected. Also, the auxiliary hypotheses H1a and H1b, which relate to the Role of reviews and Trust in reviews, are also not rejected, because both variables positively and significantly predict the Decision to install. H1c, which related to the influence of control demographic variables, did not show statistical significance, which means that age, Education level and surchase frequency do not additionally shape the Decision to install, for this sample and this decision, online reviews are the dominant factor.

The reasons for these results can be multiple. A predominantly younger and highly educated sample is likely to be digitally literate and accustomed to using online reviews when making purchase decisions, which reduces the impact of demographic differences. Also, frequency of purchase is not crucial as even occasional customers follow reviews before installing apps, suggesting that the perception of trustworthiness of reviews goes beyond frequency of use. These findings confirm that the Decision to install a mobile application depends primarily on the content and quality of online reviews, while demographic factors and frequency of purchase have a marginal influence. This has a practical implication for application developers and marketing strategies: the focus should be on transparent and high-quality reviews, because they most shape the behavior of users, regardless of their age or education. Limitations of the research include the specificity of the sample - predominantly young and highly educated users in Bosnia and Herzegovina - which may limit the generalization of the findings to the wider population. Nevertheless, the results clearly show the key role of online reviews in decision-making, which is in line with previous research in the field of digital consumer behavior.

6. CONCLUSION

The present study confirmed the indispensable role of online reviews (OCR) in making a preliminary decision in mobile commerce, which refers to making a decision on installing mobile shopping applications on the market of Bosnia and Herzegovina. Regression analysis (OLS) conducted on a sample of 268 respondents clearly showed that the role of reviews in evaluating the application ($\beta = 0.658$, $p < 0.001$) and trust in these reviews ($\beta = 0.331$, $p < 0.001$) are statistically significant and positive factors explaining the decision to install. These variables explain a significant part of the variance of the decision to install. Therefore, the central hypothesis (H1) and the supporting hypotheses (H1a and H1b) are fully supported. It is important to mention that the results of the study showed that the demographic characteristics of the respondents (age, level of education and frequency of purchase) showed statistical insignificance as control variables. This result indicates that buyers, even those who rarely shop online, focus on the reliability of reviews before installing an application. In this regard, trust in online comments has a stronger influence on the decision than the buyer's shopping habits themselves. Since the sample is predominantly young and highly educated, their digital literacy allows them to critically evaluate reviews. For this reason, the control variables of age, education, and frequency of purchase do not have a special additional impact. The key contribution of the research for marketing managers is reflected in the need to invest in transparent and high-quality reviews, because the research results show that this is a universal factor that guides the behavior of buyers regardless of their demographic characteristics. The practical message is that developers and marketers must invest in transparent and high-quality reviews, because this is a universal factor that guides the behavior of buyers regardless of their demographic characteristics.

The research has certain limitations, which are mostly reflected in the specificity of the sample, which is mainly made up of younger and highly educated buyers from Bosnia and Herzegovina, which may partially limit the possibility of generalizing the results to the wider population. Regardless of the limitations, the research results support the important role that online reviews play in making decisions about installing mobile shopping applications**.** Future research should expand the existing theoretical and empirical framework to include additional factors and other variables that can shape user behavior in the digital environment.

In this regard, it is recommended that future research include a more diverse and representative sample of respondents, especially older age groups and respondents with lower levels of digital literacy, which would allow answering the question of whether the relationship between trust in online reviews and the decision to install applications changes depending on the level of digital literacy, age structure and previous experience of users with mobile shopping. Furthermore, future research should consider the role of additional variables, such as perceived risk, brand reputation, app design, ease of use, algorithmic recommendations and previous purchase experience.

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CHARACTERISTICS OF COMMUNICATION IN INTERNAL MARKETING WITHIN BANKS ON THE MARKET OF BOSNIA AND HERZEGOVINA

ABSTRACT

The paper analyzes the attitudes of employees and management regarding selected characteristics of communication within internal marketing in banks operating in the market of Bosnia and Herzegovina.

The research objectives are: 1) to determine the attitudes of employees and management toward the internal communication system in banks in Bosnia and Herzegovina, 2) to identify the existence of statistically significant differences in attitudes between employees and management regarding internal communication in these banks, 3) to examine the influence of employees' socio-demographic characteristics on their attitudes toward internal communication in banks in Bosnia and Herzegovina.

Using the independent samples t-test, it was found that the attitudes of employees and management differ significantly in 5 out of 15 observed elements through which internal communication in Bosnian and Herzegovinian banks was analyzed. Furthermore, the results of the χ^2 test indicate that, with the exception of six observed characteristics, there is no statistically significant influence of employees' socio-demographic attributes on their attitudes toward the analyzed elements of internal communication in banks in Bosnia and Herzegovina.

Keywords: *Internal marketing, internal marketing communication, banking sector.*
JEL: M00, M30, M31

1. INTRODUCTION

Globalization of the market and the growth of the service sector on a global level have led to an increased demand for top-quality services and perceived customer satisfaction, particularly when it comes to the banking sector (Loungani et al., 2017). Technical and technological progress, along with the increasing competitive pressure from banks, requires

the identification of new ways to achieve a competitive advantage that other competitors will not be able to easily replicate.

In today's competitive environment, one of the key factors for achieving a high level of business effectiveness is healthy and efficient communication. Emphasizing that internal communication is the lifeblood of every company, Bartlett and Ghoshal point to the importance of quality communication within the company (Bartlett & Ghoshal, 1989). Internal communication, as a dimension of internal marketing, represents a source of exchange of knowledge and ideas between employees, employees and superiors, and it determines both the satisfaction of the employees themselves and the achievement of the company's defined goals. Therefore, an increasing number of banks in modern business conditions are dedicating their attention to internal marketing and internal communication as a dimension of internal marketing, given that it plays a significant role in creating competitive advantage and improving the business performance of the company.
An example that companies such as IBM place the experience and satisfaction of their employees at the core of their business activities, believing that "if employees feel great about their work, they will make clients feel satisfied as well," speaks to the necessity of applying this concept if the company's goal is progress and better market positioning.

Leonard Berry, presents for the first time the concept of internal marketing, defining it as follows: "Internal marketing is the management of employees within the company as if they were internal customers, with the goal of satisfying and motivating employees so that they provide better service to external customers" (Berry, 1981; Berry & Parasuraman, 1991). For Grönroos, internal marketing represents an approach in which the philosophy of service quality is sold to employees to ensure that everyone in the company is oriented toward providing high-quality service to end users (Grönroos, 1985). Rafiq and Ahmed define internal marketing as a company's effort to motivate, integrate, and coordinate all functions and employees to improve the perception of service and the satisfaction of external customers (Rafiq & Ahmed, 2000). On the other hand, Kotler believes that internal marketing represents the application of marketing within the company to explain to employees their place and role in the organization and to motivate and encourage them to contribute to achieving the company's goals (Kotler, 2000). Ballantyne defines internal marketing as a relationship-building process focused on renewing knowledge, where the key actors are engaged and motivated employees responsible for implementing company strategies and achieving defined marketing goals. This definition highlights the necessity of connecting and developing relationships with learning and knowledge transfer within the company to improve and enhance the company's market performance (Ballantyne, 2003). Dahl and Peltier define internal marketing as a concept that empowers employees and builds long-term relationships through transparent communication and motivation (Dahl & Peltier, 2017). For Papasolomou, internal marketing is a form of market orientation that applies marketing principles within the company with the goal of establishing corporate value (Papasolomou, 2006). This includes activities that improve the chain of internal communication and coordination between different functions, thereby achieving a more efficient realization of marketing activities (Nwokah & Briggs, 2017).

What the previously mentioned definitions have in common lies in the belief that employees cannot adequately satisfy the needs of external customers if they themselves are not satisfied with their work, conditions, and the environment in which they work. Therefore, company

management should devote due attention to developing instruments such as: an adequate system of communication with employees, an acceptable and motivating reward system, an improved system of employee training and career development, the inclusion of employees in planning and decision-making, and so forth, which will enable the creation of their satisfaction and, consequently, better output, thereby ultimately maximizing the company's business performance (Tomić Osmanović et al., 2024).

If we consider that the success of every company's operations, among other things, depends on the quality of information provided to employees, the need arises for adequate informing and familiarizing employees both with the company's goals and with the procedures and policies used to achieve business success. Well-informed, involved, and knowledgeable employees are also satisfied and motivated employees who will provide their clients with more complete, comprehensive, and timely service. This more comprehensive service precisely will result in satisfied customers, which will ultimately be reflected in the company's market position and its business performance. In this regard, the focus of this paper will be placed on internal communication in Bosnian-Herzegovinian banks.

2. THEORETICAL FRAMEWORK

The concept of internal marketing first appeared in the literature on service marketing in the late 1970s. Most of the initial research on the possible application of this concept reflected in treating employees as internal customers (Berry, 1981), developing internal knowledge exchange (Bak, 1994), and developing employees who are in direct interaction with customers, with internal marketing focused on more effective human resource management (Hwang & Chi, 2005). At the beginning, this concept was neglected by company management, both due to the lack of knowledge and understanding of its components and due to unawareness of its impact on company operations. Through emphasizing the importance of applying the concept of internal marketing for company development, most authors in their research point out that a successful marketing approach is based on the interaction of internal and external marketing and the creation of a unified system through which customer demands and needs are met more effectively, thereby achieving better business performance (Tomić Osmanović, Muratović, Čivić, 2024).

According to Foreman and Money, internal marketing implies the application of marketing techniques within a company, with the aim of engaging employees and involving them in achieving company goals and creating value for customers (Foreman & Money, 1995). A somewhat modified definition of internal marketing is given by Zhou and associates, who emphasize that it is a concept that uses a marketing approach to motivate employees (who are treated as internal customers) and to direct them toward end users of products and/or services (Zhou et al., 2005). However, for Saeedinejad, it represents a comprehensive process of managing and integrating complex marketing tasks within a business environment, all with the goal of equipping and motivating employees for efficient work performance. Internal marketing encourages employee orientation by providing them with the necessary support and enabling teamwork within the company. This process deals with issues related to the efficiency and effectiveness of internal services, market and customer orientation, and the implementation of programs and routines (Nwokah & Briggs, 2017). Hwang and Chi define internal marketing as a set of human resource management activities and an organized effort in recruiting, training, and retaining employees who are customer-

conscious (for example, Hwang & Chi, 2005). Internal marketing is also defined as redirecting traditional marketing techniques toward the internal environment, with the goal of attracting, developing, motivating, and retaining competent employees through job-products that meet their needs (Berry, 1981). According to Riketta, internal marketing is defined as the use of a marketing perspective in managing an organization's human resources, including the training and motivation of the internal market to work as a team and to satisfy external customers (Riketta, 2012).

For Qiu and associates, internal marketing represents a strategic approach to improving cross-functional integration, whose development has gone through four phases: 1. The Emergence Phase (before 2007), 2. The Establishment Phase (2007–2012), 3. The Explosion Phase (2013–2016), and 4. The Saturation Phase (2017–present) (Qiu et al., 2021).

The essence of all the previously mentioned definitions lies in creating an adequate relationship with employees, since the quality of the established relationship between employees, as well as between superiors and employees, determines not only the satisfaction of end users but also the overall success of the company. Employees are the guarantee of customer retention and this is shown by the works of numerous authors such as: Bailey et al., 2017; Conduit & Mavondo, 2001; Hwang & Chi, 2005; Shiu & Yu, 2010; Sohail & Jang, 2017; Reichheld, 1993; Boukis et al., 2014; Ferdous & Polonsky, 2014; Hernández-Díaz et al., 2017; Caruana & Calleya, 1998; Donavan et al., 2004, and so forth.

By creating a work environment based, among other things, on cooperation, trust, commitment, good two-way communication, understanding, and an adequate employee reward system, it is possible to influence employee job satisfaction and consequently the quality of services provided to end users (Herington et al., 2005). It is important to note here that in this process of creating employee satisfaction, and subsequently that of external service users, the company's communication system plays a significant role, which will be discussed further in this paper.

From the previously mentioned definitions, it can be concluded that the concept of internal marketing consists of different dimensions and aspects aimed at increasing employee satisfaction, efficiency, and productivity, which ultimately reflects in the improvement of the company's operations. The internal marketing model developed by Tansuhaj and associates consists of the following five aspects: employee training, communication with employees, employee retention, their encouragement, and employment (Tansuhaj et al., 1988).

Different approaches to internal marketing advocate a wide range of strategic and tactical activities, processes, and practices that make the implementation of this concept successful (Ahmed & Rafiq, 2003; Lings & Greenley, 2005). Thus, Qiu and associates classify all internal marketing activities into one of the following six dimensions: internal market analytics, internal communication, employee development, employee rewards and recognition, job design and empowerment, and leadership and organizational culture (Qiu et al., 2021).

A similar classification is provided by Jarvi in his paper Internal Marketing and Commitment of the Employees When Managing the Customer-Oriented Business, pointing out that

internal employee information, internal training, the creation of togetherness and teamwork, the creation of an adequate reward system, and the establishment of collective spirit and motivation represent key dimensions of internal marketing (Jarvi, 2009). Focusing on the banking sector, Bailey includes the following as key aspects of internal marketing: internal clients (employees), internal communication, rewards, employee training, and employee education and empowerment (Milanović & Miletić, 2023).

According to Tortosa and associates, internal marketing orientation is a multidimensional construct consisting of the following four dimensions: informal internal information generation, formal internal information generation, dissemination of internal information, and response to generated internal information. Emphasizing the importance of communication with employees, the mentioned authors, in their paper titled Internal Market Orientation and Its Influence on Organisational Performance, proved that informal and formal information generation directly, positively, and significantly affect its later dissemination within the company.

It was also proven that informal internal information generation directly, positively, and significantly affects managerial responses toward contact staff, while the hypothesis on the impact of formally generated information on management responses was rejected (Tortosa et al., 2009).

Emphasizing the importance of implementing internal communication between departments and individuals within a company, Dwyer defines internal communication as a process through which employees within a company send and receive messages (Dwyer, 2005). The main purpose of information sharing within a company is to ensure that employees make more efficient and better decisions based on more complete information (Pfeffer, 1998), which will improve the operations of the entire company. Therefore, the advantage of information sharing is reflected in improving the ability of frontline employees to provide better customer service (Bansal et al., 2001). To achieve this, it is necessary to have effective communication among employees, because without it, coordination between departments cannot be expected, nor will the result be high-quality and timely decisions. Thus, two-way communication between management and employees provides appropriate feedback to employees, thereby improving their work efficiency and, consequently, the company's business performance (Grönroos, 1990).

According to Park and Tran, internal communication represents an important dimension of internal marketing, as it encompasses the practices through which companies build relationships among internal stakeholders and distribute information across various organizational levels (Park & Tran, 2020). It includes various elements: the dissemination of implicit and explicit knowledge within the company (Lings & Greenley, 2005), the establishment of effective vertical and horizontal interpersonal relationships (Smith & O'Sullivan, 2012), mechanisms of cross-functional integration and cooperation (Conduit & Mavondo, 2001), as well as a shared vision (Chow et al., 2015). That internal communication represents one of the most significant dimensions of internal marketing is also confirmed by research conducted by Qiu and associates in 2021, which clearly shows that internal communication was the most emphasized dimension, especially during the "saturation" period, where 93% of articles included the measurement of internal communication—significantly more frequently compared to all other dimensions (internal market analytics,

employee development, employee rewards and recognition, job design and empowerment, and leadership and organizational culture).

A comparative overview of the representation of individual dimensions of internal marketing in scientific articles, observed through the four-phase period, is presented in the Table 1.

Table 1. Representation of research on certain dimensions of internal marketing through the four-phase period

Dimensions IM	Emergence phase (before 2007),		Establishment phase (2007-2012)		Explosion phase (2013-2016) and		Saturation phase (2017 – today)		Total	
	No. of articles	%	No. of articles	%	No. of articles	%	No. of articles	%	No. of articles	%
Internal market	6	*17.1*	17	*24.6*	18	*23.7*	19	*25.0*	60	*23.4*
Internal communication	27	*77.1*	54	*78.3*	69	*90.8*	71	*93.4*	221	*86.3*
Employee development	18	*51.4*	41	*59.4*	45	*59.2*	56	*73.7*	160	*62.5*
Employee rewards and recognitions	18	*51.4*	37	*53.6*	29	*38.2*	42	*55.3*	126	*49.2*
Job design and empowerment	24	*68.6*	41	*59.4*	51	*67.1*	43	*56.6*	159	*62.1*
Leadership and organizational culture	19	*54.3*	46	*66.6*	36	*47.4*	44	*57.9*	145	*56.6*
Number of articles	35		69		76		76		256	

Source: Authors' creation based on: Qiu et al. (2021), p. 39.

Michulek also points out the importance of internal communication in achieving greater employee motivation for improving a company's business performance. By applying various tools such as different platforms (intranet, and such), newsletters, seminars, celebrations, live meetings, internal social networks, and others, it becomes easier to share content, news about employees, as well as about the company itself and its achievements. Live meetings, seminars, various celebrations, and internal social media channels provide opportunities to get to know one another and improving communication among employees, establishing more effective cooperation and more efficient problem-solving, as well as building a sense of belonging to the team (the company) among employees. Posters and infographics are visual forms of communication that present certain information in a simple way, thus enabling easier memorization.

On the other hand, email is most often used to convey news and changes in company policies and enables communication between employees who are geographically distant from one another (Michulek, 2021). Jonathan believes that internal marketing is precisely what is responsible for employees being well-informed about the company's goals, principles, and mission. According to him, the sharing of information should be continuous and consistent so that employees know what the company has achieved, what it aims to achieve, and how they can contribute to the realization of the defined goals. In his work A New Higher Education Marketing Mix: The 7Ps for MBA Marketing, Jonathan lists various activities

that enable employees to be adequately informed. Some of these include advertising, public relations, and sales promotion, among others. By applying these activities, it is possible to create a work environment with high morale, which leads to increased employee motivation and commitment to their tasks and the company (Ivy, 2008).

There are numerous studies that, in addition to the previously mentioned ones, examine the communication dimension of internal marketing. It is important to highlight the research conducted by Hughes (2013); Huang and Rundle-Thiele (2014); Yu et al. (2018, 2019); Yao et al. (2019); Gounaris et al. (2006, 2008); Malhotra and Ackfeldt (2016); Chow et al. (2015); Tang et al. (2017); Frye et al. (2020); Shiu and Yu (2010); SeyedJavadin et al. (2012); Joung et al. (2015); Celsi and Gilly (2010); Kadić-Maglajlić et al. (2018), and many others.

Considering the above, it can be concluded that internal marketing based on adequate internal communication with and among employees, their inclusion in business planning processes, their adequate material and non-material rewarding and motivation, their training, and informing them about the company's values through external marketing activities affects both the quality of services disseminated to the end customer and the overall business success of the company.

The representation of internal communication within internal marketing in banks in Bosnia and Herzegovina, according to current knowledge, has been insufficiently researched. Considering the previously highlighted theoretical findings, it can be assumed that a more comprehensive application of the concept of internal marketing and internal communication as a key dimension of this concept would lead to greater motivation and satisfaction among banking employees, which would ultimately be reflected in the overall business performance of the bank. In line with the above, the topic of this paper has been defined, with the aim of providing a modest contribution to the study of the representation of internal marketing communication in Bosnian and Herzegovinian banks.

3. RESEARCH METHODOLOGY

The aims of the research: 1) To determine the attitudes of employees and management regarding the system of internal communication in banks in Bosnia and Herzegovina, 2) To determine whether there is a statistically significant difference between the attitudes of employees and management regarding the system of internal communication in banks in Bosnia and Herzegovina, 3)To determine the influence of socio-demographic characteristics on the attitudes of employees regarding the system of internal communication in banks in Bosnia and Herzegovina.

Data collection: The data presented in the following part of the paper are the result of primary research. The paper is based on empirical data collected through a survey method (written structured questionnaire technique) conducted among 23 respondents (banks in the Federation of Bosnia and Herzegovina and the Republika Srpska). The data were collected in Bosnia and Herzegovina from marketing managers, human resource managers, and bank employees during 2023. Descriptive and multivariate analyses will be used in data processing to determine the existence of differences in respondents' attitudes regarding the representation of individual elements of internal marketing in banks in Bosnia and Herzegovina.

4. RESULTS ANALYSIS AND DISCUSSION

4.1. Respondents' attitudes towards the system of internal communication in banks in Bosnia and Herzegovina

Table 2. Average scores regarding the attitudes of employees and management toward the system of internal communication in banks in Bosnia and Herzegovina

Elements of the rewarding system	Employees		Management	
	Average value	Standard deviation	Average value	Standard deviation
B51	3.6033	1.136364	4.015873	1.023783
B52	3.6667	1.039823	3.935484	0.903018
B53	3.6333	1.020243	3.790323	0.925718
B54	3.6050	0.783500	3.822581	0.840066
B55	3.8908	2.956721	3.774194	0.838018
B56	3.4583	1.011662	3.725806	0.926289
B57	3.7000	1.127204	3.935484	0.972928
B58	3.3782	1.214263	3.870968	1.063306
B59	3.4917	1.092340	3.806452	0.989100
B510	3.8250	1.058479	4.225806	0.894782
B511	3.9250	0.971549	4.129032	0.999736
B512	3.3697	1.141405	3.806452	1.099012
B513	3.6500	0.866268	4.016393	0.763584
B514	2.9833	1.107525	2.983871	1.336645
B515	3.6500	1.042379	3.919355	0.996689

Note:
B51 – Communication between management and employees in your bank is continuous.
B52 – Communication between management and employees is clear, efficient, and effective.
B53 – Employees are actively involved in communication with management regarding the implementation of business tasks.
B54 – A formal communication style is present in communication between management and employees.
B55 – Timely information exchange is expressed in internal communication.
B56 – In internal communication, management considers the ideas of employees from lower levels.
B57 – Employees are informed about the system of rewarding achieved results.
B58 – Employees are informed about the personal skill development programs organized by the bank.
B59 – The manner of internal communication motivates employees to perform better.
B510 – Management informs employees about relevant events within the bank through organized forms of communication (internal bulletin, internal web portal, and so forth).
B511 – Superiors are always available to employees for communication.
B512 – Management continuously communicates with employees with the aim of identifying problems.
B513 – A system of delegation is expressed in the communication between management and employees.
B514 – An autocratic style is expressed in the communication between management and employees.
B515 – In our bank, management is open to feedback and suggestions regarding process improvement.

Table 2 presents the average scores and standard deviations regarding the attitudes of employees and management toward the system of internal communication in banks operating in the market of Bosnia and Herzegovina.

The research results show that employees of Bosnian and Herzegovinian banks most strongly agree with the statement that superiors are always available to employees for communication (average score 3.92 and standard deviation 0.97).

The next highest average score among employees relates to the statement that timely information exchange is expressed in internal communication (average agreement score 3.89 and standard deviation 2.95). The surveyed employees least agree with the statement that an autocratic style of communication is expressed in the communication between management and employees (average agreement score 2.98 and standard deviation 1.10).

Regarding the attitudes of bank management, the highest level of agreement among surveyed managers is related to the statement that management informs employees about relevant events within the bank through organized forms of communication, such as internal bulletins, internal web portals, and so on (average agreement score 4.22 and standard deviation 0.89). In second place, with an average agreement score of 4.12 and a standard deviation of 0.99, is the statement that superiors are always available to employees for communication.

Based on the data presented in Table 1, it can be concluded that employees and managers have different attitudes regarding the order of elements that constitute the system of internal communication in banks in Bosnia and Herzegovina. Differences also exist in their levels of agreement (as measured by average scores) with individual elements of the internal communication system, where surveyed managers show a higher level of agreement on all observed statements except for the statement that timely information exchange is expressed in internal communication, for which the average score is slightly lower than that given by employees.

4.2. Test of significance of differences in the attitudes of employees and management regarding the system of internal communication in banks in Bosnia and Herzegovina

To determine whether there is a statistically significant difference between the surveyed employees and managers in banks regarding their average scores on attitudes about the system of internal communication in Bosnian and Herzegovinian banks, an independent samples t-test was conducted, the results of which are presented in Table 3.

In the analysis of the data presented in Table 3, the first step involved examining *Levene's Test* (values in the *Significance – Sig.* column) to test the homogeneity of variance for each observed element of the internal communication system (elements B51–B515) for the two groups (employees and managers). The *Sig.* values for the elements B54, B55, B56, B59, B510, B511, B512, and B515 are greater than 0.05, which indicates that the variances (variability) of attitudes are equal for both groups of respondents (employees and managers). For the remaining observed elements of internal communication, differences exist in the variability of mean attitude scores between employees and management.

Given the above, for elements B54, B55, B56, B59, B510, B511, B512, and B515, the values in the first rows (*Equal variances assumed*) under the column "Sig. (2-tailed)" were observed. For the elements where the obtained significance level of the *t*-test is less than 0.05 (risk of Type I error), the hypothesis of equality of mean scores for the observed attitudes of employees and management is rejected.

Accordingly, the hypothesis of equality of mean values is rejected, and a statistically significant difference in the average attitude scores of respondents (employees and managers) exists for the following elements:

- B510 – Management informs employees about relevant events within the bank through organized forms of communication (internal bulletin, internal web portal, and so forth) (Sig. 2-tailed = 0.012),
- B512 – Management continuously communicates with employees with the aim of identifying problems (Sig. 2-tailed = 0.014).

Table 3. Test of significance of differences in the attitudes of employees and management regarding the system of internal communication in banks in Bosnia and Herzegovina

		Independent samples t-test					
Elements of the system of internal communication		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. 2-tailed	$\mu_z = \mu_m$ *ili* $\mu_z \neq \mu_m$
B51	Equal variances assumed	*4.745*	*.031*	*-2.416*	*182*	*.017*	
	Equal variances not assumed			*-2.497*	*137.765*	*.014*	$\mu_z \neq \mu_m$
B52	Equal variances assumed	*9.054*	*.003*	*-1.726*	*180*	*.086*	
	Equal variances not assumed			*-1.806*	*139.619*	.073	$\mu_z = \mu_m$
B53	Equal variances assumed	*4.210*	*.042*	*-1.015*	*180*	*.312*	
	Equal variances not assumed			*-1.047*	*134.445*	*.297*	$\mu_z = \mu_m$
B54	Equal variances assumed	*.003*	*.957*	*-1.729*	*179*	*.086*	$\mu_z = \mu_m$
	Equal variances not assumed			*-1.691*	*116.455*	*.093*	
B55	Equal variances assumed	*1.161*	*.283*	*.304*	*179*	*.762*	$\mu_z = \mu_m$
	Equal variances not assumed			*.400*	*150.282*	*.690*	
B56	Equal variances assumed	*1.756*	*.187*	*-1.739*	*180*	*.084*	$\mu_z = \mu_m$
	Equal variances not assumed			*-1.788*	*133.387*	*.076*	

Elements of the system of internal communication		Independent samples t-test: Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means t	df	Sig. 2-tailed	$\mu_z = \mu_m$ *ili* $\mu_z \neq \mu_m$
B57	Equal variances assumed	*6.626*	*.011*	*-1.397*	*180*	*.164*	
	Equal variances not assumed			*-1.464*	*140.346*	*.145*	$\mu_z = \mu_m$
B58	Equal variances assumed	*4.116*	*.044*	*-2.701*	*179*	*.008*	
	Equal variances not assumed			*-2.816*	*138.904*	*.006*	$\mu_z \neq \mu_m$
B59	Equal variances assumed	*3.713*	*.056*	*-1.901*	*180*	*.059*	$\mu_z = \mu_m$
	Equal variances not assumed			*-1.963*	*134.686*	*.052*	
B510	Equal variances assumed	*1.038*	*.310*	*-2.547*	*180*	*.012*	$\mu_z \neq \mu_m$
	Equal variances not assumed			*-2.687*	*142.823*	*.008*	
B511	Equal variances assumed	*.124*	*.725*	*-1.330*	*180*	*.185*	$\mu_z = \mu_m$
	Equal variances not assumed			*-1.317*	*120.363*	*.190*	
B512	Equal variances assumed	*.588*	*.444*	*-2.474*	*179*	*.014*	$\mu_z \neq \mu_m$
	Equal variances not assumed			*-2.503*	*127.939*	*.014*	
B513	Equal variances assumed	*5.694*	*.018*	*-2.796*	*179*	*.006*	
	Equal variances not assumed			*-2.914*	*135.046*	*.004*	$\mu_z \neq \mu_m$
B514	Equal variances assumed	*5.519*	*.020*	*-.003*	*180*	*.998*	
	Equal variances not assumed			*-.003*	*105.168*	*.998*	$\mu_z = \mu_m$
B515	Equal variances assumed	*3.479*	*.064*	*-1.677*	*180*	*.095*	$\mu_z = \mu_m$
	Equal variances not assumed			*-1.701*	*128.405*	*.091*	

Note:
B51 – Communication between management and employees in your bank is continuous.
B52 – Communication between management and employees is clear, efficient, and effective.
B53 – Employees are actively involved in communication with management regarding the implementation of business tasks.
B54 – A formal communication style is present in communication between management and employees.
B55 – Timely information exchange is expressed in internal communication.
B56 – In internal communication, management takes into account the ideas of employees from lower levels.

Elements of the system of internal communication	Independent samples t-test					
	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F	Sig.	t	df	Sig. 2-tailed	$\mu_z = \mu_m$ *ili* $\mu_z \neq \mu_m$
B57 – Employees are informed about the system of rewarding achieved results.						
B58 – Employees are informed about the personal skill development programs organized by the bank.						
B59 – The manner of internal communication motivates employees to perform better.						
B510 – Management informs employees about relevant events within the bank through organized forms of communication (internal bulletin, internal web portal, and so forth).						
B511 – Superiors are always available to employees for communication.						
B512 – Management continuously communicates with employees with the aim of identifying problems.						
B513 – A system of delegation is expressed in the communication between management and employees.						
B514 – An autocratic style is expressed in the communication between management and employees.						
B515 – In our bank, management is open to feedback and suggestions regarding process improvement.						
$\mu_z = \mu_m$ – hypothesis of equality of average scores for the attitudes of employees (μ_z) and management (μ_m).						
$\mu_z \neq \mu_m$ – hypothesis of inequality of average scores for the attitudes of employees (μ_z) and management (μ_m).						

For the statements where the observed Sig. value is greater than 0.05, the null hypothesis of equality of mean values is accepted, indicating that there is no statistically significant difference in the average attitude scores between the observed groups (employees and managers). These elements are:

- B54 – A formal communication style is present in communication between management and employees (Sig. 2-tailed = 0.086,
- B55 – Timely information exchange is expressed in internal communication (Sig. 2-tailed = 0.762),
- B56 – In internal communication, management considers the ideas of employees from lower levels (Sig. 2-tailed = 0.084),
- B59 – The manner of internal communication motivates employees to perform better (Sig. 2-tailed = 0.059),
- B511 – Superiors are always available to employees for communication (Sig. 2-tailed = 0.185),
- B515 – In our bank, management is open to feedback and suggestions regarding process improvement (Sig. 2-tailed = 0.095).

Since the *Sig.* value in *Levene's Test* for testing the homogeneity of variance for elements B51, B52, B53, B57, B58, B513, and B514 is less than 0.05, the second row *(Equal variances not assumed)* was observed for the *Sig. value of the t-test*. The hypothesis of equality of mean values is rejected, and a statistically significant difference in the average

attitude scores of respondents (employees and managers) is confirmed for the following elements:

- B51 – Communication between management and employees in your bank is continuous (Sig. 2-tailed = 0.014),
- B58 – Employees are informed about the personal skill development programs organized by the bank (Sig. 2-tailed = 0.006),
- B513 – A system of delegation is expressed in the communication between management and employees (Sig. 2-tailed = 0.004).

For the remaining statements (B52, B53, B57, and B514), the null hypothesis of equality of mean values is accepted, indicating that no statistically significant difference exists in the average attitude scores between the observed respondent groups (employees and managers of banks).

Based on all the above, it can be concluded that the attitudes of employees and management differ in 5 out of 15 observed elements through which the internal communication system in banks in Bosnia and Herzegovina was analyzed.

4.3. The influence of socio-demographic characteristics on employees' attitudes towards the system of internal communication in banks in Bosnia and Herzegovina

In addition to the previously conducted analysis, it would be interesting to examine whether certain socio-demographic characteristics of employees influence their attitudes towards the internal communication system. Therefore, the following section presents the results of the χ^2 test (Table 4).

According to the results of the χ^2 test, the value of the *Pearson Chi-Square* concerning the relationship between age (as the independent variable) and respondents' attitudes regarding the elements of the internal communication system (from B51 to B515, except for B58) as dependent variables is greater than 0.05. This leads to the conclusion that, for the relationship between the independent and dependent variables (except for B58), the null hypothesis that the variables are independent is accepted - that is, no relationship exists (except for B58) between respondents' age and their attitudes toward the elements of the internal communication system in the banks where they work.

Within the observed relationships, a connection was found only between age and respondents' attitudes toward element B58 (*employees are informed about the personal skills development programs organized by the bank*), where *Pearson Chi-Square = 0.06*. The Cramer's V coefficient for this variable is 0.263, while *the contingency coefficient* is 0.465, indicating a low to moderate correlation between respondents' age and their attitudes toward element B58.

The research results also show that there is no relationship (*Pearson Chi-Square > 0.05*) between gender (as the independent variable) and respondents' attitudes regarding the elements of the internal communication system (from B51 to B515) as dependent variables, except for variables B57 and B515. Although a relationship was established for these variables (*Pearson Chi-Square = 0.013 and 0.037*), the correlation is low, given that the

Cramer's V coefficients are 0.231 and 0.212, respectively, and the contingency coefficients are 0.310 and 0.288.

Table 4. The influence of socio-demographic characteristics on employees' attitudes towards the system of internal communication in banks in Bosnia and Herzegovina

Ind. var.	Elements of Chi-Square test	Dependent variables (attitudes about the observed statements/elements of the rewards system)														
		B51	B52	B53	B54	B55	B56	B57	B58	B59	B510	B511	B512	B513	B514	B515
Age	Pearson Chi-Square (Asymp. Sig. (2-sided))	.156	.204	.426	.079	.360	.118	.432	.006	.171	.208	.795	.134	.681	.596	.500
	Cramer's V	.217	.216	.199	.238	.203	.226	.198	.263	.219	.215	.173	.224	.182	.187	.194
	Contingency Coefficient	.437	.396	.369	.381	.414	.411	.369	.465	.401	.396	.326	.409	.342	.351	.361
Gender	Pearson Chi-Square (Asymp. Sig. (2-sided))	.271	.116	.404	.681	.685	.356	.013	.244	.249	.075	.845	.082	.062	.072	.037
	Cramer's V	.182	.188	.151	.105	.143	.156	.231	.169	.168	.198	.107	.197	.203	.199	.212
	Contingency Coefficient	.250	.257	.209	.146	.198	.215	.310	.232	.231	.270	.149	.268	.276	.271	.288
Education level	Pearson Chi-Square (Asymp. Sig. (2-sided))	.115	.101	.295	.563	.841	.530	.568	.308	.551	.023	.609	.141	.422	.508	.477
	Cramer's V	.194	.180	.159	.140	.138	.143	.141	.159	.142	.200	.138	.175	.151	.145	.147
	Contingency Coefficient	.362	.338	.304	.235	.266	.275	.271	.303	.273	.372	.266	.330	.289	.278	.281
Length of employment in the bank	Pearson Chi-Square (Asymp. Sig. (2-sided))	.008	.155	.181	.886	.216	.207	.001	.306	.176	.312	.994	.136	.334	.463	.286
	Cramer's V	.221	.190	.187	.127	.183	.185	.253	.177	.188	.176	.102	.193	.175	.165	.178
	Contingency Coefficient	.444	.355	.351	.216	.378	.347	.452	.334	.352	.332	.201	.360	.330	.314	.335

Note:
B51 – Communication between management and employees in your bank is continuous.
B52 – Communication between management and employees is clear, efficient, and effective.
B53 – Employees are actively involved in communication with management regarding the implementation of business tasks.
B54 – A formal communication style is present in communication between management and employees.
B55 – Timely information exchange is expressed in internal communication.
B56 – In internal communication, management takes into account the ideas of employees from lower levels.
B57 – Employees are informed about the system of rewarding achieved results.
B58 – Employees are informed about the personal skill development programs organized by the bank.
B59 – The manner of internal communication motivates employees to perform better.
B510 – Management informs employees about relevant events within the bank through organized forms of communication (internal bulletin, internal web portal, and so forth).

Ind. var.	Elements of Chi-Square test	Dependent variables (attitudes about the observed statements/elements of the rewards system)														
		B 51	B 52	B 53	B 54	B 55	B 56	B 57	B 58	B 59	B 510	B 511	B 512	B 513	B 514	B 515

B511 – Superiors are always available to employees for communication.
B512 – Management continuously communicates with employees with the aim of identifying problems.
B513 – A system of delegation is expressed in the communication between management and employees.
B514 – An autocratic style is expressed in the communication between management and employees.
B515 – In our bank, management is open to feedback and suggestions regarding process improvement.

Source: Authors, empirical research results

Furthermore, a relationship was found between respondents' educational level (as the independent variable) and their attitudes regarding variable B510. Specifically, the *Pearson Chi-Square* for this relationship is 0.023, which is less than 0.05. Therefore, the null hypothesis is rejected, and it is concluded that the observed variables are dependent, that is, there is a relationship between respondents' educational level and the attitude that management informs employees about relevant events within the bank through organized forms of communication (internal bulletin, internal web portal, and so forth). However, the dependency coefficients, Cramer's V = 0.200 and contingency coefficient = 0.372, indicate that the relationship between educational level and respondents' attitudes toward element B510 is low to moderate. No relationship was found between age and respondents' attitudes regarding other elements of the internal communication system.

When examining the relationship between length of employment in the bank (as the independent variable) and certain elements of the internal communication system, a relationship was found only with variables B51 and B57, as the *Pearson Chi-Square* values were 0.008 and 0.001, respectively. As in the previous cases where a relationship between variables was identified, the correlation was low to moderate, given that the Cramer's V coefficients were 0.221 and 0.253, and the contingency coefficients were 0.444 and 0.452, respectively.

5. CONCLUSION

In line with the research objectives, the study determined the attitudes of employees and management regarding the internal communication system in banks in Bosnia and Herzegovina. In addition, the study examined the relationship between respondents' socio-demographic characteristics and their attitudes toward the internal communication system in Bosnian and Herzegovinian banks. The results indicate that employees and managers hold partially similar attitudes regarding the elements that make up the internal communication system in banks.

A significant difference in attitudes between employees and managers was found in 5 out of 15 elements of the internal communication system (B51, B58, B510, B512, B513; detailed in Table 3). Regarding the relationship between socio-demographic characteristics and attitudes toward the internal communication system, the study revealed:

a) Age – A relationship exists only for element B58 (employees are informed about personal skills development programs organized by the bank). Based on Cramer's V = 0.263 and contingency coefficient = 0.465, this indicates a moderate correlation.
b) Gender – A relationship was observed for elements B57 and B515, but Cramer's V (0.231, 0.212) and contingency coefficients (0.310, 0.288) indicate a low correlation.
c) Educational level – A relationship exists for B510, with a low correlation (Cramer's V = 0.200, contingency coefficient = 0.372).
d) Length of employment – A relationship was found for elements B51 and B57, with Cramer's V = 0.221 and 0.253 and contingency coefficients = 0.444 and 0.452, indicating a low to moderate correlation.

No statistically significant relationships were found for other socio-demographic variables and their attitudes toward the internal communication system (detailed in Table 4).

Implications for management: The results suggest that bank managers have a limited understanding of employees' needs regarding internal communication, as there were no differences in attitudes in 10 out of 15 observed elements. Therefore, managers should take actions to improve internal communication systems with employees to enhance both employee efficiency and customer satisfaction.

Limitations and recommendations for future research: The study primarily focused on the relationship between socio-demographic characteristics and attitudes toward internal communication. Since most relationships were not statistically significant, future research should analyze other aspects of internal marketing discussed in the theoretical section. Furthermore, it would be interesting to replicate this research in other sectors. Considering that the current study involved 5 managers from each bank and 10 employees selected by convenience sampling, it is recommended that future studies include a larger number of respondents to improve the robustness of the findings.

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EXPLORING THE ROLE OF TIKTOK IN TOURISM DESTINATION CHOICE IN BOSNIA AND HERZEGOVINA

ABSTRACT

This study explores how TikTok influences destination choices among users in Bosnia and Herzegovina, (BiH) using an extended UTAUT2 model that integrates perceived trust. Through an online survey conducted in 2024 (N = 327; valid cases = 229) and analysis via PLS-SEM, the research examines cognitive, motivational, and trust-based determinants of intention and actual use. Results show that perceived trust, hedonic motivation, and habit significantly shape behavioral intention, whereas performance expectancy, effort expectancy, social influence, and facilitating conditions do not. Overall, reliance on TikTok in travel decision-making is driven more by credibility, enjoyment, and habitual engagement than by utilitarian factors. The study validates an extended UTAUT2 framework in a Southeastern European context and offers practical guidance for destination marketing organizations, underscoring the value of trustworthy, engaging, and peer-driven short-form video content.

Keywords: *TikTok, destination choice, tourism marketing, UTAUT2, perceived trust.*
JEL: M31

1. INTRODUCTION

The rapid development of social media and communication technologies has significantly transformed how tourists plan trips and share experiences, offering richer visual and emotional engagement than traditional promotion. Younger generations increasingly rely on social media when choosing destinations (Dramićanin et al., 2023, p. 136), particularly visually oriented platforms such as YouTube, Instagram, and TikTok (Gabriel & Park, 2025, p. 526). Repeated viewing of short TikTok videos further amplifies inspiration and travel motivation (Karuna & Aiswarya, 2025, p. 3).

TikTok, which surpassed one billion users within four years – faster than Instagram or Facebook (West, 2024) – offers highly immersive, viral, and emotionally engaging content (Zhou et al., 2023, p. 2). It has become an important tool for destination image building, enabling rapid popularization of locations (Wengel et al., 2022). Although social media's influence on tourism decision-making has been examined, especially regarding TripAdvisor, Facebook, and Instagram (Gretzel et al., 2015, p. 184), TikTok remains comparatively underexplored (Wang et al., 2025), particularly in the context of BiH and Southeastern Europe.

The aim of this study is to identify the key factors influencing users' intention and behavior when relying on TikTok for destination-related decisions, using a quantitative PLS-SEM approach. The research applies an extended UTAUT2 model enriched with the construct of perceived trust, which is particularly relevant for platforms like TikTok that rely heavily on entertainment, emotional engagement, and social interaction rather than functional utility alone (Wang et al., 2025, p. 244; Zhou et al., 2023, p. 9).

This framework enables a deeper understanding of tourist decision-making, as TikTok integrates technological, social, and psychological dimensions central to UTAUT2. The model assumes that performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation, habit, and perceived trust influence intention to use TikTok for destination selection, while intention and habit shape actual behavior.

Theoretically, the study contributes by testing and adapting the extended UTAUT2 model in the context of TikTok's impact on tourism-related consumer behavior. Practically, it offers guidance for destination managers and marketers seeking to understand and leverage TikTok-driven decision-making processes. Overall, the study provides an integrated perspective on the cognitive, motivational, and trust-based drivers of TikTok use in choosing tourist destinations.

2. THEORETICAL FRAMEWORK

2.1. Social Media and Tourism

Social media have become a primary promotional channel (Xiang & Gretzel, 2010, p. 180; Femenia-Serra & Gretzel, 2019, p. 66) and exert strong positive and negative influences on the tourism industry (Usui et al., 2017, p. 2052). They shape travel-related decisions through information sharing, interaction, and preference formation (Kim et al., 2018, p. 499), and are used across all stages of trip planning (Yuan et al., 2022, p. 4). Consequently, their role in travel planning has been widely examined (Sparks & Browning, 2011; Choe et al., 2017; Ge & Gretzel, 2018). Social media serve multiple functions – from need creation to guidance and decision confirmation (Liu et al., 2020; Yuan et al., 2022, p. 5) – and are increasingly viewed as useful and reliable tools for decision-making (Pencarelli, 2020, p. 459). However, rising levels of fake content and reviews pose challenges for destination credibility (Kaszás et al., 2025, p. 1).

TikTok's short, simple, and useful video formats (Xie et al., 2019, p. 401; Li, 2021, p. 176) strongly influence user decision-making (Wang et al., 2022, pp. 3–5; Zheng et al., 2025, p.

1) and enhance perceptions of reliability (Susilo, 2020, pp. 37–38). The platform enables social connection, experience sharing, and memory preservation (Du et al., 2020, p. 9), supports destination promotion through user and celebrity content (Zhu et al., 2022, p. 2762), and can rapidly popularize lesser-known places (Wengel et al., 2022, pp. 1–6). Ryanair's use of TikTok illustrates how creative adaptation to platform trends can strengthen brand visibility and identity (Arpaia & Grace, 2022).

Given this growing influence of short-form video platforms on travel behavior, the UTAUT2 model represents an appropriate theoretical foundation for examining TikTok adoption in tourism contexts.

2.2. The UTAUT2 Model and Tourism

As tourists increasingly rely on digital platforms for information, communication, and travel decisions, the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) provides a relevant framework for explaining technology adoption in tourism contexts. Its constructs clarify how digital innovations and social networks influence behavioral intention (BI) to use TikTok for destination planning – through perceived usefulness (performance expectancy), ease of use (effort expectancy, facilitating conditions), social influence, enjoyment (hedonic motivation), and habitual behavior.

Growing concerns about misinformation on social media (Kyza & Varda, 2019, p. 1) further highlight the importance of perceived trust (PT), which is often a key predictor of BI (Zhou et al., 2023, p. 3) and is particularly relevant on TikTok, where most travel information is user-generated.

BI is widely recognized as an indicator of future actual behavior (AB) (Venkatesh et al., 2012, p. 158), incorporating intentions to continue, try, or plan usage (Gupta & Dogra, 2017, pp. 150–151; Ali et al., 2024, p. 338). Performance expectancy (PE) – the belief that TikTok helps users make better travel decisions – has been consistently identified as a strong adoption factor (Oh et al., 2009; Ayeh et al., 2013; Amaro & Duarte, 2013; Ali et al., 2024). Due to its algorithmic personalization and interactive videos, TikTok is perceived as a useful source of destination information (Chenchen et al., 2020, p. 117; Fodzi et al., 2024, p. 166).

Effort expectancy (EE), or perceived ease of use (Venkatesh et al., 2003, p. 450), may be less influential for digitally skilled users (Zhou et al., 2023), yet TikTok's simplicity continues to support exploratory travel behavior (Datu et al., 2025, p. 242). Social influence (SI) – the role of peers, family, and influencers (Venkatesh et al., 2003, p. 451) – is particularly relevant for younger users (Tan et al., 2014, p. 304; Tan & Ooi, 2018, p. 1635), with TikTok's social interaction features reinforcing tourism-related opinions (Wang et al., 2022, p. 5).

Facilitating conditions (FC), such as access to devices, skills, and platform support (Venkatesh et al., 2003, p. 453; Ali et al., 2024, p. 337), enhance usage of mobile tourism applications (Cheng, 2024; Escobar-Rodríguez & Carvajal-Trujillo, 2014). TikTok's interface, navigation, and features like trending topics and auto-captions further simplify tourism-related use (Waliaula et al., 2025, pp. 797–798; Halim et al., 2022, p. 725).

Hedonic motivation (HM) – pleasure and enjoyment derived from use (Venkatesh et al., 2012, p. 161) – is a powerful adoption driver (Baptista & Oliveira, 2015; Gupta et al., 2018; Zhou et al., 2023), especially given TikTok's entertaining short-video format (Amaro et al., 2016). Habit (HA), defined as automatic, repeated behavior (Limayem et al., 2007, p. 709), predicts both BI and AB (Zhou et al., 2023, p. 4) and is a particularly strong determinant of actual use of user-generated content (Assaker et al., 2019).

Collectively, these constructs form an integrated framework capturing the cognitive (PE, EE, FC), social (SI), motivational (HM, HA), and trust-related (PT) dimensions of TikTok use in tourism decision-making.

3. RESEARCH FRAMEWORK

This study builds on the UTAUT2 model (Venkatesh et al., 2012), widely used to explain consumer adoption of digital technologies, and extends it by incorporating perceived trust (PT) to better capture the credibility dynamics of social media environments such as TikTok. PT reflects users' confidence in the reliability of user-generated and marketer-generated content, reducing uncertainty in tourism-related decision-making.

The framework includes several core constructs: performance expectancy (PE), or the belief that TikTok improves and speeds up destination decisions; effort expectancy (EE), the perceived ease of accessing travel information; social influence (SI), the impact of peers and influencers; and facilitating conditions (FC), the resources and support enabling effective use. Hedonic motivation (HM) captures enjoyment and entertainment, while habit (HA) reflects automatic and repeated use of TikTok for tourism purposes. Together with PT, these constructs form an integrated basis for understanding users' intention to rely on TikTok when evaluating destinations.

Figure 1 shows the conceptual research model based on the extended UTAUT2 framework.

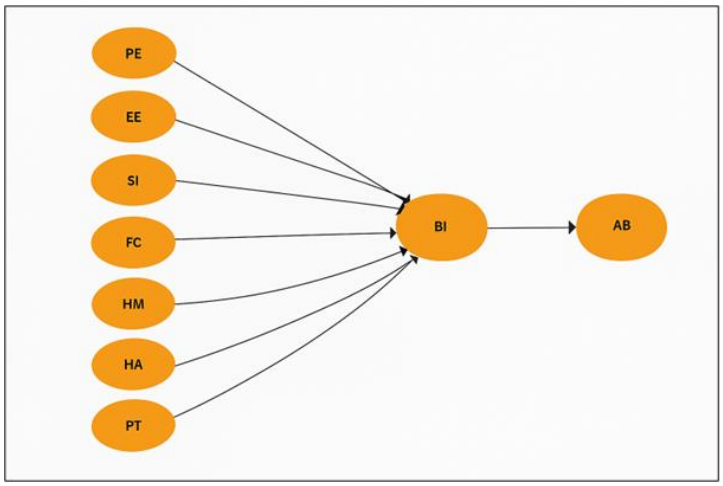


Fig. 1. Research model for the use of TikTok in choosing a destination.
(PE = Performance expectancy, EE = Effort expectancy, SI = Social influence, FC = Facilitating conditions, HM = Hedonic motivation, HA = Habit, PT = Perceived trust, BI = Behavioral intention; AB = Actual behavior)

Two outcome variables capture behavioral aspects. BI reflects the willingness of users to rely on TikTok in future destination choice, while AB denotes the concrete use of the platform in selecting and confirming destinations. Based on prior studies (e.g., Zhou et al., 2023), the hypothesized relationships posit that PE, EE, SI, FC, HM, HA, and PT positively influence BI; that both BI and HA directly predict AB; and that FC may also exert a direct effect on AB. The framework therefore assumes that BI mediates the influence of motivational, cognitive, and trust-related factors on actual behavior, while HA reinforces usage both directly and indirectly.

3.1. Research Design and Methodology

The study adopted a quantitative, cross-sectional design to empirically examine the extended UTAUT2 model, which incorporated the construct of perceived trust. To test the conceptual framework, Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed, as this approach is particularly suitable for predictive modeling, exploratory theory extension, and the analysis of complex models with multiple latent constructs (Hair et al., 2021).

A structured online questionnaire was developed to capture the relevant constructs. The instrument consisted of three main parts:

- Items on TikTok usage patterns, serving both as screening criteria and descriptive measures.
- Measurement scales for all latent variables (PE, EE, SI, FC, HM, HA, PT, BI, AB), adapted from validated sources (Venkatesh et al., 2003; Venkatesh et al., 2012; Zhou et al., 2023). Each construct was measured using multiple reflective items on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree).
- Demographic questions, including age, gender, education level, and occupation.

The target population comprised TikTok users in BiH. Respondents were recruited through snowball sampling techniques to ensure adequate reach within the relevant age cohort. The questionnaire was administered online via Google Forms in 2024, yielding a total of 327 responses, of which 254 were from TikTok users. After screening for completeness and validity, 229 responses were used in the final analysis. The analytical procedure followed established guidelines for PLS-SEM:

- Measurement model assessment, focusing on internal consistency (Cronbach's alpha, composite reliability), convergent validity (average variance extracted, AVE), and discriminant validity (heterotrait-monotrait ratio, HTMT).
- Structural model assessment, examining the significance and strength of path coefficients, t-statistics generated through bootstrapping (5000 resamples), explained variance (R^2), and predictive relevance (Q^2).
- Model fit evaluation, based on standardized root mean square residual (SRMR) and other recommended indices for variance-based SEM.

The choice of an online survey was appropriate given the digital orientation of the target group, ensuring efficient access to TikTok users within the specified age range. PLS-SEM

was selected as the analytical method due to its capacity to handle complex models, extend theoretical frameworks, and provide robust predictive insights with medium-sized samples.

3.2. Profile of Respondents

The sample is predominantly female (69%), with males making up 31%. Most participants are aged 18–25 (59%), followed by 26–35 (13%) and 46–55 (15%). In terms of education, 61% hold a university degree and 39% secondary education. Regarding employment, 65% are employed or self-employed, 30% are students, 5% unemployed, and 1% retired. Most respondents have over six months of TikTok experience: 33% between six months and one year, and 23% more than two years. A smaller share (16%) reported less than six months. Daily use is relatively moderate: 49% spend under 30 minutes, 32% between 30–60 minutes, and only 4% more than two hours per day.

Tourism-related use is significant: 72% engage with TikTok for travel purposes. While 62% have not traveled because of TikTok, 38% reported finding travel inspiration on the platform, highlighting its influence on destination choice. Besides TikTok, respondents also rely on Booking.com (75%) and Instagram (68%), with Airbnb (53%) and Tripadvisor (37%) also common. Pinterest (11%) and Google (1%) are used less frequently.

4. RESULTS AND DISCUSSION

4.1. Measurement Model

The measurement model demonstrated strong reliability and validity. Composite reliability (Jöreskog's rho – ρc) values ranged from 0.90 to 0.96, Cronbach's alpha values exceeded 0.88, and AVE values were all above 0.83, confirming convergent validity. Discriminant validity was supported by the HTMT criterion, with all ratios below the conservative threshold of 0.85. Discriminant validity was further confirmed using the Fornell–Larcker criterion, as the square roots of AVEs for all constructs exceeded their inter-construct correlations, supporting the distinctiveness of the latent variables.

Table 1. Construct reliability and validity

Construct	Cronbach's α	ρc	AVE
BI	0.883	0.945	0.895
AB	0.945	0.965	0.901
PE	0.937	0.955	0.840
EE	0.903	0.937	0.833
SI	0.897	0.898	0.747
FC	0.896	0.898	0.747
HM	0.920	0.920	0.792
HA	0.908	0.908	0.767
PT	0.940	0.940	0.840

Source: primary data

In addition, all standardized loadings exceeded the recommended cut-off value of 0.70, providing further support for indicator reliability. This confirms that each survey item contributed meaningfully to its intended construct.

Table 2. Standardized loadings of measurement items

Construct	Items	Loading
AB – Actual Behavior	I am going to use TikTok for destination decision making	0.947
	If I already use it, I will continue to use TikTok for destination decisions in the future	0.943
	I plan to recommend using TikTok for destination decision-making to my friends and family	0.958
BI – Behavioral Intention	I would like to try/learn to use TikTok for destination decision making	0.945
	I would like to continue to use TikTok to make destination decisions in future travel	0.947
EE – Effort Expectancy	I think learning to use TikTok is easy	0.867
	The user interface of TikTok is clear and easy to understand	0.942
	I can easily search for travel information using TikTok	0.927
FC – Facilitating Conditions	I have the resources needed to use TikTok (mobile device, internet)	0.829
	I know how to use TikTok to search for short travel videos	0.931
	When I have trouble using TikTok, I can ask others or customer service for help	0.895
HA – Habit	I am used to using TikTok to watch short travel videos	0.956
	I use TikTok when I need travel information	0.970
	It is natural for me to use TikTok to help me make destination decisions when I need to	0.964
HM – Hedonic Motivation	The short tourism video content in TikTok is interesting and fun	0.885
	Watching short travel videos on TikTok makes me feel good	0.900
	I would love to use TikTok to filter travel destinations	0.921
PE – Performance Expectancy	I find TikTok useful in searching for travel information	0.912
	Travel information shared by TikTok users is useful	0.912
	Using TikTok can help me keep abreast of the travel information of the destination in real-time	0.935
	Using TikTok can help me to choose and determine the destination faster	0.907
PT – Perceived Trust	I believe TikTok can provide me with relevant travel information	0.922
	I think the travel information (videos, reviews) on TikTok is reliable	0.927
	I think it is possible to make travel decisions based on the travel information provided by TikTok	0.923
SI – Social Influence	If people around me (family, friends, peers) use TikTok to search for travel-related videos, I will be interested in using it	0.887
	If a celebrity, star, or blogger I respect or love posts a travel video on TikTok, I will be interested in using it	0.867
	The recommendations of people around me will affect my willingness to use TikTok for destination selection	0.863

Source: primary data

Variance inflation factors (VIF) were also assessed to examine potential multicollinearity issues. All values were well below the recommended thresholds (Hair et al., 2021), indicating that multicollinearity was not an issue.

4.2. Structural Model

The structural model exhibited strong explanatory power, with $R^2 = 0.815$ for BI and $R^2 = 0.865$ for AB, indicating that the proposed framework explains more than 80% of the variance in both constructs. The model demonstrated good fit, with SRMR = 0.066, below the recommended threshold of 0.08. Predictive relevance was also supported, as Q^2 values were greater than zero for all endogenous constructs.

Table 3. Path coefficients and hypothesis testing

Path	β	t-value	p-value	Result
BI → AB	0.930	79.61	<0.001	Supported
PE → BI	0.079	1.38	0.169	Not supported
EE → BI	0.006	0.11	0.909	Not supported
SI → BI	0.016	0.39	0.696	Not supported
FC → BI	-0.108	-1.66	0.097	Not supported
HM → BI	0.189	2.47	0.014	Supported
HA → BI	0.369	6.48	<0.001	Supported
PT → BI	0.382	4.35	<0.001	Supported

Source: primary data

Regarding effect sizes (Cohen's f^2), BI exerted a very large effect on AB ($f^2 = 6.40$), while HA ($f^2 = 0.21$) and PT ($f^2 = 0.19$) showed medium-to-large effects on BI. HM had a small but significant effect ($f^2 = 0.04$), whereas PE, EE, SI, and FC had negligible effects.

These findings reveal that HM, HA, and PT are significant positive predictors of BI. In contrast, PE, EE, SI, and FC did not significantly affect intention.

The results provide several important insights into the use of TikTok in tourism decision-making among consumers in BiH. First, the path from BI to AB ($\beta = 0.93$, $p < 0.001$) is exceptionally strong, confirming that once users intend to rely on TikTok for travel purposes, this intention almost inevitably translates into actual use. This is consistent with the central assumptions of UTAUT2 and aligns with prior research conducted in China (Zhou et al., 2023). Second, the significance of PT highlights the centrality of credibility in social media–driven tourism contexts. Users are willing to base their travel decisions on TikTok only if they perceive the content – both user-generated and marketer-generated – as trustworthy. This finding supports the adaptation of the UTAUT2 model with PT as a critical extension, in line with arguments that reliability is decisive in environments where information quality is highly variable. Third, HM was also a significant predictor, suggesting that enjoyment and entertainment are key drivers of intention. Users are more likely to engage with TikTok for travel decision-making when the process is perceived as fun and emotionally engaging, confirming previous findings that Gen Z prioritizes entertainment value in digital interactions. Fourth, HA emerged as a robust factor influencing BI. This suggests that repeated use of TikTok for entertainment and information gradually establishes automatic reliance on the platform when considering travel destinations. HA thus plays a dual role – strengthening BI and indirectly reinforcing actual usage. In contrast, the classical UTAUT2 predictors – PE, EE, SI, and FC – were not significant in this study. This non-significance reflects the digital fluency of the sample. For a generation accustomed to seamless digital

interactions, the perceived usefulness and ease of use of TikTok are taken for granted, while peer influence is less decisive compared to intrinsic motivation and trust in the platform.

Overall, the findings indicate that trust, enjoyment, and habitual use are the true levers of intention and behavior in the context of TikTok and tourism, rather than utilitarian or social factors. This highlights the need for tourism marketers to focus on building credibility and designing engaging, emotionally appealing content that strengthens habitual engagement with their destinations on TikTok.

4.3. Theoretical and Practical Implications

This study advances understanding of social media in tourism decision-making by validating an extended UTAUT2 model that includes perceived trust in the context of TikTok usage in BiH. Incorporating trust captures a credibility dimension often overlooked in traditional adoption models. The model's high explanatory power ($R^2 > 0.80$ for BI and AB) shows that motivational and trust-based factors outweigh utilitarian predictors in explaining digital tourism behavior. These results underscore the theoretical relevance of adapting established models to the dynamics of social media platforms.

For destination marketing organizations and tourism businesses, three practical implications emerge: (1) ensuring credibility through authentic and reliable content; (2) designing emotionally engaging and entertaining material that aligns with the preferences of younger travelers; and (3) fostering repeated exposure to destination-focused videos to strengthen habitual use of TikTok early in the customer journey. Aligning strategies with these drivers can enhance TikTok's effectiveness as a tool for destination branding and consumer influence.

5. CONCLUSION

This study shows that for consumers in BiH, TikTok is not primarily evaluated through usefulness or ease of use, but through whether its content is trustworthy, enjoyable, and integrated into daily routines. This highlights a shift from utilitarian to hedonic and trust-based drivers in tourism decision-making. For destination marketers, this means that strategies should prioritize building credibility, creating emotionally engaging content, and encouraging repeated interactions, rather than emphasizing functional benefits.

This study has limitations related to its cross-sectional design, snowball sampling, and focus on BiH, which may affect generalizability. Future research should use longitudinal data to track changes over time, conduct cross-cultural comparisons, examine other short-form platforms such as Instagram Reels and YouTube Shorts, and extend the model with constructs such as perceived risk, authenticity, or algorithmic influence.

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TRENDS AND TRANSFORMATION IN E-COMMERCE IN BOSNIA AND HERZEGOVINA FROM 2023 TO 2025

ABSTRACT

This paper presents findings from a three-year longitudinal study (2023–2025) on e-commerce in Bosnia and Herzegovina (BiH), conducted in collaboration with the E-Commerce Association of BiH. The research, based on annual online surveys with a cumulative sample of 4,697 respondents, examines the evolution of online consumer behaviour, payment practices, delivery preferences, perceived risks, and trust in digital commerce. Results indicate steady growth in mobile-first purchasing and digital payment adoption, accompanied by rising consumer confidence and gradual convergence with global e-commerce trends. While domestic platforms remain relevant, their share is declining as consumers increasingly turn to regional and Asian marketplaces offering broader assortments and competitive pricing. The study also reveals that transparency, product information quality, and delivery reliability are the most decisive factors shaping online purchasing decisions, while data security concerns persist but are diminishing over time. These longitudinal insights contribute to understanding the digital transformation of emerging markets such as BiH. The findings have practical implications for retailers, policymakers, and platform developers aiming to enhance consumer trust, digital infrastructure, and competitiveness of the e-commerce ecosystem in BiH.

Keywords: *e-commerce, Bosnia and Herzegovina, online shopping.*
JEL: L81, M31

1. INTRODUCTION

Global e-commerce has rapidly expanded, growing by almost 60% between 2016 and 2022 to reach USD 27 trillion (UNCTAD, 2024, p.3). This growth, accelerated by the COVID-19 pandemic, was driven by digitalisation, new payment systems, and mobile connectivity, transforming both consumer behaviour and retail logistics (European Commission, 2024, p.1; Mo & Wang, 2025, p.1).

E-commerce in BiH follows EU and global trends but progresses more slowly (Peštek & Hadžijamaković, 2024a, p. 81). In 2024, 87% of BiH citizens used the internet and 51% of them shopped online, i.e., 26% below the EU average (European Commission, 2024, p. 2). Nevertheless, digital transformation and the growth of mobile and social commerce are increasingly evident. Although newly established SMEs were initially less likely to adopt e-commerce than mature firms (Činjarević et al., 2021, p. 16), by 2023, younger enterprises showed stronger digital engagement (Peštek & Hadžijamaković, 2024b, p. 101). Recent data show further increases in mobile commerce (m-commerce) (5.3%), social commerce (s-commerce) (20.4%), and digital payments (card +9.6%, wallets +4.9%) in 2024 compared to 2023 (Peštek & Arnaut Smajlović, 2025). However, despite growing internationalisation, both consumers and SMEs in BiH continued to engage primarily in domestic e-commerce up to 2024.

While numerous studies have examined e-commerce development in advanced economies, longitudinal evidence from emerging digital markets such as BiH remains scarce, particularly regarding consumer trust and behavioural adaptation. Existing research in BiH also provides limited evidence on how consumers balance the benefits of e-commerce, such as accessibility, convenience, and variety, against barriers like trust, security, and delivery. Understanding this dynamic is vital for digital retailers, platform developers, and policymakers seeking to strengthen the e-commerce ecosystem and build consumer trust. This study addresses the lack of longitudinal evidence on e-commerce behaviour and trust in emerging markets, focusing on BiH. It builds on three key frameworks: the Technology Acceptance Model, which links adoption to perceived usefulness and ease of use (Davis, 1989, p. 320); the Unified Theory of Acceptance and Use of Technology 2, which adds hedonic motivation, price–value, and habit (Venkatesh et al., 2012, p. 160 - 161); and the Perceived Risk Framework, which emphasises the role of privacy, security, and performance concerns in shaping trust (Featherman & Pavlou, 2003, p. 451).

2. THEORETICAL FRAMEWORK

2.1. Consumer Behaviour, Digital Trust and Perceived Risk

Understanding consumer behaviour in e-commerce requires analysing both cognitive and emotional factors that drive online decision-making. Digital consumers have access to extensive product information, price comparison tools, and peer reviews, which enhance autonomy and rationality in purchase decisions (Karaniya Wigayha et al., 2025, p. 2; Rahardja et al., 2024, p. 8). However, the absence of physical interaction and the anonymity of online transactions introduce a psychological dimension of uncertainty that makes trust a crucial determinant of behaviour (Soleimani, 2022, p. 57-78).

Trust functions as a mechanism that reduces perceived risk and fosters willingness to engage in online exchanges. It is shaped by prior experience, platform reputation, interface quality, and third-party assurances (Handoyo, 2024, p. 7; Bulsara & Vaghela, 2023, p. 148-164). When consumers perceive an online environment as secure and transparent, their trust mitigates potential fears related to financial loss, data misuse, or delivery failure (Featherman & Pavlou, 2003, p. 451-474). Conversely, higher perceived risk discourages purchases, especially in markets where digital literacy and institutional safeguards are still developing. This interplay between trust and perceived risk thus directly influences

consumer confidence, purchase frequency, and loyalty in digital contexts. Accordingly, RQ3 investigates how these factors - trust, perceived risk, and prior experience - shape purchasing behaviour and overall engagement with e-commerce platforms in BiH.

2.2. Mobile-first Commerce and Delivery

M-commerce represents one of the most dynamic dimensions of digital retail, enabling consumers to shop anytime and anywhere via smartphones and tablets. The increasing adoption of m-commerce reflects the growing importance of convenience, immediacy, and personalised digital experiences, as well as rising confidence in mobile payment systems (Wang et al., 2015, p. 555-572). In BiH, the expansion of mobile-first behaviour signals higher digital literacy and the integration of mobile wallets, s-commerce, and retailer applications. Yet, the success of m-commerce relies not only on technological access but also on the effectiveness of delivery infrastructure.

The "last-mile" phase - linking online platforms with the physical customer experience - remains one of the most complex and costly components of e-commerce logistics (Lim et al., 2018, p. 309). Delivery speed, affordability, and reliability directly affect user satisfaction and repeat purchasing intentions (Alkhalifah et al., 2022, p. 51).

Furthermore, trust and perceived risk play mediating roles in shaping consumers' willingness to engage in mobile transactions (Jaradat et al., 2018, p. 399-439). Accordingly, RQ1 examines how consumer habits and device usage have evolved with the rise of mobile shopping; RQ2 investigates how payment and delivery preferences affect user experience and satisfaction; and RQ3 explores how trust and perceived risk interact with these technological and logistical dimensions in shaping online purchasing behaviour in BiH.

2.3. Social Commerce and Internationalisation

S-commerce merges the interactive nature of social media with the transactional functions of e-commerce, allowing consumers to discover, evaluate, and purchase products within social environments. It relies heavily on user-generated content, reviews, and social interaction, which together shape perceived credibility and influence purchase intentions (Lin et al., 2017, p. 190-201; Zhao et al., 2023, p. 1-12). Unlike traditional e-commerce, where consumers engage directly with online retailers, s-commerce operates within digital communities that facilitate peer recommendations and collective decision-making (Sheikh et al., 2019, p. 68-93).

As digital ecosystems mature, social platforms have evolved into key commercial spaces, enabling personalised engagement, influencer-driven marketing, and direct shopping features. These interactions enhance consumer trust through visibility and social proof while simultaneously reinforcing the importance of value perception and usability. Consequently, RQ4 investigates which factors - such as price, trust, product information, and loyalty programmes - most strongly shape decision-making in online shopping contexts.

Parallel to this social dimension, e-commerce is increasingly global. The internationalisation of digital retail has been accelerated by technological innovation, regulatory harmonisation, and cross-border logistics, enabling firms of all sizes to access global markets (Cumming et

al., 2022, p. 3-20; Pereira et al., 2023, p. 225-248). Successful internationalisation requires adaptation to local cultures, payment systems, and consumer preferences (Fan et al., 2022, p. 2-17). Recent cases such as Temu illustrate how emerging Asian platforms rapidly gain market share through competitive pricing, gamification, and efficient logistics (Wen, 2025, p. 196). RQ5, therefore, examines the shift from domestic toward international platforms and the key drivers behind this transition in the e-commerce landscape in BiH.

3. RESEARCH FRAMEWORK

This study examines the transformation of e-commerce in BiH between 2023 and 2025, focusing on how consumers adapt to rapid digital growth while balancing opportunities with concerns over security, reliability, and trust. The objective is to analyse key trends and challenges in consumer behaviour and provide insights for building a more trustworthy, efficient, and competitive digital commerce ecosystem.

Based on this objective, the study is guided by the following research questions:

RQ1 - How have consumer habits in BiH shifted between 2023 and 2025 in terms of frequency of online purchases, devices used, and product categories bought?
RQ2 - What are the dominant payment methods and delivery preferences among online shoppers, and how have they evolved over time?
RQ3 - How do consumers perceive risks related to data security, privacy, and delivery reliability, and what role do these concerns play in shaping purchasing decisions?
RQ4 - What factors (e.g., price, trust, product information, user-friendly interfaces, loyalty programs) most strongly influence consumer decision-making in online shopping?
RQ5 - To what extent are consumers shifting from domestic to international e-commerce platforms, and what drives this transition?

3.1. Research Design and Methodology

This study is based on a longitudinal research design, capturing developments in e-commerce in BiH over a three-year period (2023 - 2025). The empirical research was conducted annually using online surveys administered via Google Forms, enabling broad reach and efficient data collection from digital consumers across the country.

The survey instrument was a structured questionnaire developed based on relevant academic literature and prior studies in the fields of e-commerce, consumer behaviour, and digital trust. Its content validity was ensured by aligning the items with findings and recommendations presented in the theoretical framework of the study. The research was planned, designed, and implemented in collaboration with the E-Commerce Association in BiH, which provided both methodological and practical input.

The annual surveys yielded robust datasets: 2023 (N=1,317), 2024 (N=1,483), and 2025 (N=1,897), providing a cumulative sample of 4,697 respondents over the three years. This design enabled both cross-sectional and longitudinal analysis of evolving patterns in consumer behaviour and market dynamics.

The data analysis combined descriptive statistics to identify general patterns and trends, and comparative approaches to detect year-to-year differences in consumer attitudes and practices. Where appropriate, inferential statistical tests were employed to examine relationships between variables and assess the significance of observed differences.

4. RESULTS AND DISCUSSION

The findings of this three-year longitudinal study provide a comprehensive overview of evolving consumer behaviour, payment and delivery practices, perceived risks, decision-making factors, and the balance between domestic and international e-commerce platforms in BiH. Each research question is discussed below through descriptive and comparative insights derived from the 2023–2025 data.

4.1. Evolving Consumer Patterns in E-Commerce

The results indicate a steady rise in online shopping engagement among consumers in BiH between 2023 and 2025. The share of non-users fell from 7.6% in 2023 to 5.1% in 2025, while mid-frequency buyers (2 - 3 purchases per quarter) consistently formed the largest segment (37.5% in 2023; 37.7% in 2024; 41.2% in 2025). Heavy users (6+ purchases) also increased, from 15.5% to 17.3%, reflecting the emergence of a more active group of digital shoppers.

Device usage confirms a strong mobile-first trend. Mobile phone shopping grew from 78.1% in 2023 to 86.6% in 2025, while laptop/desktop use declined from 20.7% to 12.8%. This aligns with global m-commerce growth and the spread of mobile payments, app-based retail, and s-commerce platforms such as Instagram and TikTok.

Product categories reveal both stability and diversification. Clothing remained the leading segment but declined slightly (17.5% in 2023 to 14.1% in 2025). Electronics rose sharply, reaching the Top 3 by 2025, while footwear and household items declined. Books and tickets remained stable, and jewellery increased in 2025 due to broader reporting. Overall, the data points to a maturing e-commerce ecosystem with more varied consumer demand.

Table 1. Top 10 Product Categories Purchased Online (% of all purchases)

Category	2023	2024	2025	Trend
Clothing	17.5	14.7	14.1	Stable leader, gradual decline
Footwear	10.1	9.6	8.8	Decline
Household items	9.9	8.2	7.4	Decline
Cosmetics & Personal Care	6.4	5.7	5.2	Slight decline
Jewelry & Accessories	4.5	3.7	6.6*	Fluctuating, increase in 2025
Electronics	4.3	3.1	7.8	Strong growth
Books	4.6	4.4	4.3	Stable
Tickets	3.7	4.1	3.9	Stable
Sports/Outdoor Equipment	3.7	3.7	3.3	Stable/slight decline
Travel services	3.4	3.4	3.1	Stable/slight decline

*In 2025, jewellery is reported jointly with watches and glasses, explaining the higher share.

4.2. Payment Methods and Delivery Preferences

The period between 2023 and 2025 marked a pronounced transition from cash-based to digital payment systems among online consumers in BiH. Cash-on-delivery, traditionally perceived as the most secure and convenient method, declined from nearly 70% of all transactions in 2023 to below 50% in 2025.

In contrast, card payments almost doubled, reaching 43%, while e-wallets such as PayPal and AliPay maintained a smaller but steady user base of around 8–10%. This indicates that digital payments are gradually being normalised as trust in financial technology and online authentication grows. Younger consumers, in particular, demonstrate higher confidence in using cards and mobile wallets, aligning with global generational patterns of cashless adoption.

The evolution of delivery practices complements this shift toward digital maturity. Courier delivery to home addresses remained the dominant model, accounting for roughly four-fifths of all shipments across the three years. However, notable innovation appeared in 2025 with the introduction of parcel lockers and contactless delivery points. Although only 7–8% of respondents reported using them regularly, more than three-quarters expressed willingness to adopt these services, citing convenience, privacy, and time flexibility as main advantages. Regular mail remains more common for international purchases, especially from Asian platforms offering low-cost shipping.

Overall, these findings suggest that consumers in BiH are increasingly open to adopting secure and flexible logistics systems, provided they combine reliability with transparent tracking and affordable pricing. The interplay between digital payments and delivery efficiency thus reinforces user trust and positively affects overall satisfaction with the e-commerce experience.

4.3. Perceived Risks and Consumer Trust

Consumers in BiH continue to express concerns about privacy, data security, and delivery reliability. Despite modest improvements between 2023 and 2025, almost half of respondents reported at least one negative online shopping experience - 42.8% in 2023, 45.7% in 2024, and 44.4% in 2025. The most common issues were related to product quality, misrepresentation, and delivery delays.

Payment-related problems decreased significantly during the observed period, from 14.8% in 2023 to only 2.5% in 2025, while concerns over data theft or misuse also declined, from 6.6% to 3.7%. Delivery issues, although still the most frequent source of dissatisfaction, dropped from 28.5% to 23.9%. Mean concern scores for privacy (from 4.11 to 3.92) and data misuse (from 4.08 to 3.94) show a gradual but consistent decline, suggesting that consumers perceive higher platform security and increasingly adopt trusted payment solutions.

While consumer confidence in e-commerce is growing, perceived risk remains a critical factor in purchase decisions. Shoppers in BiH expect the same standards found in mature markets - secure payments, reliable delivery, transparent return policies, and accurate

product information. These findings underline the importance of continuous investment in consumer protection, trust-building mechanisms, and service quality as preconditions for sustainable growth of e-commerce in the country.

4.4. Factors Influencing Consumer Decision-Making

Over all three years, consumers in BiH consistently prioritized price, detailed product information, and return policies as the most important decision-making factors. These rational, risk-reducing elements align with global patterns where value and transparency dominate online purchasing.

Table 2. Core Value Factors (Mean score, 1 - 5 scale)

Factor	2023	2024	2025	Trend
Price of the product	4.01	3.90	4.14	Stable, always high
Detailed product description (text, photos, video, AR)	4.07	4.00	4.19	Increasingly important
Possibility of replacement/return	4.12	4.06	4.16	Stable and essential
Warranty availability	4.02	3.99	4.04	Consistently high

Table 3. Trust and Social Proof (Mean score, 1 - 5 scale)

Factor	2023	2024	2025	Trend
Reviews and ratings by other consumers	3.81	3.83	3.89	Gradual increase
Reputation of the seller	3.84	3.86	3.98	Growth in significance
Recommendations from friends/family	3.62	3.58	3.61	Stable
Influencer recommendations	2.19	2.17	2.31	Low influence

Table 4. Additional Services and Convenience (Mean score, 1 - 5 scale)

Factor	2023	2024	2025	Trend
Delivery cost	4.03	4.05	4.17	Increasing importance
Customer support availability	3.68	3.65	3.92	Stronger role in 2025
Loyalty programs	3.34	3.37	3.65	Growing but not decisive
Mobile app of the retailer	3.31	3.35	4.15	Strong increase by 2025

Trust-building mechanisms such as reviews, ratings, and seller reputation grew in importance, reflecting the global rise of user-generated content in shaping credibility. In contrast, influencer recommendations remained weak (scores below 2.5), suggesting a more cautious local consumer base compared to international markets. Convenience-related factors gained weight over time. Delivery cost and customer support became more decisive, while the sharp rise in the importance of mobile apps by 2025 highlights the growing relevance of mobile-first ecosystems, consistent with global e-commerce trends. Overall, consumer decision-making in BiH is shaped by a combination of value, transparency, and convenience, positioning the market on a path of convergence with international standards.

4.5. Domestic vs. International Platforms

Between 2023 and 2025, consumers in BiH gradually shifted from domestic to international e-commerce platforms. Local webshops remained central to the market, but their share decreased from 72% in 2023 to 44% in 2025, while purchases from foreign sites increased from 26% to 43%. Domestic social media stores also maintained a modest role, used by around one-quarter of respondents, while foreign social media channels accounted for only 2–3%, confirming that social commerce remains supplementary rather than dominant. The most dynamic change was the rise of Asian marketplaces: purchases from Asia nearly doubled, from 14.8% in 2023 to 24.1% in 2025, driven by lower prices, wide assortments, and increasingly fast delivery. Regional and EU-based purchases declined steadily, showing that price and product variety now outweigh geographic proximity. North American platforms such as Amazon and eBay maintained smaller but stable shares.

Table 5. Regional Origins of International Purchases (% of respondents, multiple choice)

Region	2023	2024	2025	Trend
Neighbouring region (HR, SLO, SRB, MNE, AL, MK)	52.6	47.1	40.3	Declining
EU (excl. HR, SLO)	22.4	20.1	17.5	Declining
Asia	14.8	13.7	24.1	Strong growth
Other Europe	7.5	9.9	12.1	Growth
North America	2.0	7.1	4.2	Fluctuating
Latin America	0.4	1.6	1.5	Stable low
Australia	0.2	0.3	0.2	Marginal
Africa	0.1	0.2	0.1	Marginal

By 2025, Temu had become the single most popular global platform, used by 42% of online shoppers, followed by AliExpress (20%), eBay (11%), and Amazon (8%). The rapid rise of Temu illustrates how aggressive promotion, gamified discounts, and mobile-first strategies can quickly reshape consumer habits in emerging markets.

Overall, shopping patterns in BiH are becoming increasingly global. Domestic retailers retain relevance but face mounting competition from international players. To sustain competitiveness, they must improve user experience, delivery reliability, and social media integration while emphasising trust and local brand authenticity.

5. CONCLUSION

This three-year study provides a longitudinal overview of e-commerce transformation in BiH, revealing a market that increasingly aligns with global trends while remaining shaped by local constraints. Consumer habits (RQ1) shifted toward structured and mobile-first purchasing, with product diversification beyond fashion. Payment and delivery patterns (RQ2) show a clear move from cash to digital methods, while emerging parcel locker use signals readiness for more flexible logistics. Trust-related challenges (RQ3) persist, although concerns about privacy and data misuse are gradually declining. Decision-making (RQ4) remains driven by price, transparency, and trust, whereas influencer impact is still limited. Platform choice (RQ5) reflects growing globalization, with domestic sites losing ground to regional and Asian competitors.

Overall, e-commerce in BiH is converging with international standards, driven by digital payments, mobile adoption, and evolving consumer expectations. Persistent challenges in trust and delivery reliability, however, highlight the need for stronger consumer protection and service quality. Future research should address these issues using mixed methods and cross-country comparisons to better understand the mechanisms of trust and digital adoption in emerging markets.

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RESEARCH ON DETERMINANTS OF USER INTEREST IN IT CONTENT ON SOCIAL NETWORKS

ABSTRACT

The main purpose of this work is reflected in the attempt to identify the factors that play a role in the level of interest of users in IT content on social networks. The user's interest in IT content can be influenced by the choice of social network through which the message is placed and the brand is positioned, as well as formed attitudes about technology within the target group. The research was conducted on a sample of 400 respondents and proved 2 set hypotheses: H1 - Interest in content from the IT industry depends on the choice of network on which the most time is spent, and H2 - Attitude about the contribution of IT to other industries and the development of humanity, and preferences regarding instant content, to a certain extent determine respondents' interest in content from the IT industry.

The paper quantitatively analyzes these factors in order to determine to what extent the use of different platforms and attitudes about the role of technology in society contribute to the formation of interest in monitoring IT content. The obtained results enable a more precise segmentation of the audience according to psychographic and behavioral characteristics and the identification of groups with a high or potentially high level of interest. The results also indicate clear patterns of behavior that can improve the understanding of digital marketing and the targeted creation of IT content. At the end of the paper, research limitations and guidelines for future research are stated.

Keywords: *Market research, marketing, social media, Artificial Intelligence.*
JEL: M30, M31

1. INTRODUCTION

One of the goals of writing this paper is to apply modern marketing tools in the IT sector, combining theoretical foundations with research data collected from the general public, who hold different perceptions about the role of information technologies in everyday life.

The IT industry is one of the fastest-growing, and at times the most dynamic, industries in the world. Because of this, it is even more important to anticipate movements in trends and numerous environmental factors when developing marketing strategies. The relevance of this topic is reflected in the advancement of technology, business needs, and user requirements, which change almost on a daily basis. This creates a complex environment for marketing professionals who must constantly adapt and adjust to technological innovations.

Therefore, it is important to minimize resistance to change and more easily adopt and use advanced technological tools that support achieving business objectives and provide relief for humans who are not perfectly rational and objective in the decision-making process.

2. THEORETICAL FRAMEWORK

Below is an overview of previous research relevant to the purpose and objectives of this paper, including: the impact of social media on user behavior and attitudes toward technology as determinants of interest in IT content.

2.1. The impact of social media on user behavior

Over the years of AI development, social media has significantly changed the way consumers think and the importance of their role in the overall process: through reviews, chatbots, online prize purchases, and similar activities. The advantage of machine learning is that it enables computers to learn on their own and improve performance, making them capable of solving complex real-world problems (Knežević, 2018). For example, chatbots and virtual assistants provide instant answers about products, while AI analyzes reviews and displays the most relevant product information.

Digital channels and social media have changed consumer behavior and the way companies operate, and further research is suggested in the areas of personalization, marketing automation, data, AI, and consumer behavior in a digital context (Dwivedi et al., 2021). For success in modern marketing, it is crucial to create personalized experiences that match individual consumer needs and desires (Lemon, 2016).

AI systems can significantly enhance the user experience on digital platforms through personalization and content automation (Burns et al., 2022). AI can help in marketing and sales strategies through Sprout Social, which is one of the most widespread social media management tools and includes all key elements, from quality visual content to descriptions, location tags, and tagged users (Bubalo, 2021). AI and machine learning will revolutionize every company's marketing strategy and teach them how to communicate with consumers in the most effective way, which also represents AI taking over marketing (Sterne, 2017). The rapid advancement of AI and automation introduces a new era often called the "Fourth Industrial Revolution" (Galić, 2025). This revolution is characterized by the blurring of boundaries between the digital and physical world, as advanced technologies are increasingly used in various spheres of life (Kljajić et al., 2025).

2.2. Attitudes toward technology as determinants of interest in IT content

The easiest ways brands try to build and gain trust are by offering value (coupons, points) in exchange for customer information. In this process, AI comes into play, and it must be built on ethical norms that protect consumers (Lucić, 2022). AI applications can bring significant benefits to companies, but they can also cause negative consequences if not implemented carefully. This includes risks such as incorrect or biased recommendations, privacy breaches, loss of trust, and financial or reputational losses for companies (Eitel-Porter, 2021). Stephen et al. (2021) address the technical and legal consequences of data collection and usage, which are used for research at the intersection of information systems and marketing.

The impact of AI on younger and older populations can differ significantly due to differences in digital literacy, experience, and technology usage habits. In the era of modern technologies and social networks, young people more than older people leverage the power of AI on social media and in that way present their knowledge and skills for business purposes.

AI also affects the education sector, opening the possibility of creating a dynamic and adaptable environment for learning and teaching, but only if it is used responsibly, with solutions found with the help of AI (Kralj et al., 2024). In a study on the impact of AI chatbots on young consumers' behavior in e-commerce, results showed that socio-demographic factors (age, level of education) significantly affect chatbot adoption, as do web-based factors such as digital literacy and access to data (Timothy et al., 2024). It is necessary to invest in educating older people so they can become familiar with the benefits of AI—for example, smart devices for measuring blood pressure, the Siri assistant as a reminder for tasks, and similar (Kljajić et al., 2025).

3. METHODOLOGY OF EMPIRICAL RESEARCH

3.1. Research objectices and scope

The subject of the research is the gap between IT companies' marketing strategies and the interests of the target group, as well as the awareness, analysis, and drawing of conclusions about the local public's perception of the IT industry and the marketing efforts it invests toward them.

The objective of the research is to understand the target group's attitudes, preferences, and knowledge regarding IT's contribution to other industries and the development of humanity.

3.2. Hypotheses

Hypothesis 1. Interest in content from the IT industry depends on the choice of the network on which the most time is spent.

Hypothesis 2. Attitudes about IT's contribution to other industries and the development of humanity, as well as preferences regarding „instant" content, to some extent determine respondents' interest in IT-industry content.

3.3. Research methodology

An online survey was used as the primary data collection method. Respondents from Mostar and the surrounding area were reached through a combination of channels, including the professional network LinkedIn and educational institutions in Mostar. To ensure a broad perspective on how IT-related content is perceived, participants were structured and analyzed across key demographic and professional segments (gender, age groups, and industry affiliation), with an effort to include respondents from diverse sectors and age categories. Data processing and statistical analysis were conducted in IBM SPSS software. Inferential statistical procedures were applied in line with the research hypotheses, as outlined below.

4. RESEARCH RESULTS

Results were analyzed on a sample of 400 respondents. The questionnaire had 42 questions. In the first part of the questionnaire, questions related to respondents' demographic characteristics were asked, such as gender, age, occupation, and similar.

Table 1. Segmentation Variables Distribution by Gender

Gender	N	%	Cumulative
Female	268	67.0	67.0
Male	152	33.0	100.0

Source: Authors' output in SPSS software

Table 2. Segmentation Variables Distribution by Gender

Age group	N	%	Cumulative
15 – 24	132	33.3	33.3
25 – 34	100	25.0	58.3
35 – 44	46	11.3	69.6
45 – 54	89	22.3	91.9
55 and above	33	8.1	100.0

Source: Authors' output in SPSS software

Most respondents included in the survey were employed – 219 of them. Next most numerous were students – 122. There were also part-time students who can also be legally employed, as well as full-time students who may have student jobs. Other groups had fewer than 30 members (30 unemployed, 20 pupils, and 8 retirees). The next question related to the industry in which respondents are employed or for which they are being educated, i.e., the occupation or profession they have if unemployed, or had if retired. 119 respondents selected the education/culture/training sector as their profession; 75 selected the information and communications sector; 37 selected financial activities or insurance; 30 selected medicine/pharmacy/healthcare; and 22 selected trade. 19 worked (or had worked) in manufacturing and the processing industry, while 15 were in arts, entertainment, and recreation. 14 selected construction and architecture, while 8 respondents worked in hospitality or had no occupation, 7 worked in transport, warehousing, and vehicle-related services, and 45 were employed in other activities or professions. Other relevant variables will be mentioned in the hypothesis-testing section.

4.1. Testing H1: Interest in content from the IT industry

Hypothesis H1 posits that users' interest in IT-related content differs depending on the social network on which they spend the most time.

To test this assumption, respondents' self-reported interest in IT content (measured on a 5-point Likert scale) was treated as the dependent variable, while the most-used social network (grouped into Instagram, Facebook, and TikTok) served as the independent grouping variable. Prior to hypothesis testing, the distribution of the dependent variable was assessed for normality using the Kolmogorov–Smirnov and Shapiro–Wilk tests. Both tests indicated a significant deviation from normality ($p < .001$), thus violating the assumptions required for parametric group comparisons.

Table 3. Normality test of the distribution of the IT-content interest variable

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Rate your level of interest in content categories related to the IT industry on social networks	.220	396	.000	.908	396	.000

Source: Authors' output in SPSS software

Tables 4 and 5. report result of the Kruskal-Wallis U test for the first hypothesis

Table 4. Rank-based comparisons

Ranks				
	Socials	N	Mean Rank	Mean
Rate your level of interest in content categories related to the IT industry on social networks.	Instagram	150	203.91	3.19
	Facebook	156	171.36	2.88
	TikTok	66	182.73	3.00
	Total	372		

Source: Authors' output in SPSS software

Table 5. Kruskal-Wallis Output

Test Statistics[a,b]	
	Content categories related to the IT industry?
Kruskal-Wallis H	7.814
Df	2
Asymp. Sig.	.020

Source: Authors' output in SPSS software

Accordingly, a Kruskal–Wallis H test was applied to examine differences in interest levels across the three platform groups. The results revealed a statistically significant difference in interest in IT content between users of different networks ($H = 7.814$, $df = 2$, $p = .020$). Rank-based comparisons suggest that respondents who primarily use Instagram reported the highest levels of interest in IT-related content (Mean Rank = 203.91; M = 3.19), followed by TikTok users (Mean Rank = 182.73; M = 3.00), while Facebook users demonstrated the lowest interest (Mean Rank = 171.36; M = 2.88). These findings support H1, indicating that

platform preference is meaningfully associated with users' engagement with IT-related content.

4.2. Testing H2: Determinants of interest in IT-industry content

Hypothesis H2 proposes that users' interest in IT-industry content is associated with (i) attitudes toward IT's contribution to the development of other industries, (ii) perceptions of the broader impact of technological progress on humanity, and (iii) self-assessed English-language proficiency.

To examine the combined predictive effects of these variables, a correlation analysis and a multiple linear regression model were employed, with interest in IT-industry content as the dependent variable and the three attitudinal and skill measures as independent predictors.

Table 6. Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error
1	.586[a]	.343	.305	1.018

Source: Authors' output in SPSS software

Table 7. Anova output

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	41.711	3	13.904	13.420	.000[b]
	Residual	406.127	392	1.036		
	Total	447.838	395			

Source: Authors' output in SPSS software

Table 8. Anova output Regression Coefficients for Predictors of Interest

Coefficients[a]					
	Unstandardized Coefficients		Standardized Coefficients		
Model 1	B	Std. Error	Beta	t	Sig.
(Constant)	.934	.338		2.764	.006
To what extent do you believe information	.190	.073	.137	2.599	.010
technologies contribute to the development of other	.228	.072	.168	3.158	.002
industries?	.143	.063	.124	2.827	.020
In your opinion, what kind of impact does technological progress have on humanity?					
Rate your knowledge of the English language:					

Source: Authors' output in SPSS software

The overall model indicated a moderate association between the predictors and the outcome ($R = .586$) and explained a meaningful share of variance in interest in IT content ($R^2 = .343$; adjusted $R^2 = .305$). The regression model was statistically significant, $F(3,392) = 13.420$, $p < .001$, confirming that the predictors jointly contribute to explaining differences in respondents' interest.

All three predictors demonstrated statistically significant positive effects. Interest in IT content increased with stronger beliefs that IT contributes to the development of other industries (B = .190, p = .010), with more positive perceptions of technological progress for humanity (B = .228, p = .002), and with higher self-rated English proficiency (B = .143, p = .020). Among the predictors, perceived impact of technological progress showed the strongest standardized contribution (β = .168), followed by perceived contribution of IT to other industries (β = .137) and English proficiency (β = .124).

The estimated regression equation is:

$$Y = 0.934 + 0.190X + 0.228Z + 0.143W$$

where **Y** denotes interest in IT-industry content, **X** perceived contribution of IT to other industries, **Z** perceived impact of technological progress on humanity, and **W** self-assessed English proficiency.

By way of illustration, if all predictors are set to their lowest value (1), the model yields a predicted interest score of 1.49 (approximately corresponding to a rating of 1). Conversely, when all predictors take their highest value (5), the predicted score rises to 3.73 (approximately corresponding to a rating of 4), indicating a meaningful upward shift in interest; however, given that the model explains only a portion of the variance ($R^2 = .343$), additional determinants should be considered in future research. Overall, the results support H2, indicating that both technology-related attitudes and English-language proficiency are significant determinants of interest in IT-industry content.

5. CONCLUSION

Divergent patterns of engagement with IT-related content across social networks indicate that platform choice is meaningfully associated with users' interest levels, thereby supporting H1. In addition, the results confirm H2 by showing that more positive attitudes toward IT's contribution to other industries and to societal development, together with higher self-assessed English proficiency, are significant determinants of interest in IT-industry content. Taken together, these findings suggest that interest in IT content is shaped by both behavioral factors (the primary platform users engage with) and cognitive/attitudinal factors (beliefs about technology and language readiness).

From a practical perspective, the results imply that IT communication should be purposefully segmented rather than treated as universally applicable across audiences and channels. IT companies can improve relevance and engagement by aligning content strategy with the dominant platforms used by target segments and by tailoring message complexity, tone, and language to the audience's attitudes and English proficiency. Finally, because the model explains only part of the variance in interest, future research should expand the set of predictors (e.g., digital literacy, prior exposure to IT topics, professional role, content consumption motivations...) to further refine the understanding of what drives sustained interest in IT-industry content.

The research results can provide insight into the dynamics of the consumer and business IT market in Mostar and HNŽ/K. In conclusion, the key recommendation for companies in the IT industry is that not every piece of content can be intended for the entire audience. It is important to regularly conduct market research and strive to create quality content for everyone.

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PARASOCIAL RELATIONSHIPS AND HEURISTICS IN SUSTAINABILITY COMMUNICATION

ABSTRACT

The aim of this study is to examine the potential applications of parasocial relationships and heuristics in promoting sustainability. Parasocial relationships refer to one-sided emotional bonds formed with media figures or fictional characters. Through these relationships, consumers perceive issues that their favorites consider important as more relevant and closer to themselves. Heuristics, which play a key role in behavioral economics, simplify and speed up decision-making. By connecting these two phenomena, sustainability messages can be communicated more effectively, and the encouragement of sustainable behavior can become more successful. In this study, the author reviews practices that have aimed at social change. Based on the literature review and its analysis, recommendations are formulated that may contribute to more effective communication of sustainability messages in the future through the appropriate design of communication and campaigns.

Keywords: *parasocial relationships, heuristics, sustainability, marketing, communication.*
JEL: M31, D91

1. PREVIOUS RESEARCH

In the context of increasing environmental awareness, sustainability has become a central theme in contemporary marketing communication. However, while more brands attempt to position themselves as environmentally responsible, consumer trust in green advertising has steadily declined. Also, sustainable behavior is hard to follow for consumers (Vereckei-Poór, 2023). This erosion of trust can be largely attributed to the widespread use of greenwashing practices, when companies exaggerate or falsify their environmental claims to appear more sustainable than they truly are (Breves & Liebers, 2022). As a result, even though a growing number of sustainable products are available on the market, many consumers continue to choose items packaged in plastic or made through environmentally harmful processes (Heidbreder et al., 2019). This discrepancy between pro-environmental attitudes and actual purchasing behavior highlights the complexity of sustainable consumption and the limitations of traditional persuasive strategies.

At the same time, social media has become one of the most influential communication platforms, where consumers increasingly rely on digital personalities for product information and lifestyle inspiration (Guld, 2022). Influencers – individuals who cultivate audiences through consistent, personal, and often relatable content – have emerged as powerful mediators between brands and consumers. Their ability to form parasocial relationships, which are one-sided yet emotionally meaningful connections with followers, allows them to exert substantial influence on attitudes and behavior. However, this influence

is not unconditional. When audiences perceive an influencer's sustainability-related message as inauthentic or deceptive, for instance in cases of greenwashing, trust diminishes, and persuasive power declines (Le et al., 2025).

Understanding the psychological mechanisms that underlie such trust dynamics is crucial for improving sustainability communication. One relevant framework for this is heuristics—mental shortcuts that simplify decision-making processes and enable individuals to make judgments quickly and efficiently. Heuristics such as representativeness, availability, and anchoring (Tversky & Kahneman, 1974) are often used in everyday decision-making and play an important role in shaping consumer choices. When combined with affective processing, heuristics can influence behavior in subtle yet powerful ways, particularly when individuals are exposed to repetitive and emotionally charged content. These psychological mechanisms are closely related to influencer marketing, where repeated exposure and emotional connection often enhance persuasion and loyalty.

This study therefore aims to examine how heuristics, parasocial relationships, and trust interact within the context of influencer marketing and sustainability communication. It explores how influencers can use heuristics-based and emotionally engaging strategies to promote environmentally friendly behavior, while also addressing the challenges posed by declining trust due to greenwashing. By analyzing the underlying psychological and relational factors that shape consumer perceptions, this study seeks to identify strategies that could strengthen the credibility of sustainability messages and foster genuine behavioral change towards more sustainable consumption.

2. THEORETICAL FRAMEWORK

2.1. Heuristics

Heuristics are widely used as part of quick decision making, as they use less resources, compared to slow and rational decision making. Some examples of heuristics are representativeness, availability and anchoring. These are used to make simplified decisions (Tversky & Kahneman, 1974; Kahneman et al., 1982; Tversky, 1972). For this reason if heuristics can be an effective tool to reinforce and encourage desired behavior, such as sustainable and environmentally friendly actions. Heuristics are used to solve problems by relying on personal experience, they are mental shortcuts, used to save time, and they help us in quick decision making without needing to deeply research and analyze the information (Dale, 2015). This means, that they can also make purchase decisions easier, and quicker (Rosillo-Díaz et al., 2024). When making decisions, according to Kahneman, we can use two different processing systems, System 1 is an automatic, associative and therefore fast and effortless information processing system, that is also emotionally charged. While System 2 is an effortful and more controlled system, and so it is much slower, but also more flexible. Therefore, System 1 is intuitive while System 2 is analytical (Kahneman, 2003). When we process information, affect is also applied in most cases, this means that we automatically add the affecting information to our perception, and these later will influence our decisions that we believed were solely rational (Zajonc, 1980). For example, when we buy a product without too much thinking, or when we turn off the lights to save energy. Affect heuristics can be used as manipulation tools. For example, repetitive exposure results in positive attitude towards the object, which can turn into preference too (Zajonc, 1968).

This is well aligned with the repetitive content consumption of influencers. In that case as followers spend more time watching the influencer's content, the parasocial relationship develops and as the relationship deepens the engagement increases and the follower will watch the contents even more.

This effect could also be used to achieve sustainability goals. For example, as we see more sustainable options, we get more used to them and they will be more familiar and not as distant, therefore we are more inclined to buy them.

2.2. Parasocial Relationships

The popularity of social media platforms and the increasing screen time makes parasocial relationships more prominent in the case of young people (Guld, 2022; Ong et al., 2022; Törőcsik & Szűcs, 2021). Furthermore, parasocial relationships help us cope with hard situations and they can provide a sense of security (Derrick et al., 2009). The relevance of parasocial relationships increases in times of change and uncertainty. Faster, modern lifestyles and as a result weakening interpersonal relationships also make parasocial relationships more prevalent in today's age (Törőcsik, 2017). One recent example is the Covid-19 pandemic. With the lockdowns and social distancing of Covid-19 people turned to media as entertainment, as a result, the number of parasocial relationships increased (Farber et al., 2020). Media personalities, including actors, musicians and influencers were more frequently seen compared to one's real-life connections (Bond, 2021). The higher frequency of contact resulted in the formation of parasocial relationships (Schiappa et al., 2007). The pandemic also brought a mixture of emotions, fear, uncertainty, isolation, loss, anxiety and so on. Parasocial relationships are coping mechanisms, and so they helped to relieve the stress brought on by the concerning situation (Jarzyna, 2021). Similarly to the Covid-19, current events such as wars and economic recession, also bring out negative emotions and so they make parasocial relationships even more important. Influencers can offer soothing in times of difficulty, and they can make people feel heard and understood when they miss real emotional connections (Sen, 2023).

However, following an influencer or celebrity on social media doesn't necessarily mean having a parasocial relationship with them. Having a parasocial relationship with an influencer increases their credibility in the eyes of their followers. It makes the followers' attitude towards the advertised brands more positive, and it leads to increased purchase intention, and followers also tend to share the influencer's content on social media (Balaban et al., 2022). While young people often form parasocial relationships out of information motive, for example to get travel suggestions, in case of older people, loneliness and lack of social relationships is more prevalent (Bi et al., 2021).

2.3. Influencers

When it comes to follower's trust in influencers, the main contributing factors are authenticity, the expertise of the influencer and the homophily. Attitude homophily is positively related to forming parasocial relationships with influencers, however attractiveness has no effect (Sokolova & Kefi, 2020). The attractiveness of an influencer only plays a role in the initial following phase, and as time passes, physical attractiveness

becomes less important (Kim & Kim, 2021). Instead, the followers pay more attention to the content and overall behavior of the influencer. The more creative and well designed the posts, the more attractive they become. This highlights the importance of the social media content. Apart from the content, homophily also plays major role in engagement. When followers find an influencer similar to themselves, they can connect more easily, and as a result the engagement increases (Sardar et al., 2024). If the content is entertaining, it has a positive effect on the customers rebuying intention (Chen et al., 2020).

Similarly to the attractiveness, the importance of authenticity is more prominent when the follower has a weak relationship with the influencer, as time passes, authenticity also becomes less important. However, as the relationship grows, and becomes stronger, trust in the influencer has a greater impact on follower loyalty (Kim & Kim, 2021). Authenticity of the influencer and sharing numerous personal details can help build stronger parasocial relationships with the followers (Ferchaud et al., 2018). This strong parasocial relationship and the need to know the personal insights of a famous person's life can even result in media addiction (de Bérail et al., 2019). Forming a vicious cycle where consuming more and more content leads to an even stronger parasocial relationship which again results in longer screen time. This strong parasocial relationship increases the buying intention of the followers (Ashraf et al., 2023). Social media influencers try to develop their follower base and communities, which increases social influence. In the case of micro influencers, the content must be aligned with the followers' interest (Balaban et al., 2022). The relationship can be even stronger in the case of micro influencers (Conde & Casais, 2023). The stronger relationship in case of micro influencers can be due to the heuristics of spending more time with people who have fewer connections (Tenev, 2024). This way the connection between the micro influencer and their community feels more intimate and realistic.

The previous factors became less important with time, although in the case of expertise, an increased number of interactions, and more time is needed so that the followers notice the influencer's expertise (Kim & Kim, 2021). The expertise of the influencer does not affect the engagement with the content. Customer engagement is greater when the followers find the influencers trustworthy and similar to themselves (Sardar et al., 2024). Trust in the influencer results in higher purchasing intentions in regards of the endorsed product, as followers view those products more positively. As previously described, trust can indeed affect the behavior and opinions of the followers (Kim & Kim, 2021; Zhang et al., 2022; Yun et al., 2023). Having a strong parasocial relationship with an influencer makes the endorsed product more attractive and so increasing the purchasing intentions (Ashraf et al., 2023; Chen et al., 2021). Strong parasocial relationships and credibility increase the purchase intentions of followers (Sokolova & Kefi, 2020). On the other hand, having weak parasocial connection with the influencer results in the decrease of buying probability in case of a strong initial decision (Penttinen et al., 2022).

2.4. Trust

We view smiling people more positively, we see their smiles as a sign of trustworthiness, goodness, honesty and sincerity. A smiling person would also appear more obedient and admirable compared to someone who is not smiling (La France & Hecht, 1995). This also applies to media personalities, in most cases they are photographed as smiling, happy people, most of them try hard to always show only their positive emotions. They mostly start their

posts by smiling and waving at the camera, showing their good intentions and friendliness. As trustworthiness is a main factor in content engagement, most influencers want to appear trustworthy and sincere. However, it is really important that true sincerity includes showing the reality, which can sometimes even be negative. Many influencers started to show their real selves, including no makeup photos, pre-editing shots and many more. This results in higher perceived sincerity (Wize, 2023). When followers view the source trustworthy, they tend to perceive the content as higher quality. So, when the influencer is honest, viewers feel that their content is also honest and accurate and therefore highly informative (Filieri et al., 2023). This means that to help people believe in sustainable content, the influencers creating them should be trustworthy.

Apart from parasocial relationships, the influencer's self-presentation is also important, when building connections with followers. Influencers who are perceived as altruistic and genuine and not self-interested are more likely to build connections and acceptance among followers, and therefore they are more effective in transferring messages (Zheng et al., 2024). However, people tend to trust experts more than their peers (Zhang, Yu, & Yao, 2024). So apart from influencers it is important to have experts backing up what the influencers say. This could be a collaboration too, where the influencer invites an expert and they discuss a topic together. When followers feel they are aligned with the influencer's values and attitudes, they form stronger parasocial relationships with them and so they support, promote and even defend the influencer when needed, as well as they are more likely to support their values (Wong & Wei, 2023). Consumers prefer to purchase and use products that align with their self-concept (Sirgy, 1985). So when a person values sustainability they are more likely to purchase environmentally friendly products. When choosing celebrities for brand endorsement, it is most beneficial to choose a celebrity, who represents a rare or unique value, that also matches the brand's identity. This can boost the impact and the profitability of the partnership (Zamudio, 2016). This could also mean choosing an influencer who also leads a sustainable lifestyle. Emotional connection with the influencer leads to positive response towards the influencer advertising. In case of short video ads, the sensory experience leads to increased purchase intentions, while the positive feelings contribute to engagement with the ad (Li et al., 2023). In case of short videos, there are several important factors that affect customer engagement. For example, when the video is entertaining, or when the relationship between the content creator and the consumer is close, it has a positive impact on customer engagement (Xiao et al., 2023). Celebrity posts on social media encourage consume engagement (Bazi et al., 2020).

Followers have especially strong parasocial relationship with nano-, micro- and macro influencers, as they seem closer to them. Smaller influencers benefit from this strong relationship with their followers, while mega influencers benefit from this likeability and expertise when increasing purchase intention (Zhang, Tang, & Krallman, 2024). The highest return on investment can be obtained while cooperating with nano influencers (Beichert et al., 2024). Higher follower count means the influencer reaches a broader audience, but the relationship with the followers is weaker, and so engagement is less likely (Wies et al., 2023). So for effectively transferring sustainability related messages, it is best to collaborate with influencers, who have less followers, but their values align with sustainable development. Strong parasocial relationships has a direct effect on the intention to adopt the influencer's recommendations. Influencers with less followers have a higher pursuasive power, as they can form stronger bonds with the audience (Conde & Casais, 2023). Based on this combining

smaller and bigger influencers seem like a good strategy, however, when promoting the same product in livestreams, they weaken each other's sales performance. It is caused by the decreased trust in big influencers, when followers find out that multiple influencers promote the same product (Gu et al., 2024). This can also be translated to sustainability messages. It is important to work with a few influencers, and to make sure they are all a good fit for the content. Parasocial relationship with the correctly chosen influencer can further enhance environmentally friendly actions (Breves & Liebers, 2022). However, information value could be even more important in creating environmental communication strategies (She et al., 2025). This could be due to recent trust issues with influencers.

2.5. Marketing Tools

Several advertisements feature animals to positively influence the viewers' attitude. Most people love animals, and most people view their pets as family members (Lancendorfer et al., 2008). Animal companions can also be considered as an extension of the consumer's self (Belk, 1988). Furthermore, animals can transfer both cultural symbols and meaning to a brand, making them useful in brand messaging (Lancendorfer et al., 2008). Animals also give space to include nature-related and playful experiences in the advertisements (Holbrook et al., 2001). For this reason, using animals in sustainability messaging could also be effective. Many times, consumers are more aware of the link between an animal and the brand compared to a person and the brand (Hoggan, 1989). However, when used in advertisements they encourage heuristic processing, opposed to systematic processing. Therefore, using animals in advertisements is useful if we want consumers to process information heuristically, however, if the goal is for them to use the systematic processing, using animals is counterproductive (Lancendorfer et al., 2008). Based on the Heuristic Systematic Model, individuals can process information with both systematic and heuristic processing, usually depending on their motivation and involvement. Highly motivated consumers tend to make more effort and analyze the available information, while less motivated consumers apply heuristics in their decision making, making the decision faster and simpler. The two information processing styles can even occur at the same time (Todorov et al., 2002; Chaiken & Maheswaran, 1994). In conclusion, featuring animals in advertisements can have positive effects when used correctly and in accordance with our goals.

When an influencer posts informative content, the trust increases and therefore they affect people's decision making, however when the content is entertaining. Being attractive, trustworthy and similar to the followers also boosts trust in the branded posts (Lou & Yuan, 2019). Followers tend to form parasocial relationships with influencers, who are attractive and similar to themselves, however being trustworthy alone doesn't help forming parasocial relationships (Yuan & Lou, 2020). Furthermore, parasocial relationships can also improve attitude towards values mentioned in posts (Du et al., 2023). In case of a global health crisis, such as Covid-19, parasocial relationships can be important in message delivery. Public health institutions can utilize the audience of celebrities and influencers (Chang et al., 2023). They can also be used to reinforce sustainability communication.

3. RESULTS – RECOMMENDATIONS FOR MORE EFFECTIVE SUSTAINABILITY COMMUNICATION

Drawing upon the psychological principles discussed – particularly heuristics, parasocial relationships, and trust – hit becomes evident that effective sustainability communication must combine emotional resonance, ethical integrity, and cognitive simplicity. Understanding how consumers process information and form relationships with influencers provides an opportunity to design strategies that not only capture attention but also inspire genuine, long-term behavioral change. The following recommendations summarize key practices that can enhance the credibility and impact of sustainability communication.

Firstly, it is important to prioritize authenticity and transparency. Authenticity is the foundation of trust in environmental communication. Influencers and brands should ensure that sustainability claims are accurate, verifiable, and consistent with observable actions. Sharing personal challenges, partial progress, or even failed attempts at sustainable living can make messages more relatable and credible. This openness reduces perceptions of manipulation and helps rebuild trust damaged by greenwashing practices.

Secondly, combining emotional engagement with informational value can be effective for sustainability communication. Since most individuals rely on affective and heuristic processing, sustainability messages should evoke emotion while maintaining factual integrity. Storytelling, relatable imagery, and emotional framing can make abstract environmental issues more tangible. However, this emotional component must be complemented by clear, evidence-based information. The combination of emotion and knowledge enables audiences to connect with sustainability both intuitively and rationally, reinforcing trust and understanding.

It is also important, to utilize parasocial relationships ethically. Influencers' parasocial bonds with their followers present powerful opportunities for shaping sustainable attitudes, yet they must be handled with responsibility. Genuine self-disclosure, consistent behavior, and alignment between personal and promoted values help sustain long-term credibility. Instead of exploiting emotional closeness for profit, influencers should act as authentic advocates for sustainable living, emphasizing education, empathy, and shared purpose.

Encouraging heuristic cues that support sustainable behavior is an other way to make sustainability communication more effective. Many sustainability-related decisions occur quickly and automatically, so communicators should design cues that simplify these decisions in favor of environmentally friendly options. Repetition, familiar symbols (such as eco-labels), and positive emotional associations—like nature imagery or animal representations—can strengthen the mental availability of sustainable choices. When used ethically, such cues make sustainability feel both familiar and achievable, supporting intuitive pro-environmental behavior.

Fostering collaborations between influencers and experts can further help in making communication more powerful. Partnerships between influencers and credible experts, such as environmental scientists, NGOs, or policy advocates, can bridge the gap between emotional appeal and factual authority. These collaborations reinforce informational reliability and demonstrate a shared commitment to truth and impact. The presence of expert

voices also mitigates the risk of misinformation, particularly in complex sustainability topics where emotional narratives alone may be insufficient.

Lastly, maintaining consistency and long-term engagement is also important. Sustainability should not be treated as a transient marketing trend. Long-term consistency across campaigns, platforms, and personal behavior demonstrates sincerity and strengthens message credibility. Over time, repetition and alignment between values and actions reinforce positive heuristics, deepen parasocial trust, and encourage enduring pro-environmental habits.

By implementing these practices, sustainability communicators and influencers can move beyond superficial messaging toward meaningful engagement. Ethical persuasion grounded in authenticity, trust, and emotional intelligence has the potential to bridge the gap between awareness and action, transforming sustainability from an abstract concept into a shared, lived commitment.

4. DISCUSSION

In conclusion, the effectiveness of sustainability communication in today's media landscape depends not only on the accuracy of information but also on the psychological and emotional mechanisms that guide consumer perception and behavior. As greenwashing practices have weakened consumer trust in environmental claims, it has become essential to understand how trust can be rebuilt and maintained through authentic and transparent communication. Influencers, who occupy a unique position between brands and audiences, play a crucial role in this process. Through parasocial relationships, they can form meaningful emotional bonds with followers, fostering identification, empathy, and a sense of shared values. When these relationships are supported by perceived authenticity, expertise, and moral integrity, they can significantly enhance the persuasiveness of sustainability messages.

Heuristics also play a pivotal role in shaping how sustainability information is processed. Because most consumers rely on intuitive, affect-driven decision-making rather than deliberate analysis, sustainability campaigns must consider the role of these mental shortcuts in influencing choices. Repetition, familiarity, and emotional cues can all reinforce sustainable attitudes and behaviors when applied ethically and strategically. At the same time, affect heuristics and parasocial bonds must be used responsibly, as manipulation or exaggeration can easily lead to the erosion of credibility and trust.

Ultimately, building effective sustainability communication requires a balance between emotional engagement and informational value. Collaborating with trustworthy influencers who authentically embody sustainable values, combined with transparent and evidence-based messaging, can help bridge the gap between environmental concern and consumer action. By understanding the interplay of heuristics, parasocial relationships, and trust, marketers and communicators can design campaigns that not only promote sustainability but also cultivate long-term attitudinal and behavioral change. In a time when audiences are increasingly skeptical of corporate intentions, sincerity and consistency remain the most powerful tools for restoring confidence and inspiring genuine commitment to environmental responsibility.

5. LIMITATIONS AND FUTURE RESEARCH

Although this study highlights key connections between heuristics, parasocial relationships, and trust in sustainability communication, several limitations must be acknowledged. Much of the current research in these areas remains conceptual, making it difficult to establish causal relationships between influencer credibility, emotional processing, and sustainable behavior. Additionally, the rapid evolution of social media platforms creates challenges for maintaining relevance, as algorithms, formats, and influencer practices change quickly over time. Finally, while heuristics and parasocial dynamics offer valuable psychological insights, their potential ethical risks, such as manipulation or exploitation of emotional attachment require more critical examination.

Future research should therefore aim to address these gaps through more diverse and methodologically rigorous approaches. Longitudinal and experimental studies could clarify how parasocial relationships and heuristic processing develop and influence sustainable choices over time. Cross-cultural research is particularly important to understand how values, trust, and authenticity are interpreted in different societies, as cultural norms strongly affect both environmental attitudes and influencer credibility. Moreover, comparative studies between influencer-led and expert-led sustainability communication could help determine the optimal balance between emotional engagement and informational depth. Finally, as digital media continues to evolve, future work should investigate how emerging forms of online communication – such as AI-generated or virtual influencers – reshape perceptions of trust, authenticity, and sustainability.

By addressing these limitations and exploring these future directions, research can contribute to a deeper and more ethically grounded understanding of how digital influence and psychological mechanisms can support genuine, long-term environmental engagement.

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ARTIFICIAL INTELLIGENCE IN MARKETING: TRENDS, OPPORTUNITIES AND CHALLENGES

ABSTRACT

The rapid development and application of artificial intelligence (AI) are transforming marketing practices and altering the way companies engage with customers. The changes are multifaceted and are reflected in improved message personalization, optimization of communication channels, detailed data analysis, and enhanced customer experience.

The aim of this research is to analyze the role and significance of AI in contemporary marketing communications, with a special focus on how it transforms the approach, form, and effectiveness of communication between companies and consumers. The paper is based on a literature review and reports, with a particular focus on the latest research on the application of AI in marketing. Sources were selected based on relevance and timeliness, and the analysis was conducted through systematization and interpretation of key trends.

The findings are discussed in the context of the existing literature and practical implications for the use of artificial intelligence in marketing. The findings suggest that AI in marketing is not only a technical tool but also a strategic resource for sustainable competitiveness and digital transformation acceleration, with its adoption in organizations continuously increasing. This reveals the need for further research and careful application of AI tools in business practice, as well as the alignment of educational and development policy to meet the needs of the digital economy.

Keywords: *Artificial Intelligence, Marketing Communications, Digital Marketing, Personalization, Market Segmentation.*
JEL: M31, M39, O33

1. INTRODUCTION

The contemporary business environment is characterized by extremely rapid technological change that continuously redefines the way organizations operate, communicate, and create value. In the context of globalization and digitalization, technology has become one of the key determinants of competitiveness and long-term growth. Its role is no longer merely operational but increasingly strategic. Technology profoundly influences business models, consumer relationships, and decision-making processes across all sectors of the economy (Davenport et al., 2020). In this regard, artificial intelligence (AI) represents one of the most

significant phenomena of the modern era, whose impact extends beyond technical innovation and deeply permeates economic, social, and ethical dimensions.

AI can be defined as the capability of computer systems to perform tasks that typically require human intelligence such as learning, reasoning, pattern recognition, and decision-making (Huang & Rust, 2021). Today, AI is applied across a wide range of business functions, from process automation, supply chain management, and financial analytics to personalized marketing and customer relationship management (Shankar, 2018).

From an academic perspective, research on the role of AI in marketing and marketing communications holds dual significance. First, it enables a better understanding of how technology is transforming into a tool for strategic communication and brand reputation management. Second, it opens the possibility of redefining theoretical models of consumer behavior within the digital environment (Huang & Rust, 2021).

This paper focuses on analyzing the role of AI in marketing, particularly within marketing communications, and identifying key trends in this field. The aim of the study is to highlight the fundamental benefits and challenges that organizations face when implementing AI in communication with consumers. Accordingly, the research addresses how artificial intelligence transforms marketing communications, as well as the advantages and challenges arising from its development and application. The paper also analyzes current trends in the use of artificial intelligence in business and factors that influence its acceptance by companies.

The methodological framework of this study is based on a qualitative approach, specifically the analysis of relevant academic and professional literature, reports of international organizations, and market research findings related to the use of AI in business. By employing the desk research method, the study identifies key trends, opportunities, and challenges in the digital transformation of marketing and marketing communications. This approach contributes to a deeper understanding of the impact of artificial intelligence on modern business and provides a foundation for future empirical studies and practical implications in the field of marketing communication.

2. LITERATURE REVIEW

Driven by the pace of technological advancement, marketing is undergoing a process of structural transformation. Within this context, artificial intelligence (AI) has emerged as a dominant catalyst of change, offering numerous benefits while simultaneously presenting a range of challenges (Gayaparsad & Ramlutchman, 2024). In its broadest sense, AI encompasses a set of methods machine learning, deep learning, natural language processing, computer vision, and expert systems that enable computer systems to perform tasks associated with human cognition, such as learning, reasoning, prediction, and adaptive decision-making (Huang and Rust, 2021).

As an emerging technological solution, AI has found extensive application across various business domains, including marketing. Early traces of automated “intelligence” in the consumer environment can be observed in recommendation systems and collaborative filtering experiments from the late 1990s. However, the exponential rise in marketing-related

applications occurred after 2010, driven by the availability of large-scale data sets, the advancement of GPU computing, and progress in deep learning (Shankar, 2018; Davenport et al., 2020). The current wave includes NLP-powered chatbots and generative AI tools that automate content creation and enable hyper-personalization across multiple channels (Huang & Rust, 2021; Verma et al., 2021).
Numerous studies and reports highlight the benefits of applying artificial intelligence in business, especially in marketing and communications, including improved targeting, personalization of content and more effective decision-making. From a marketing perspective, AI is most frequently applied in the stages of market analysis and consumer behavior prediction, as well as in the tactical phase of marketing mix development. AI also enhances decision-making accuracy and facilitates greater personalization of marketing activities (Ljepava, 2022). In marketing practice, AI is operationalized through data analytics, predictive modeling, recommender systems, dynamic segmentation, and real-time communication automation (Davenport et al., 2020; Wedel and Kannan, 2016).

The development and use of AI are redefining how marketing communications are created and experienced (Nesterenko & Olefirenko, 2023). In communication with consumers, AI enables two-way, 24/7 interactions through chatbots and virtual assistants, supports intent and sentiment recognition, and guides adaptive user journeys (Shankar, 2018). According to Davenport et al. (2020), the integration of AI into marketing redefines the very nature of the brand–consumer relationship. Companies are moving away from traditional mass communication toward personalized, data-driven, and automated interactions. For instance, AI systems enable the dynamic adjustment of advertisements, content, and offers according to user context, behavior, and preferences. As a result, marketing becomes more precise, relevant, and cost-effective, yet also more complex in terms of ethics and privacy (Verma et al., 2021). The rise of digital platforms and the abundance of data have enabled companies to analyze consumer behavior in real time and tailor communication to their needs, interests, and values (Wedel & Kannan, 2016).

Crucially, AI enhances data processing and interpretation, accelerates test–learn cycles, and improves the accuracy of communication attribution (Guha et al., 2021; Wedel and Kannan, 2016). In terms of customer experience (CX), it facilitates omnichannel contact orchestration and predictive churn prevention (Huang and Rust, 2021). Haleem et al. (2022) identify data analysis as one of the most significant advantages of AI in marketing. Moreover, AI is transforming content creation by enabling faster and more efficient production with reduced costs (Murár and Kubovics, 2023). Empirical evidence demonstrates that AI significantly reduces costs and increases efficiency through the automation of repetitive processes and better allocation of media resources (Davenport et al., 2020; Shankar, 2018).

Huang and Rust (2021) argue that AI can improve consumer loyalty by enabling personalized experiences. More relevant messages and recommendations enhance satisfaction, engagement, and long-term customer value. According to certain studies, the implementation of AI in marketing leads to more efficient segmentation and precise consumer targeting (Wedel & Kannan, 2016). Specifically, AI facilitates the creation of dynamic and predictive consumer segments that are continuously updated based on new data, allowing marketing messages to be more precisely tailored to relevant target groups. This results in more efficient budget utilization and a higher return on investment (ROI). For segmentation and targeting, machine learning (ML) models form dynamic, high-throughput

audiences that are continuously refined based on real-time behavioral data (Wedel & Kannan, 2016). Guha et al. (2021) emphasize that AI substantially enhances the measurement of marketing effectiveness and enables real-time campaign optimization, leading to improved overall performance. Thus, through the use of machine learning algorithms, AI supports market segmentation, campaign optimization, and trend prediction, thereby increasing the precision and efficiency of marketing decision-making (Guha et al., 2021).

Artificial intelligence involves the use of advanced algorithms and machine learning to automate, personalize, and optimize marketing decisions and consumer interactions (Davenport et al., 2020). The integration of AI into marketing communications has provided organizations with substantial benefits, including deeper insights into consumer behavior and the automation of key processes, leading to improved resource management. These technologies allow for the creation of personalized customer experiences that foster engagement and loyalty while simultaneously optimizing marketing strategies and enhancing data analytics (Gökerik and Aktaş, 2024).
Despite its numerous benefits, the application of AI also introduces a series of challenges. The most critical among them concerns ethical responsibility and algorithmic transparency. Issues such as data bias, privacy protection, and accountability in automated decision-making have become central to modern marketing practice. AI technologies carry ethical risks, particularly regarding algorithmic bias and the lack of transparency, which may lead to discriminatory practices and reduced accountability. Consequently, there is an increasing need for explainable and responsible AI systems that provide greater insight into model reasoning and decision logic (Jobin et al., 2019).

Gayaparsad and Ramlutchman (2024) emphasize that an ethical approach is essential in implementing AI within marketing communications. Their research highlights the importance of transparent AI usage so that consumers are aware and informed when interacting with AI-generated content. Some studies further suggest that consumers perceive AI-generated messages differently from those created by humans. Nesterenko and Olefirenko (2023) note that consumers often view AI-generated messages as less authentic, which can evoke moral discomfort and negative emotional responses. Similarly, Kirk and Givi (2025) underline the necessity of a cautious approach to AI-generated marketing content to preserve authenticity and build consumer trust.
When considering the main challenges of AI implementation, Verma et al. (2021) particularly stress organizational barriers, pointing to the competence gap between marketing professionals and data experts. Their findings suggest that a lack of skills and preparedness within organizations remains a key obstacle to the successful adoption of AI solutions. In addition to human factors, technological infrastructure plays a crucial role. Wedel and Kannan (2016) note that fragmented systems and inconsistent, biased, or incomplete data severely undermine AI model performance, limiting their reliability in practice. The implementation of AI technologies can also be complicated by regulatory factors that impose restrictions, particularly regarding data accessibility and usage (Davenport et al., 2020). Shankar (2018) warns about the high initial costs of implementation and operational challenges related to model maintenance over time, including the need for mature MLOps practices and managing model drift. Moreover, internal characteristics, such as internationalization and firm size, as well as external factors, including the availability of digital skills and infrastructure, are recognized as key drivers of enterprise-level

digitalization and therefore important determinants of AI adoption (Segarra-Blasco et al., 2025).

3. RESULTS AND DISCUSSION

In this study, through a review of the relevant literature, numerous benefits of applying artificial intelligence in marketing were identified, including improving targeting accuracy, optimizing costs and improving customer experience. Owing to the wide range of benefits, AI is becoming an indispensable component of business processes for an increasing number of enterprises. These observations are further supported by date from the latest Eurostat report (2025), according to which the share of companies in the European Union that use at least one artificial intelligence technology increased from 8.0% in 2023 to 13.5% in 2024, which represents a growth of more than five percentage points.

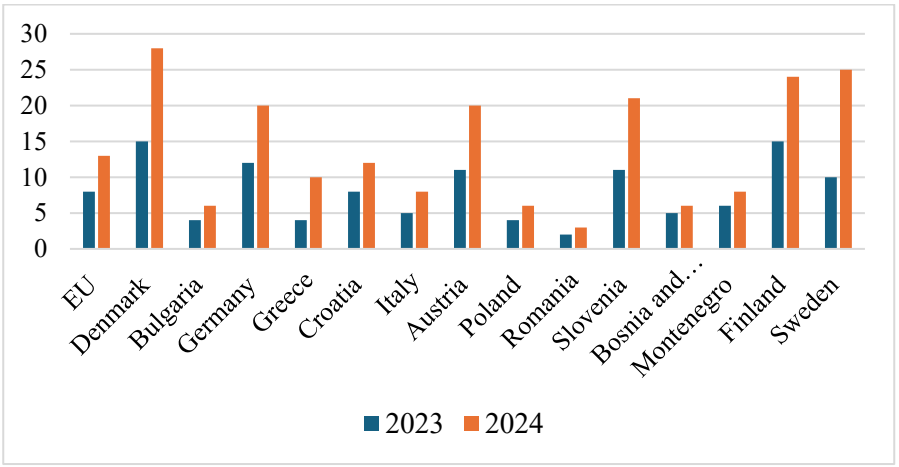


Fig. 1. Use of AI Technologies in Enterprises across Selected EU Economies, 2023–2024 (%)

Source: Eurostat (2025), Usage of AI technologies increasing in EU enterprises

The literature also indicates that the application of artificial intelligence in marketing can be limited, as it depends on resources, technological infrastructure and professional staff in the organization. Findings from multiple studies indicate that company size significantly influences both the diversity and intensity of use of AI technologies, with larger organizations having a wider range of uses, while smaller firms still use AI to a more limited extent.

Eurostat (2025) data show that large enterprises (with more than 250 employees) are significantly more active in the use of AI solutions 41.2% of them implemented AI in 2024, compared to 33.5% in 2023. Among medium-sized enterprises, the share of AI users increased from 13.8% to 20.9%, while in small enterprises the growth was more modest yet noticeable, rising from 6.0% to 10.9%.

At the EU level, AI is most used in enterprises for marketing and sales, organization of business processes and management, with larger enterprises also applying it extensively in

areas such as IT security, production and logistics (Eurostat, 2025). Similarly, McKinsey & Company (2025) confirms that larger organizations with annual revenues exceeding USD 500 million tend to implement AI more rapidly than smaller firms.

The OECD (2025) report also highlights significant disparities in the level of artificial intelligence adoption among firms of different sizes and sectors. Compared to large corporations, small and medium-sized enterprises (SMEs) lag considerably in implementing AI technologies, primarily due to limited financial and technical resources, a shortage of skilled personnel, and underdeveloped data management infrastructure. Additional barriers include organizational cultures resistant to change and an insufficient understanding of the specific ways in which AI can enhance business processes and market competitiveness (OECD, 2025).

These results are not unexpected, as large enterprises easily use artificial intelligence thanks to the abundance of resources and professional staff, which further confirms that available resources and digital maturity strongly influence the ability to implement AI technologies. This is particularly evident in marketing and communication, where both technological capacity and analytical expertise are required (Dwivedi et al., 2021). Larger enterprises have established infrastructures for data collection and analysis, while smaller firms continue to rely on external solutions and limited budgets for digital transformation.

On the other hand, considering the specific characteristics of small businesses and the growing importance of marketing communication in today's business environment, the application of modern information technologies can help small enterprises overcome weaknesses in marketing performance (Lazarević-Moravčević, 2019, p. 111; Lazarević-Moravčević et al., 2018, p. 45). In this context, the application of AI in small businesses is extremely desirable, because small organizations using it can significantly improve business efficiency, optimize marketing activities and improve user experience with relatively low costs of introducing modern technologies.

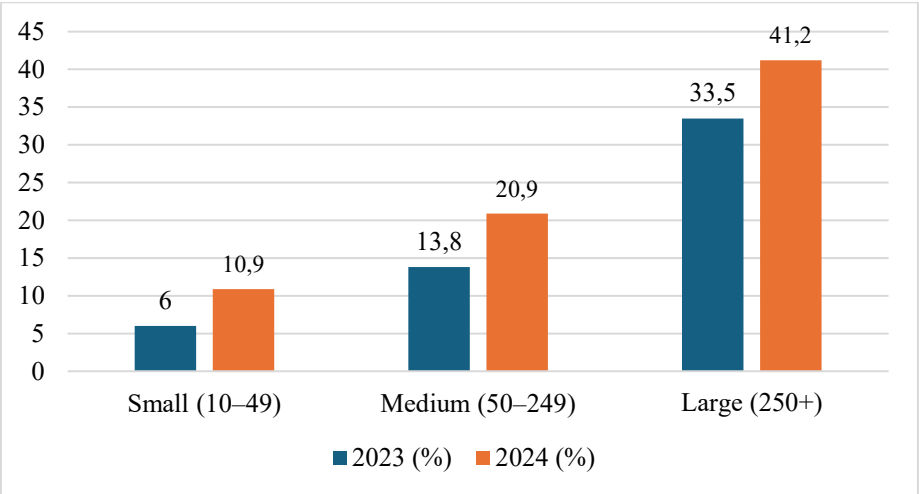


Fig. 2. Share of enterprises by size using AI technologies in the EU, 2024 (%)
Source: Eurostat (2025), Usage of AI technologies increasing in EU enterprises

Despite existing barriers and uneven adoption levels across enterprises, available data indicate that AI continues to expand within European companies at a pace consistent with global technological trends. The most prominent areas of application include those directly related to marketing, such as language analysis and generation, speech recognition, and consumer data analytics all increasingly used for personalized campaigns and the optimization of customer experience (Davenport et al., 2020; Huang & Rust, 2021). As organizations achieve higher levels of digital maturity, AI is increasingly utilized for dynamic segmentation, predictive targeting, and campaign attribution, leading to reduced costs and improved efficiency (Wedel and Kannan, 2016; Guha et al., 2021).

From the perspective of marketing practice, industry surveys reveal that a growing number of professionals use AI tools daily, primarily for text generation, idea development, headline creation, and content drafting (Social Media Examiner, 2025; SurveyMonkey, 2025). Although not peer-reviewed, these findings align with the academic "collect-reason-act" framework, according to which AI transforms data into insights and subsequently into automated recommendations and decisions (Huang and Rust, 2021; Davenport et al., 2020). According to AllAboutAI (2025), the use of AI tools in marketing has increased substantially, with 88% of marketers now employing them daily. The AI marketing industry has reached a global value of USD 47.32 billion, with continued growth projected. Between 2022 and 2025, AI adoption in marketing rose by 36 percentage points. The United States currently leads in adoption, followed by China and the United Kingdom, positioning these regions as key drivers in shaping global best practices for AI-powered marketing campaigns.

In terms of future perspectives, the literature points toward a shift to prescriptive decision-making systems, where AI not only predicts outcomes but also recommends specific next steps such as the optimal communication channel, posting time, or tailored offer for an individual user (Guha et al., 2021; Verma et al., 2021; Jobin et al., 2019). At the same time, generative AI is rapidly advancing, increasingly taking on roles in creative development and automation of service processes. The principles of Explainable and Responsible AI are gaining particular attention, as transparency, ethics, and data protection become central themes in the evolution of AI-driven marketing.

The latest report from McKinsey & Company (2025) also provides evidence of the continued growth of the application of artificial intelligence in business, although, despite wider adoption, a significant number of companies are still not seeing measurable effects on profits. Despite the perceived lack, organizations increasingly recognize the need to integrate AI technologies strategically, including necessary organizational changes and the establishment of leadership roles dedicated to AI oversight. Moreover, an increasing number of companies are proactively mitigating risks associated with generative AI, such as inaccuracies, cybersecurity threats, and intellectual property violations, while simultaneously employing new experts, including ethics and compliance specialists (McKinsey & Company, 2025).

Although artificial intelligence is increasingly being integrated into various industries, most companies have still not managed to achieve significant benefits from its application. The prevailing trend shows that only a limited number of companies have developed advanced AI capabilities that yield significant outcomes. Conversely, the majority of organizations are still in the early stages of adoption, striving to build the necessary capacities. Sectors such

as fintech, software development, and banking currently demonstrate the highest concentration of AI adoption leaders (Boston Consulting Group, 2025).

It is important to highlight that recent research emphasizes that the speed of technological integration is often not matched by the development of ethical frameworks and governance mechanisms necessary for responsible use (Floridi & Cowls, 2019; Taddeo & Floridi, 2018). The integration of AI into marketing communication thus raises complex questions regarding data privacy, algorithmic bias, and the transparency of automated decision-making processes. As digital ecosystems evolve, companies are increasingly expected to align AI-driven marketing strategies with ethical principles such as accountability, fairness, and consumer autonomy (Pasquale, 2017). These expectations are particularly relevant in the European context, where regulatory frameworks such as the EU Artificial Intelligence Act aim to ensure that technological innovation proceeds hand in hand with consumer protection and societal trust.

From a strategic standpoint, organizations that approach AI implementation through the lens of ethical sustainability are more likely to achieve long-term brand equity and customer loyalty (Haenlein et al., 2022). Ethical AI is thus emerging not only as a compliance requirement but also as a competitive differentiator, shaping public perception and stakeholder relations. In this regard, the marketing discipline is undergoing a paradigmatic shift from a purely efficiency-oriented perspective toward one that integrates ethical, social, and environmental dimensions into digital transformation strategies (Akter et al., 2023).

4. CONCLUSION

The analysis of contemporary trends demonstrates that artificial intelligence has become a key driver of transformation in marketing and market communication, reshaping how companies understand, target, and engage with consumers. AI fundamentally changes the paradigm of marketing communication and practice by introducing new forms of interaction between brands and consumers. It not only enables personalized and data-driven communication but also transforms the entire marketing decision-making process from market research and message design to campaign performance measurement. Companies increasingly employ algorithms that analyze vast amounts of data to understand consumer needs, predict behavior, and automatically adapt content and offers in real time. This approach accelerates the cycle of testing and optimization while enhancing the relevance and emotional tone of messages.

Official statistics confirm that AI technologies are being adopted in European enterprises at an accelerating pace and on an ever-wider scale, with implementation levels strongly influenced by organizational size and digital maturity. Marketing is increasingly integrating AI into its everyday processes, both in content creation and optimization, further supporting theoretical findings on the importance of resources, organizational readiness, and close integration between marketing, IT, and analytics. The next phase of development is expected to be marked by a shift from predictive to prescriptive decision-making systems, accompanied by the expansion of generative models and the broader adoption of explainability and responsible AI principles. The integration of these principles is likely to become a standard component of future AI-driven marketing systems, particularly in alignment with regulatory frameworks ensuring data privacy and algorithmic transparency.

Overall, the findings of this study indicate that AI has become an essential element in the transformation of marketing from traditional, linear, and campaign-based communication toward continuous, adaptive, and automated interaction between consumers and brands. Consequently, the role of marketers is being redefined: instead of intuitive decision-making, the focus shifts to analytical, experimental, and data-driven management of consumer relationships, enabled by the combination of machine learning, automation, and generative intelligence.

Through a comprehensive literature review, this study offers a deeper understanding of AI applications in marketing, highlights its growing importance for business, and identifies the key patterns shaping AI use among enterprises. A key methodological limitation lies in the fact that the analysis is based primarily on secondary sources, without direct empirical investigation in a specific business environment. Due to the limited availability of recent data for Serbia and neighboring countries, the study primarily relies on analyses reflecting global and European developments. The lack of local data constrains the ability to accurately assess the specific challenges and opportunities of AI implementation in regional marketing contexts. The identified gap underscores the need for future research that would include empirical data from Serbia and the surrounding region, with particular emphasis on industry-specific applications, market segments, and the practical implications of AI use. Such research would enable a deeper understanding of the degree of digital transformation in regional marketing and provide a foundation for developing strategies for responsible and sustainable AI integration in business processes.

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WORD OF MOUTH MARKETING (WOMM) AS A DETERMINANT OF CONSUMER DECISION MAKING IN TOURISM

ABSTRACT

The main purpose of this paper is to examine the influence of word-of-mouth marketing (WOMM) on consumer decision-making in the tourism sector. The study seeks to contribute new insights to the existing body of knowledge by emphasizing the role of WOMM in attracting and retaining potential customers. In the context of digital communication, WOMM has become a crucial factor in shaping tourist choices, as consumer experiences—shared both orally and through online reviews—have a global reach and significantly affect perceptions of destinations and tourism services. This paper investigates the extent to which positive tourist experiences, conveyed through WOMM, impact consumer decision-making, loyalty, and the long-term success of the tourism industry.

The empirical research is based on an online survey conducted on a random sample of respondents, aiming to highlight the importance of WOMM in shaping consumer perceptions and purchasing decisions. While acknowledging limitations related to sample size and representativeness, the findings offer valuable implications for tourism companies. Specifically, the results may assist businesses in improving communication strategies and leveraging consumer feedback to enhance their services, thereby underlining the practical applicability and relevance of the study.

Keywords: *WOMM, consumer behavior, decision-making, tourism.*
JEL: M30, M37

1. INTRODUCTION

Nowdays, in the age of digital communications and artificial intelligence, the influence of "Word of Mouth Marketing" is becoming a key factor in shaping consumer behavior in tourism and making the final purchase decision. This paper aim to research how WOMM reflects on consumers in the tourism sector, analyzes various aspects of WOMM, and how consumers react to the recommendations and information they receive, and how credible they consider them as well. One of the key problems in this paper is to understanding the

impact of WOMM to the behavior of consumers in tourism. As consumers increasingly rely on recommendations from friends, family and colleagues through social networks and personal contacts, it is important to understand how much these recommendations shape their travel decisions. According to Ismagilova et al. (2020, p.2) the development of Internet technologies and popularity of e-commerce has prompted electronic word-of-mouth (eWOM) communications, such as online reviews, to become a key source of information about products and services.

2. THEORETICAL FRAMEWORK

In the process of making a purchase decision, the consumer goes through several key stages: from recognizing the need, through searching and processing the obtained information, evaluating alternatives according to their own criteria, to making the final decision. In the phase of searching for information, the consumer first reaches for already existing information that is in his memory, and only after that he searches in external sources. WOMM was defined as the transfer of information from one customer (or a group of customers) to another customer (or a group of customers) in a way that has the potential to change their preferences, actual purchase behavior, or the way they further interact with others (Libai et al., 2010, p269).

Kotler et al. (2010, p.218) emphasize that when it comes to products related to hotel, catering and travel, personal and public sources of information are more important than advertising. These authors classify all sources of information into several categories:

- Personal sources: family, friends, neighbors, acquaintances
- Commercial sources: advertising, sellers, distributors, packaging, billboards
- Public sources: restaurant reviews, editor's word in the travel section, consumer association

Promotion through WOMM has a great influence on the decisions of consumers in tourism, and is primarily based on the trust and personal experience of other consumers, which is often significantly more effective than any form of traditional promotion. Consumers trust other consumers who have already tried the product/service more than the providers themselves. People/consumers have more trust in the recommendations of their friends, family, but also complete strangers who pass on their experience through reviews. Effective WOMM promotion significantly lowers promotion costs, and very often consumers themselves play the role of promoters of a certain destination or tourist facility. According to Grbac et al. (2008), through word of mouth communication, the consumer promotes the product, for example, to his friends and other persons with whom he is in contact, which directly affects the market entity's need for smaller investments in other forms of promotion, because actually a satisfied consumer promotes the product instead of the market of the subject.

According to Kotler et al. (2017, p.25-26) the truth is that today's customers have become highly dependent on the opinions of others. In many cases, others' words have even outweighed both personal preference and marketing communications. The reason for this is none other than the connectivity itself. Because it is very convenient to receive advice from others, the importance of word of mouth is growing in the final purchase decision

2.1. The Concept and Forms of WOMM

Numerous authors define the term WOMM in different ways. Hubijar (2011, p.49) defines word-of-mouth marketing as a range of activities whose origin is consumer satisfaction and their natural desire to share their experiences with friends, colleagues, acquaintances, which implies encouraging, facilitating and strengthening word-of-mouth communication. What can be done by using word-of-mouth marketing is for the company to achieve the highest possible level of perceived commercial independence among consumers while respecting ethical norms and standards. A customer who is loyal to a company is the type of customer who is most likely to want to become a customer promoter – even if they are not directly asked to do so (Kotler and Kotler, 2015, p39). To ensure repeat purchases, an organization needs to get close and stay close to its consumers by adjusting its offering and constantly providing new value, thus generating satisfaction (Grbac, 2014, p.47).

Oral, person-to-person communication between a receiver and a communicator, whom the receiver perceives as non-commercial, concerning a brand, product, service, or organization (Ismagilova et al, 2017, p.7). any positive or negative statement made by potential, actual, or former customers about a product or company, which is made available to a multitude of people and institutions via the Internet (Hennig-Thurau, et al.,2004., p.39) . Prema Ismagilova et.al. (2017, p.18) Electronic word of mouth (eWOM) is defined as the dynamic and ongoing information exchange process between potential, actual, or former consumers regarding a product, service, brand, or company, which is available to a multitude of individuals and institutions via the Internet. . Even though eWOM may be less personal, mostly anonymous and happens between people with weak ties in comparison with traditional WOM, it is seen as a more powerful tool because it is credible, publicly available and has significant reach (Hennig-Thurau, et al.,2004., p.). WOM advertising is a very powerful means of spreading good or bad information about a company. If one person tells another that he is satisfied with the product of a manufacturer, then advertising through the media will give better results because consumers have already heard positive things about the product and the company (Renko, 2010, p.195).

Word-of-mouth marketing is a specific form of promotion that is based on the personal experiences of individuals, who, by conveying their personal positive or negative experience, influence the decisions of potential consumers, and unlike other forms of promotion, the creators and spreaders of messages in this case are not the providers but the consumers themselves who now play the role of promoters. Providers can use various strategies to try to motivate their consumers to write reviews and share their experiences on the basis of which future consumers will make their decisions. The specificity of this form of promotion lies in the minimal influence of the provider himself on the content shared by consumers. Some authors call the WOMM concept Advocacy.

Kotler, Karatajaya, and Setiawan (2017, p.26-27) analyse the Paradox Negative Advocacy versus Positive Advocacy: Connectivity allows customers to express opinions that others may listen to. It changes the mindset of customers to admit that advice from strangers might be more credible than a recommendation from celebrity brand endorsers. Thus, connectivity creates a perfect environment for customer advocacy of brands. Advocacy itself is not a new concept in marketing. Also known as “word of mouth,” it has become the new definition of

"loyalty" during the past decade. Customers who are considered loyal to a brand have the willingness to endorse and recommend the brand to their friends and family. Like brand awareness, brand advocacy can be spontaneous or it can prompted.

eWOM communication can take place in many ways - e.g., Web-based opinion platforms, discussion forums, boycott Web sites, news groups (Hennig-Thurau, 2004, p.39). The classic classification of the form of WOMM is the one that is related to the way of transmitting the message from consumer to consumer, so in that context we can talk about traditional WOMM, which implies the transmission of messages "from mouth to mouth" in direct communication between consumers, while modern WOMM implies the transmission of messages between consumers through digital means, such as reviews, blogs, chats, articles, etc. Ismagilova E, et al. in their book, they summarize several of the most relevant definitions of the term WOMM as well as the key limitations of each of the selected definitions (Figure 1)

Author	Definition	Limitations	Examples
Arndt (1967a, p 3)	Oral, person-to-person communication between a receiver and a communicator whom the receiver perceives as non-commercial, concerning a brand, a product or a service.	Does not consider the communications about organizations.	Breazeale (2009), Buttle (1998), Chatterjee (2001), Gelb and Johnson (1995), Lam and Mizerski (2005), Mauri and Minazzi (2013), Sweeney et al. 2005
Webster (1970, p 186)	Interpersonal communication between a perceived non-commercial communicator and a receiver concerning a product or a service.	Does not mention communications about brand.	Nyilasy (2005)
Holmes and Lett (1977, p 35)	Product related information transmitted by satisfied customers.	Only considers positive WOM; does not consider communications from dissatisfied customers.	Nyilasy (2005), van Scheers and Prinsloo (2014)
Richins (1984, p 697)	Interpersonal communication among consumers concerning a marketing organization or product which denigrates the object of communication.	Does not consider the fact that WOM communications are perceived as non-commercial by consumers.	Audrain-Pontevia and Kimmel (2008), Coombs and Holladay (2007), Laczniak et al. (1996), Mohammad and Turney (2013)
Westbrook (1987, p 261)	Informal communications directed at other consumers about ownership, usage, or characteristics of particular goods and services and/or their sellers.	Does not define whether or not the source of the communications is considered as independent of commercial influence.	De Matos and Rossi (2008), Gremler et al. (2001), Van Rijnsoever et al. (2012), Zwass (2010)
Singh (1990, p 3)	Complaining to friends and relatives.	Sole focus on definition of negative WOM communications.	Bach and Kim (2012), Nyilasy (2005), Von der Heyde and dos Santos (2007)
Bone (1992, p 579)	An exchange of comments, thoughts, and ideas among two or more individuals in which none of the individuals represent a marketing source.	Does not specify content of communication between customers.	Carl (2006), Edwards et al. (2008), Goyette et al. (2010)
Litvin et al. (2008, p 459)	The communication between consumers about a product, service, or a company in which the sources are considered independent of commercial influence.	Does not consider the communications about brand.	Lopez and Sicilia (2011), Sotiriadis and Van Zyl (2013)

Fig. 1. Summary of definitions of WOM

Source: Ismagilova et al., 2017, p. 8

One of the oldest forms of communication that can lead to customer acquisition is word of mouth (WOM) marketing. Technological innovations have given marketers many new tools to harness electronic WOM for customer acquisition in the form of ereferrals. Overall referrals take many forms in both offline and online environments. Offline referrals can be described as one consumer's promotion of a product or service in offline environments such as in person or by telephone. Ereferrals are those referrals that occur online (Ahrens, J , 2013, p.1035). Not restricted to any specific type of information, we conceptualize e-WOM as a special case of a more general communication behavior, in which individuals communicate through e-mails or instant messaging to accomplish certain communication goals. Although not widely studied this way, the forwarding of electronic content can be viewed as part of a

conversation and as a possible forum for interpersonal communication (J.Y.C. Ho, M. Dempsey / Journal of Business Research 63 (2010) 1000–1006, p.1001) . When WOM becomes digital, the large-scale, anonymous, ephemeral nature of the Internet induces new ways of capturing, analyzing, interpreting, and managing the influence that one consumer may have on another (Litvin W.S, et al., 2008, p.458).

Kotler (2011, p.185) emphasizes the importance of WOMM and states that no ad or seller can convince you of the virtues of a product as convincingly as a friend, acquaintance, former customer or expert can. Mahmutovic (2021. p.74), researching the effects of digital technology on consumer behavior, emphasizes the advantage of WOOM from the company's point of view, among other things, reflected in the following: The online environment enables the collection of "unsolicited" feedback. Since consumers today themselves share comments and reviews of products on social networks and forums, companies can use appropriate online tools to collect this information and analyze consumer sentiment and thus gain insight into their real preferences and attitudes about imports, much better than when classic focus groups use that purpose.

Based on research and analysis of the available literature, they also discuss the key characteristics of WOMM (Ismagilova E, 2017, p.7):

- Valence - WOM communications can be negative or positive in their valence.
- Focus - Management's focus does not only include WOM between consumers.
- Timing - WOM communications can be used and spread by customers before or after a purchase is made
- Solicitation - Not all WOM communications are initiated by customers
- Degree of management intervention - WOM communications can be spontaneously generated. However, more and more companies make an effort to stimulate and manage WOM activity
- Credibility

Nowdays we are talking about the WOW concept.WOW is an expression that a customer utters when experiencing speechless delight. We also learn that three characteristics constitute a WOW. First, a WOW is surprising. When one has a certain expectation but gets much more, that is a WOW moment. A deviation to an expected outcome is what creates a WOW. Second, a WOW is personal and can be triggered only by the person experiencing it. Finally, a WOW is contagious. One who experiences a WOW moment will advocate and spread the good news to many others (Kotler, et al. 2017, p.167-168).

2.2. Managing WOMM

The WOMM management process includes several stages from planning these activities, i.e. planning that part of WOMM on which the company has influence, to implementing and controlling the process and managing negative reviews. Communication between consumers cannot be controlled, but the quality of the service provided and consumer satisfaction can certainly be influenced, which leads to positive stories and consumers – promoters

The limit reached here is the conclusion that word-of-mouth communication, if properly used, is an extremely effective marketing tool in almost all situations and areas of marketing, whether it is about products or services, end consumer markets or business markets, and on

that's what he usually stops at (Hubijar, p.99) . Tom Peters (1998, p.96) confirmed the possibility, but also the necessity, of managing word-of-mouth marketing, who says that "... you can be organized, designed, and systematic with word-of-mouth marketing as well as with other forms of advertising." and marketing." He further points out that "...you can never see the word-of-mouth marketing section in overall marketing plans." Silverman (2001, p.24) also argues that word of mouth can be generated and controlled to at least the same extent as advertising, sales promotion, public relations, coupons, samples, and other marketing tools and tactics. ." He emphasizes that it "...like most things in life, cannot be fully controlled. Word-of-mouth marketing management process activities (Hubijar, 2011, p.100-106):

- Research on word of mouth communication
- Planning word-of-mouth marketing activities
- Defining the communication problem
- Identification of the target audience
- Determining goals
- Budgeting
- Defining the strategy

The process of managing word-of-mouth marketing involves several key steps. First, word-of-mouth research involves analyzing consumer trends and tracking reviews to understand product perceptions. After that, activity planning includes developing strategies to encourage positive conversations among consumers. Defining communication problems focuses on identifying challenges related to a product or service. The identification of the target audience and the determination of the goals enable precise targeting of marketing efforts. Budgeting involves the allocation of financial resources for the necessary activities, while defining the strategy involves developing comprehensive plans to encourage word of mouth marketing. Through these activities, companies can build positive conversations among consumers and strengthen the product's reputation in the market.

Ismagilova, et al. (2020) made a comprehensive study on the impact of WOMM on consumer purchase intentions and behavior, which was based on as many as 19 work hypotheses. The results of their research showed that only 10 of the 19 elements for which they investigated the impact had a satisfactory effect. According to the research results (Ismagilova, et.al., 2020, p.1216) promising predictors with significant meta-analysis results and strong correlations (e.g. eWOM credibility, emotional trust, attitude towards website, and attitude towards online shopping) are more likely to qualify as best predictors and should be included in future eWOM research. Successful management of WOMM communication void to increase sales and business success. The latest statistics from April 2024 show the following data that indicate the importance of WOMM as a form of promotion (Table 1).

Table 1. Key WOMM statistics

WOM is directly responsible for **90%** of all purchases
WOMM is **37%** better for retaining customers
78% of social media users talk about brands they follow
A trusted review makes **92%** of B2B buyers more likely to purchase
32% of people come across new podcats from WOM recommendations and **29%** specifically from friends recommendations
73% of consumers prioritize reviews from the past month
70% of consumers belive the opinions of other consumers
WOM is even more effective than paid ads, resulting in **five times (5X) more sales**
23% of consumers consider buying their Christmas gifts because of WOM recommendations

Source: adjusted according to:https://persuasion-nation.com/word-of-mouth-marketing-statistics/(access 02.07.2025.)

3. RESULTS OF THE RESEARCH

For the purposes of the conducted research, an online survey was chosen as the primary method of data collection. A structured survey questionnaire composed of 11 questions covering various aspects of WOOM's impact on consumer decisions in tourism was used. The questions were structured to include demographic information, travel habits, the influence of recommendations on destination selection, the use of social networks in travel research, and the importance of information credibility. The research was conducted in the period from April 19 to May 9, 2024.

3.1. Methodology and sample

The survey was conducted through a questionnaire on a sample of 155 respondents (n=155). The survey questionnaire was distributed via e-mail addresses or via social networks, while the survey was created with the help of Google docs. A structured survey questionnaire was used for the research, and a Likert scale was used for the open-ended questions. The data collected by the survey was processed with the help of Google docs, visualization and analysis of the answers was made.

3.2. Discussion of the results

The survey included demographic characteristics of respondents such as gender, age and frequency of travel. Also, it was investigated how often consumers use the recommendations of other travelers when choosing destinations and how often they share their positive experiences with others. It is important to investigate which channels consumers most often use to collect information about tourist destinations, as well as how important the credibility of that information is to them, especially on social networks. In addition, it was analyzed how often consumers share their experiences via word of mouth or social networks and how important the reputation of tourist destinations on social networks is to them when making travel decisions. Through a detailed analysis of the collected data, a better understanding of the dynamics of WOOM's influence on consumer behavior in tourism is expected, which will enable the creation of targeted marketing strategies and provide guidelines for the improvement of tourist services.

The first part of the survey questionnaire refers to the structure of the sample. Different aspects of the tourist experience may vary depending on the gender of the respondents, such as preferences in choosing destinations, activities during the trip or the way in which they are informed about tourist destinations. Understanding the age structure of respondents is key to adapting tourism offers and marketing strategies to better respond to the needs of different generations of travelers. The structure of the sample included in this research is shown in the following table:

Table 2. Sample structure

Characteristics	N	%	Cumulative
Gender			
female	103	66, 5	66, 5
male	52	33, 5	100
Age			
18- 21	5	3, 2	3, 2
22- 26	30	19, 4	22, 6
26- 30	21	13, 5	36, 1
30+	99	63, 9	100

Source: author

Analyzing the results, we observe that the majority of respondents were female, with a share of 66.5%, while the share of male respondents was 33.5%. The results show that most of the respondents (63.9%) belong to the age group over 30 years old. A smaller percentage of respondents are younger age groups: from 18 to 21 years old (3.2%), from 22 to 26 years old (19.4%), and from 26 to 30 years old (13.5%). Different age groups may have different preferences and interests when it comes to tourist travel. Younger respondents may prefer adventure travel or destinations that offer a rich nightlife, while older respondents may prefer quieter travel or family-friendly destinations. These results enable the adjustment of marketing strategies and tourist offers in order to better meet the needs and preferences of each age group.

The next question analyzes the frequency of travel among respondents and provides insight into their habits in tourist activities. Analysis of the results shows variations in travel frequency among respondents. The majority of respondents (54.8%) travel occasionally, which indicates that for them, tourist trips are an activity that occurs with medium frequency. A significant number of respondents (25.8%) travel regularly, which may suggest that they are travel enthusiasts or that travel is often a part of their everyday life. A smaller percentage of respondents (16.1%) travel rarely, which may be a consequence of limited time or financial resources or a preference for other activities over travel. Only a small number of respondents (3.2%) stated that they travel almost never, which may indicate a lower tendency to travel or specific circumstances that prevent them from traveling often.

The next question "Have you ever decided on a tourist destination based on the recommendation of someone who has already traveled there?" explores how relevant the influence of "word of mouth" communication is when choosing a tourist destination. The

results indicate a significant influence of this type of promotion on the final choice and decision on choosing a destination, as many as 84.5% of respondents answered affirmatively to this question. This implies that the positive experiences of others have a significant influence on the formation of the perception of the destination by potential travelers.

The question "Have you ever shared positive recommendations about tourist destinations via social networks?" investigates how often respondents share positive recommendations about tourist destinations on social networks. Based on the results of the research in this part, it is possible to identify how wide is the range of users who actively share their experiences with others via social networks. 53.5% of respondents gave an affirmative answer to this question. The results indicate that there is a significant number of users who are actively involved in sharing their positive travel experiences on social networks.

Table 3. Research on the influence of recommendations on the choice of tourist destinations and giving feedback after the trip

question	yes		no	
	N	%	N	%
Have you ever choose a tourist destination based on the recommendation of someone who has already traveled there?	131	84, 5	24	15, 5
Have you ever shared positive recommendations about travel destinations via social media?	83	53, 5	72	46, 5

Source: author

The next question analyze how often respondents share their positive impressions of tourist destinations with others? The results of this research provide insight into the level of engagement and activity of travelers in promoting certain destinations through word of mouth or social networks. The results show that there is diversity in the frequency of sharing positive recommendations among respondents. While a smaller number of respondents (3.2%) never share positive recommendations, a larger number of respondents rarely (8.4%) or sometimes (33.5%) share such recommendations. However, a larger number of respondents often (41.9%) or very often (12.9%) share positive recommendations about tourist destinations. The results indicate the importance of word-of-mouth transmission of information and positive experience among passengers. Those who often or very often share positive recommendations can have a significant influence on other travelers and their destination decisions.

The next question of the survey questionnaire was: Which channels do you most often use to research information about tourist destinations? Understanding the preferred channels for researching information about tourist destinations is key to tailoring marketing strategies to reach target audiences in the most effective way. The results of the research provide an insight into the channels that respondents most often use to gather information about tourist destinations. Analyzing, we notice that respondents use different channels to collect information about tourist destinations. According to the data, the most used channel for research is search engines such as Google, which were chosen by 32.9% of respondents. This indicates the importance of online searching and searching for relevant information

through the Internet. Social networks, such as Facebook and Instagram, are also a popular channel for research, with 27.1% of respondents using them. These statistics confirm the importance of the presence of tourist destinations on social networks and the role of content on these platforms in attracting potential visitors. Forums and reviews, such as those on TripAdvisor, are also a significant source of information for 20% of respondents. Recommendations from friends and family also play a significant role in researching tourist destinations, as confirmed by 20% of respondents. This highlights the power of word of mouth and trust in personal recommendations.

The question "How important is the credibility of information about tourist destinations that you get via social networks?" investigates how much respondents value the credibility of information about tourist destinations that comes via social networks. Analyzing the results, we can see how much influence these communication channels have on the perception of potential travelers. The results will show how much respondents trust the information that comes through social networks and how important it is for them to have that information reliable.

The question "How important is the reputation of tourist destinations on social media to you when making a travel decision?" explores how important the reputation of tourist destinations on social media is when making a travel decision. The results provide insight into the participants' views on the importance of destination reputation on social networks in the process of making travel decisions.

Table 4. The importance of the credibility of WOM information and the reputation of the destination

	very important		important		neutral		less important		irrelevant	
	N	%	N	%	N	%	N	%	N	%
How important is the credibility of information about tourist destinations that you get via social networks?	70	42, 2	50	32, 3	16	10, 3	18	11, 6	1	0, 6
How important is the reputation of tourist destinations on social networks when making travel decisions?	34	21, 9	81	52, 3	27	17, 4	10	6, 5	3	1, 9

Source: author

The results show that the majority of respondents, as much as 77.5%, consider the credibility of information about tourist destinations on social networks to be important or very important. More precisely, 45.2% of respondents stated that the credibility of information is very important to them, while 32.3% said that it is important to them. The results highlight the importance of authenticity and reliability of information shared on social networks when it comes to travel and tourist destinations. With so many people relying on social media as a source of travel information, it's crucial to ensure that information is accurate and relevant.

The results show that for the majority of respondents (52.3%), the reputation of tourist destinations on social networks plays an important role in the process of making travel decisions. Also, 21.9% of respondents point out that reputation is very important, while 17.4% are neutral about this issue. A smaller percentage of respondents (6.5%) believe that reputation is not that important in making their travel decisions, while only 1.9% expressed the view that reputation is not important. According to these results, recommendations for tourist destinations on social networks can have a significant impact on travel decision-making. Destinations should invest in managing their social media presence to maintain or improve their reputation. Also, quality information and reviews on social networks can further stimulate the interest of potential travelers.

4. CONCLUSION

Based on research results on travelers' habits and preferences regarding sharing travel experiences through word of mouth or social networks, we can identify key links to the concept of WOOM. WOOM, as a form of marketing strategy, is based on recommendations and sharing experiences among consumers. The majority of respondents (45.2%) stated that they often share their tourist experiences, while 37.4% do so sometimes. This indicates the widespread use of word-of-mouth information about travel experiences, which is a key element of WOOM. When travelers regularly share their positive experiences, it can generate positive promotion of destinations among their social network, family and friends.

The respondents (84.5%) accept the recommendations of other travelers as an important factor when choosing a tourist destination. The high rate of acceptance of recommendations confirms the power of word of mouth in the tourism sector. When travelers share their experiences and recommendations with others, it can significantly influence the perception of destinations and encourage others to explore the same or similar destinations.

Analysis of the dependence between personal experiences with tourist destinations and the likelihood of sharing positive recommendations shows that the majority of participants (91%) report that their previous experiences influenced the likelihood of sharing positive recommendations. The link between personal experience and willingness to share recommendations further confirms the key role of positive travel experiences in WOOM.

The main limitation of this study is the sample size. It is necessary to conduct a study on a larger sample to get more generalizable results. Overall, the research results clearly show the importance of WOOM in the tourism industry. When travelers share their experiences, recommendations and information about destinations through word of mouth or social networks, it can significantly influence destination perceptions and consumer travel decisions.

Tourism destinations and marketers should actively manage WOOM to maximize its potential to promote destinations and attract new visitors.With the growing importance of digitization in the world of marketing, it is certainly to be expected that WOMM will become one of the strongest elements of the promotional mix, especially when we talk about the tourism sector where communication between consumers, direct or digital, has become a crucial element for consumers when deciding on choosing a tourist destination or general tourist services

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DIGITAL ECONOMY

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THE INFLUENCE OF DIGITAL INFRASTRUCTURE ON THE CONNECTIVITY IN BOSNIA AND HERZEGOVINA

ABSTRACT

This study explores the influence of digital infrastructure on household connectivity from the perspective of citizens in Bosnia and Herzegovina, responding to a notable gap in empirical research on digital inclusion at the national level. As digital technologies increasingly shape access to services and opportunities, understanding how citizens perceive public and private investment in ICT infrastructure becomes critical.

Based on a representative sample of 1,547 citizens (n = 171), the study examines how perceptions of government and telecom operator investments, alongside the perceived accessibility of digital infrastructure, impact the extent of fixed and mobile internet usage within households.

The findings reveal that citizens' confidence in institutional and corporate commitment to digital infrastructure development significantly correlates with higher levels of household connectivity. This underscores the importance of not only expanding access but also improving public trust in the digital ecosystem. The study highlights disparities in perceived infrastructure availability, indicating that equitable digital access remains a persistent challenge. These insights offer actionable recommendations for policymakers and telecom providers aiming to foster inclusive digital development, particularly in underserved regions of Bosnia and Herzegovina.

Keywords: *digital infrastructure, internet connectivity.*
JEL: L96, L86

1. INTRODUCTION

Digital infrastructure forms the foundational backbone through which digital connectivity is enabled, expanded, and sustained at individual, regional, and national levels. It encompasses the physical and organizational structures needed for the operation of information and communication technologies (ICT), including broadband networks, data centers, mobile networks, and related hardware and software systems. In the context of Bosnia and Herzegovina, digital infrastructure plays a critical role in shaping the patterns and quality of connectivity among citizens, businesses, and public institutions. While global digital transformation is accelerating, the disparities in digital infrastructure within Bosnia and

Herzegovina highlight a crucial gap in ensuring equitable access to digital services, which, in turn, affects the ability of society to fully engage with and benefit from the digital economy.

Connectivity, understood as the ability to access and effectively use digital networks and services, is influenced not only by the presence of digital infrastructure but also by socio-economic, geographic, and institutional factors. Robust digital infrastructure can act as an enabler of connectivity by reducing barriers to Internet access and improving the quality of service, thereby fostering digital inclusion. Conversely, inadequate or unevenly distributed infrastructure perpetuates digital divides, restricting access to vital digital resources for large segments of the population, especially in rural and underserved areas of Bosnia and Herzegovina. Moreover, connectivity goes beyond mere access — it encompasses the capacity of users to engage meaningfully with digital platforms, which depends on factors such as affordability, digital skills, and relevant content.

The development and maintenance of digital infrastructure in Bosnia and Herzegovina are strongly influenced by policy frameworks, regulatory environments, and investment priorities set by governmental institutions and private sector actors. These institutional arrangements either stimulate or hinder the deployment of modern ICT infrastructure, affecting overall connectivity levels. For instance, regulatory bottlenecks or lack of coordination between different governing bodies can delay infrastructure projects or limit competition among service providers, impacting the affordability and quality of connectivity. Therefore, understanding the interplay between infrastructure development and institutional factors is crucial to devising effective strategies that enhance digital connectivity nationwide.

From a broader perspective, digital infrastructure is a key determinant of the digital economy's growth and sustainability. High-quality connectivity enabled by well-developed infrastructure allows businesses to operate more efficiently, innovate, and access new markets, thus fostering economic growth and social development. For citizens, improved connectivity facilitates access to education, healthcare, government services, and social participation, which are increasingly digital. However, the unequal distribution of digital infrastructure in Bosnia and Herzegovina raises concerns about social exclusion and economic disparity, underscoring the need for policies that prioritize inclusive infrastructure development.

The presented research examines the influence of digital infrastructure on connectivity patterns within Bosnia and Herzegovina, aiming to identify critical challenges and opportunities affecting citizens' digital engagement. The reserch starts with a literature review situating digital infrastructure and connectivity within global and regional frameworks, followed by a methodology section outlining the empirical approach for analyzing infrastructure availability and connectivity metrics. The results section presents findings on the current state and trends of digital infrastructure in Bosnia and Herzegovina and their impact on connectivity disparities. Finally, the study concludes with recommendations for fostering an inclusive and resilient digital infrastructure ecosystem that supports sustainable connectivity and digital economy growth.

2. LITERATURE REVIEW

Digital infrastructure represents the foundational technological framework that underpins modern connectivity systems, serving as the cornerstone for economic growth, social inclusion, and technological innovation. The relationship between digital infrastructure and connectivity has emerged as a critical area of research, particularly as nations worldwide recognize the transformative potential of robust digital ecosystems in driving economic development and societal advancement. The conceptual foundation for understanding digital infrastructure was established by KPMG (2020), which defined digital infrastructure as "an ecosystem of interconnected devices that exchange information with each other, including access to network connections, ICT devices, software and applications." This comprehensive definition highlighted the interconnected nature of digital systems and established the framework for subsequent research examining the relationship between infrastructure development and connectivity outcomes.

Some authors (Cavallo et al., 2022) investigated the resilience aspects of digital infrastructure during global disruptions, particularly focusing on the COVID-19 pandemic's impact on connectivity requirements. Research findings underscored how investments in digital infrastructure enhance business resilience and enable organizations to maintain connectivity during unprecedented challenges, thereby demonstrating the strategic importance of infrastructure development for sustained economic activity. A large number of authors emphasize the need for countries to invest in infrastructure, talent development and digital technology to improve their competitiveness in the global digital economy, highlighting the transformative potential of robust digital infrastructure in driving economic growth and innovation (Di et al., 2022).

The OECD (2022) contributed to the discourse by emphasizing coordinated approaches to infrastructure development, highlighting that countries effectively aligning infrastructure investment with digital skills development and policy reform tend to exhibit stronger digital economies and more inclusive growth patterns. This research established the importance of holistic infrastructure planning in achieving optimal connectivity outcomes. Research in 2023 focused significantly on the transition to next-generation connectivity technologies. The ITU (2023) conducted comprehensive analysis on mobile broadband penetration as a critical driver of connectivity, particularly in regions with limited fixed infrastructure. The research demonstrated that while 4G networks transformed access in developing regions, the transition to 5G and fiber broadband remains essential for meeting the demands of data-intensive applications and future digital services.

The Cisco Annual Internet Report (2023) provided empirical evidence supporting the relationship between strategic fiber optic expansion and digital adoption rates. Their analysis showed that countries investing systematically in next-generation networks experience accelerated digital adoption and more effective closure of digital divides, reinforcing the causal relationship between infrastructure quality and connectivity accessibility. Different research concluded that connectivity improvements facilitated by advanced digital infrastructure are crucial for supporting economic growth, competitiveness, and bridging regional and enterprise-level disparities (Osei, 2024).

The World Economic Forum (2023) synthesized international research to emphasize coordinated approaches combining infrastructure investment, digital skills development, and policy reform. Their comprehensive analysis demonstrated that countries successfully aligning these components exhibit stronger digital economies and more inclusive growth patterns, reinforcing the systemic nature of infrastructure-connectivity relationships.

The World Bank (2024) established digital infrastructure as "the first pillar of the digital economy," emphasizing that affordable and fast internet availability is essential for inclusive digital participation. Their definition encompasses highly developed connectivity networks, including broadband internet, internet exchange points, and IoT-enabling devices, reinforcing the fundamental role of infrastructure in enabling connectivity. Other authors concluded that the rapid development of multiple technologies, including big data, the Internet of Things, and cloud computing, is driving the modern economy into a phase of digital evolution (Piepponen et al., 2022).

The OECD Digital Economy Report (2024) provided the most comprehensive recent analysis of broadband infrastructure's critical role in enabling digital connectivity and economic growth. This report emphasized that investments in broadband infrastructure are essential for providing fast internet access across urban and rural areas, enabling comprehensive digital service deployment. The OECD (2024) report also highlighted significant disparities in broadband access between urban and rural areas, suggesting that addressing these disparities is vital for ensuring equitable access to digital opportunities. Furthermore, the research identified 5G network deployment as transformative for mobile network infrastructure, promising higher internet speeds, reduced latency, and enhanced device connectivity capabilities essential for IoT growth.

As demonstrated throughout this review, the nexus between digital infrastructure and connectivity represents a fundamental determinant of national competitiveness, social equity, and technological sovereignty in an increasingly interconnected world. The empirical evidence consistently underscores that nations failing to adequately invest in robust digital infrastructure risk systemic exclusion from the global digital economy, perpetuating socioeconomic disparities and limiting their capacity for sustainable development. Conversely, countries that strategically prioritize infrastructure-connectivity optimization position themselves to harness the transformative potential of emerging technologies, foster innovation ecosystems, and achieve inclusive economic growth. This literature review thus affirms that understanding and optimizing the digital infrastructure-connectivity relationship is not merely an academic exercise, but an urgent societal imperative that demands continued scholarly attention, empirical investigation, and interdisciplinary collaboration to inform evidence-based policy frameworks and strategic investment decisions that will shape the digital future of nations and communities worldwide.

3. RESEARCH METHODOLOGY

As part of the primary research (field research), data were collected using the survey method, using a survey questionnaire as a technical means of data collection. The collection of primary data for this research is part of a wider research Primary data was collected using the snowball method, which was partly done electronically using Google Forms a platform for online surveys, and partly by personally surveying respondents. In principle, the main

advantage of the snowball or multiple sample is the economic efficiency of the procedure, given that it is formed in such a way that the researcher, on a case-by-case basis, identifies the initial persons who have the studied trait, and then asks them to identify other respondents who also have the same. In other words, based on the information obtained from the initial respondents, the subsequent ones are identified, and so on, hence the metaphorical name of the "snowball" sample.

In the process of data collection, the answers of 1547 respondents were collected, based on which empirical research will be carried out for the needs of this part of the work. The survey questionnaire that was used in the research was designed in several parts, so, in addition to the categorical socio-demographic characteristics of the respondents in terms of territorial distribution, gender, and the number of household members, they are through segmented parts of the same, collected data on the perception of of public sector investment, telecom operators' investmentand perceived accessibility of ICT infrastructure.

The survey questionnaire, except for the question about territorial affiliation, is structured in the form of closed-ended questions, whereby the respondents had the opportunity to evaluate their degree of agreement with certain statements through the offered answer form in the form of a five-point Likert response scale.

The methods that will be used in the presented scientific research work to investigate and present the results of scientific research are inductive and deductive, methods of analysis and synthesis, comparative methods, and statistical methods. During the research, the analysis of relevant scientific research and studies in the form of books, textbooks, magazines, official publications, websites, as well as other relevant literature will be carried out. The inductive method will be applied in the reverse direction - to derive general propositions from individual facts. The deductive method will be used to derive appropriate concrete assumptions and conclusions from general statements. These two methods will be used to explain established and discover new knowledge and new laws, as well as to prove established theses and test hypotheses and predict future events.

The method of analysis will enable the explanation of the problem and the subject of research by breaking it down into simpler parts and researching each part separately concerning other parts, which will enable the observation, discovery, and study of the scientific truth about mutual relationships. The synthesis method will be used to combine the obtained research results into a single unit in which these results are mutually related. The comparative method will be used to compare the same or related facts, phenomena, processes, and relationships, i.e. it will help to establish their similarities in behavior and intensity, as well as the differences between them. Following the usual research standards in the social sciences, the data obtained from the questionnaire will be processed using SPSS modern software package for statistical analysis. Bearing in mind that the research hypotheses were formulated in such a way as to test the influence (causality) of one variable on another, and not the connection (connection) between the defined variables, regression analysis was used in the paper. The method of description will be used to describe facts and their empirical confirmation but without scientific interpretation and explanation.

3.1. Research variables

The variables observed in the context of the empirical research are:

The independent variable relates to the digital infrastructure. An digital infrastructure refers to the foundational technological systems and components that enable digital communications, data processing, and online services. It encompasses both physical and virtual elements that support the digital economy and society.

The dependent variable is related to the connectivity as a determinant of digital economy. The connectivity is one of the main dimensions that evaluates the EU's fixed and mobile broadband infrastructure through indicators measuring availability, adoption, and affordability.

Indicators for measuring independent variables are the functions of the digital infrastructure, as follows:

- Perception of public sector investment: The extent to which citizens believe that local (municipal and cantonal) and state-level government institutions are investing in the development of ICT infrastructure to support business digitalization and the expansion of e-business.
- Perception of telecom operators' investment: Citizens' views on whether state-owned and private telecommunications operators are actively investing in the development of information and communication infrastructure with the goal of advancing digitalization and improving everyday life for the population.
- Perceived accessibility of ICT infrastructure: The degree to which citizens perceive information and communication infrastructure (e.g., high-speed internet, mobile network coverage) as being equally accessible to all members of society.

Indicators for measuring dependent variables are the functions of the Connectivity, as follows:

- Number of fixed internet connection users in the household
- Number of active mobile devices with internet access in the household,

The planned research will be based on the application of scientific methods of secondary and primary research.

4. RESULTS AND DISCUSSION

Inspecting the results of the research, 63% of respondents reside in the territory of the Federation of Bosnia and Herzegovina, 32.45% of them in the territory of Republika Srpska, and 4.55% in Brčko District of Bosnia and Herzegovina. This distribution reflects the demographic and economic weight of each entity and suggests a representative sample aligned with national population structures.

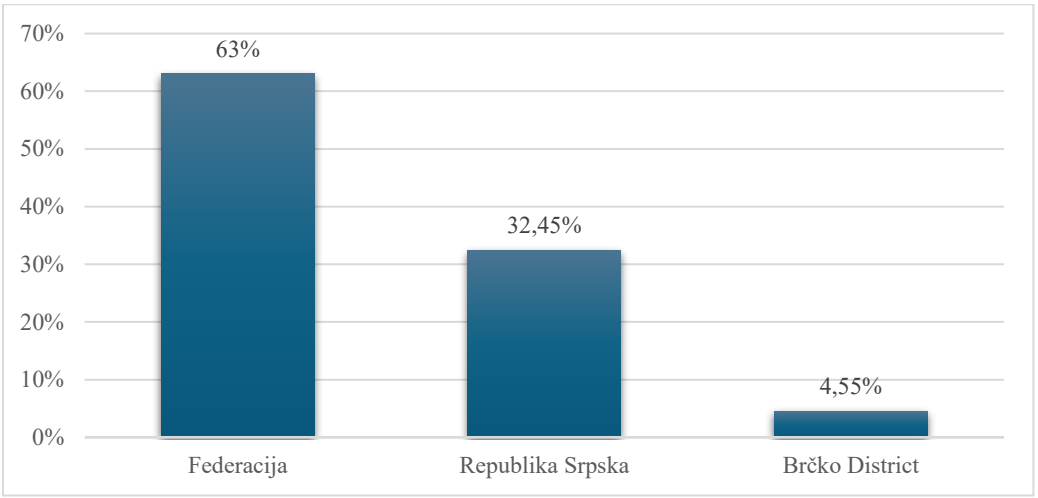


Fig.1. Respondent demographics based on entity
Source*: Authors' research*

If the location of the residence is considered according to whether it is an urban or rural environment, our research includes 78.98% of respondents who live in urban areas and 21.02% of respondents who live in rural areas.

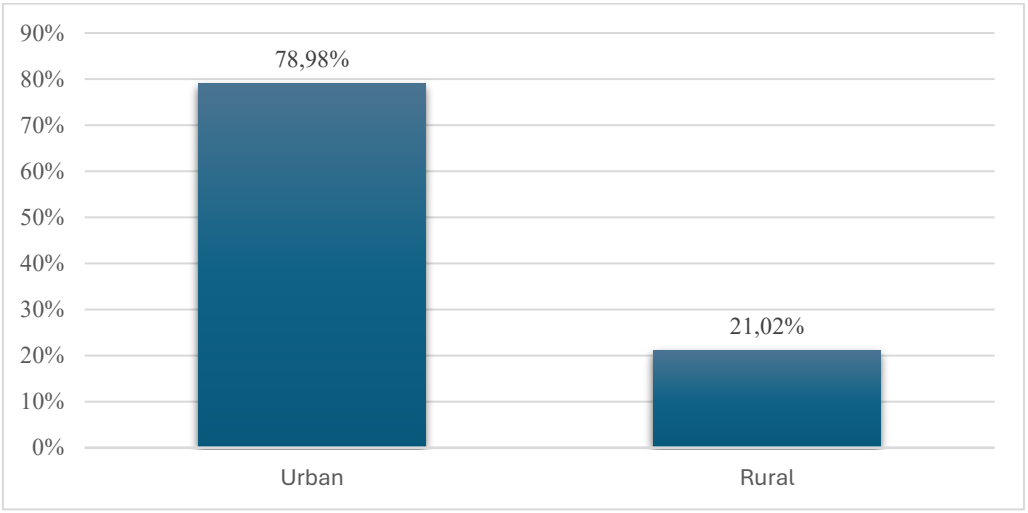


Fig. 2. Respondent demographics based on urban vs. Rural
Source*: Authors' research*

Gender representation among respondents is nearly balanced, with 51.09% identifying as male and 48.91% as female. This equitable distribution enhances the reliability of the findings by ensuring gender-inclusive perspectives on digital infrastructure and connectivity.

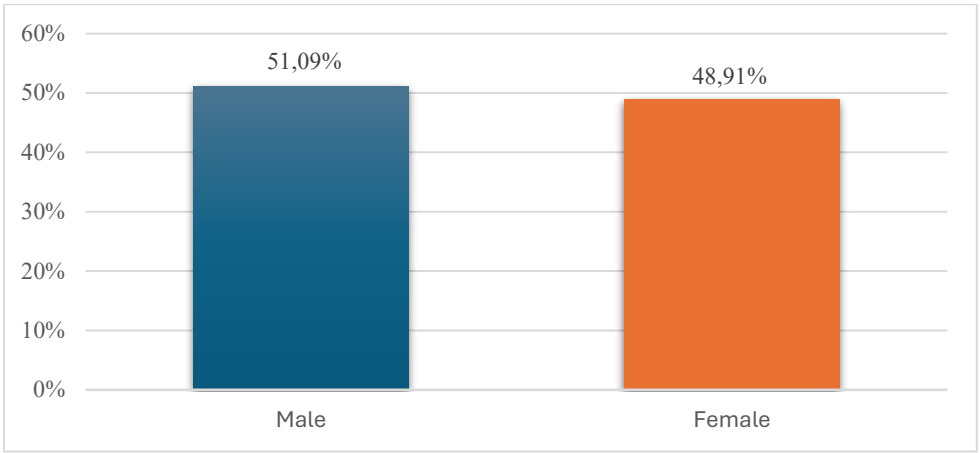


Fig. 3. Respondent demographics based on gender
Source: *Authors' research*

Results are presented with two dimensions of household digital access: fixed internet connections and mobile devices with internet access. The most common number of fixed connections per household is three (33.61%), followed by four (22.95%). For mobile devices, the highest frequency is also three (35.10%), followed by four (23.08%). These figures suggest a moderate to high level of digital penetration at the household level, with mobile connectivity slightly outpacing fixed-line access.

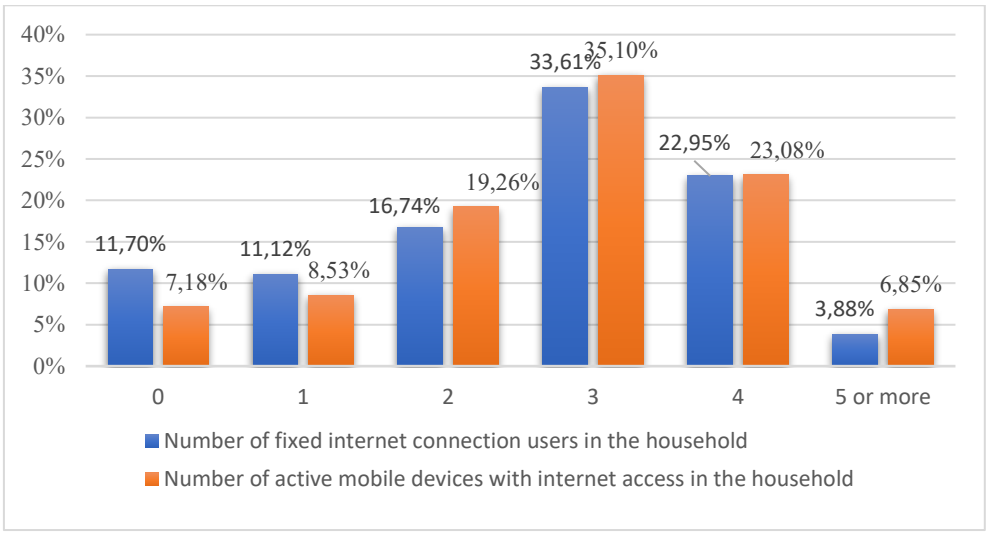


Fig. 4. Households connectivity in Bosnia and Herzegovina
Source: *Authors' research*

Respondents express skepticism regarding government investments in ICT infrastructure, with 39.24% strongly disagreeing and only 5.49% strongly agreeing. In contrast, perceptions of telecom operators are more favorable: 40.21% neither agree nor disagree, and 17.71% agree, indicating a more neutral or slightly positive view of private sector involvement. These results suggest a perceived gap in public sector commitment to digital development.

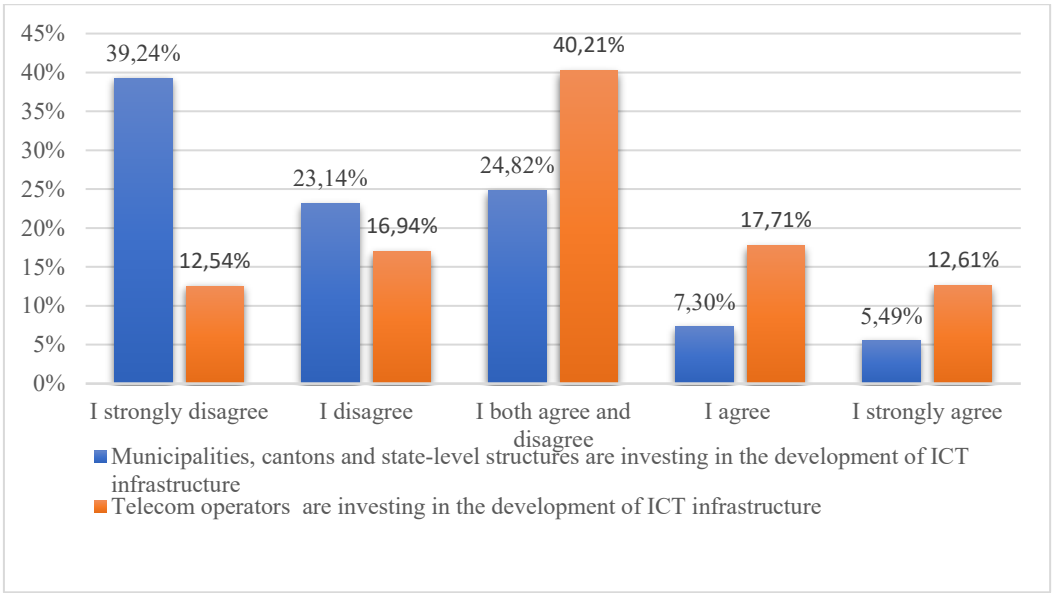


Fig. 5. Citizens perception on government and telecoms investments in ICT
Source*: Authors' research*

The majority of respondents (40.85%) neither agree nor disagree that ICT infrastructure is equally accessible to all citizens. Only 13.38% strongly agree, while 12.15% strongly disagree. This ambivalence points to perceived inequalities in digital access, potentially influenced by geographic, socioeconomic, or infrastructural disparities.

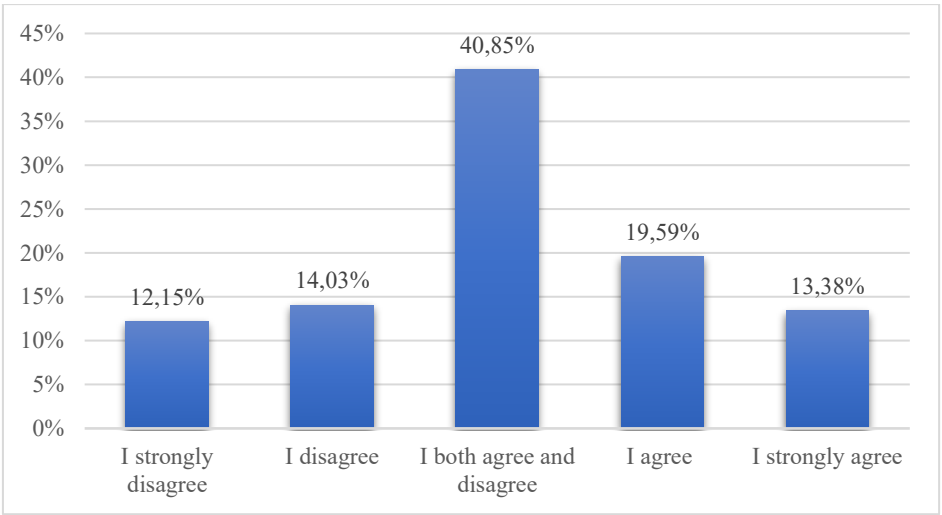


Fig. 6. Citizens perception on equally accessible of ICT infrastructure
Source*: Authors' research*

For the purposes of testing this working hypothesis, regression analysis was also used, and the most important part of the results is shown in Table 1, which represents an investigation of the impact of digital infrastructure on connectivity.

Table 1. Descriptive statistics on investment in information and communication infrastructure development

Statement	Average	Modus	Standard deviation
Municipalities, cantons and state-level structures are investing in the development of information and communication infrastructure with the aim of supporting digitalization and making citizens' lives easier.	2,17	1	1,183
Telecom operators (state and private) in our country are investing in the development of information and communication infrastructure with the aim of supporting digitalization and making citizens' lives easier.	3,01	3	1,162

Source: *Authors' research*

Respondents rate the equal accessibility of ICT infrastructure with an average score of 3.08 and a mode of 3, indicating a neutral stance. The standard deviation (1.163) reflects a wide range of opinions, reinforcing the notion of uneven access across different population segments, presented in Table 2.

Table 2. Descriptive statistics on ICT availability

Statement	Average	Modus	Standard deviation
The information and communication infrastructure (high-speed internet, mobile phone signal coverage, etc.) in our country is equally accessible to everyone.	3,08	3	1,163

Source: Authors' research

Table 3. Regression analysis: Impact of Digital Infrastructure on Connectivity

Summary of model[b]				ANOVA	Coefficients	
R	Coefficient of determination	Corrected coefficient of determination	Standard error of estimate	Sig.	Beta	Sig.
0,284[a]	0,081	0,080	2,374	0,000	0,284	0,000
a. Predictor: DIGITAL INFRASTRUCTURE						
b. Dependent variable: CONNECTION						

Source: Authors' research

The regression model (Table 3.) reveals a statistically significant relationship between digital infrastructure and connectivity (Sig. = 0.000). The coefficient of determination ($R^2 = 0.081$) and the standardized Beta coefficient ($\beta = 0.284$) confirms a moderate positive effect, suggesting that improvements in infrastructure are associated with enhanced digital connectivity.

In summary, the results of this research clearly demonstrate that digital infrastructure development in Bosnia and Herzegovina faces significant challenges that directly impact connectivity accessibility and quality across different regions and demographic groups. The findings confirm that inadequate broadband coverage, and insufficient mobile network infrastructure are viewed as key barriers rather than enablers of comprehensive digital inclusion. These connectivity disparities reflect broader challenges in infrastructure investment coordination, policy implementation effectiveness, and regulatory framework harmonization, indicating that significant institutional and technical adjustments are required to improve the availability, reliability, and affordability of digital connectivity services tailored to the diverse needs of citizens, businesses, and public institutions throughout Bosnia and Herzegovina.

5. CONCLUSION

The integration of digital technologies into the socio-economic structure of Bosnia and Herzegovina is increasingly recognized as a strategic imperative for national development, competitiveness, and social inclusion. This study underscores the multifaceted nature of digital transformation, revealing that while foundational elements of digital infrastructure are present, their distribution, accessibility, and perceived effectiveness remain uneven and contested.

A key insight emerging from the analysis is the centrality of infrastructure quality in shaping digital connectivity. High-speed internet, reliable mobile networks, and widespread device penetration are essential enablers of digital engagement, yet their impact is contingent upon broader systemic factors. The perception of infrastructure investment, particularly by public institutions, suggests a disconnect between policy intentions and public experience. This gap may reflect limitations in implementation, communication, or responsiveness to local needs, and points to the necessity of more transparent, inclusive, and accountable governance in the digital domain.

Equally important is the role of private sector actors, particularly telecom providers, whose contributions to infrastructure development are viewed with greater neutrality or moderate approval. This indicates a potential for public-private partnerships to play a more dynamic role in accelerating digital access, provided they are guided by clear regulatory frameworks and aligned with public interest objectives.

The issue of equitable access remains a persistent challenge. Geographic disparities, socio-economic divides, and infrastructural limitations contribute to a digital landscape where not all citizens benefit equally from technological advancements. Addressing these disparities requires a holistic approach that combines infrastructure investment with digital literacy programs, affordability measures, and targeted support for marginalized communities. Digital inclusion must be understood not merely as a technical goal but as a social commitment to ensure that no individual or region is left behind in the digital age.

Furthermore, the findings suggest that connectivity is not solely a function of infrastructure availability but also of user engagement, institutional trust, and perceived relevance. As such, fostering a digitally empowered society demands more than technological deployment—it requires cultivating a culture of innovation, participation, and adaptability.

Education systems, local governments, and civil society organizations all have critical roles to play in nurturing digital competencies and promoting meaningful use of technology.

In conclusion, Bosnia and Herzegovina stands at a pivotal juncture in its digital evolution. The foundations are in place, but the path forward requires strategic coordination, inclusive policymaking, and sustained investment in both infrastructure and human capital. By embracing a comprehensive vision of digital development such as equity, transparency, and resilience, the country can harness the transformative potential of technology to drive economic growth, enhance public services, and strengthen democratic engagement.

This research reveals digital infrastructure as the cornerstone of Bosnia and Herzegovina's digital transformation, directly impacting both economic development and quality of life. Success requires a comprehensive approach: resolving current limitations, ensuring active participation from all stakeholders, and implementing robust monitoring mechanisms.

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THE INFLUENCE OF THE INSTITUTIONAL FRAMEWORK ON PUBLIC DIGITAL SERVICES IN THE BUSINESS SECTOR IN BOSNIA AND HERZEGOVINA

ABSTRACT

The purpose of this research is to identify the influence of the institutional framework on public digital services in the business sector in Bosnia and Herzegovina. By analyzing the research findings, it can be confirmed that the determinants of the institutional framework have a significant impact on the development and accessibility of digital public services aimed at the business community. More specifically, the institutional framework makes a unique and important contribution to predicting the availability, efficiency, and quality of digital services essential for business operations in Bosnia and Herzegovina's digital economy. Based on the theoretical foundations, empirical analyses, and research results, it can be concluded that the institutional framework substantially affects the business sector and the extent to which it can benefit from public digital administration services. The research findings further confirmed a high level of dissatisfaction among businesses regarding institutional support for the digitalization of public services, as well as a generally negative perception of investment efforts by municipalities, cantonal authorities, and state-level institutions in the development of ICT infrastructure aimed at facilitating business operations. The study also highlighted the need to improve the legislative and regulatory framework to create conditions for faster development of digital services and their alignment with the needs of the business sector. The research sample consisted of 171 respondents (n = 171) from Bosnia and Herzegovina, selected using the snowball sampling method. The basic motive for the realization of this research is the fact that there is no relevant research in Bosnia and Herzegovina that focuses on the impact of the institutional framework on public digital services for the business sector.

Keywords: *institutions and growth, government policy, entrepreneurship.*
JEL: O43, O38, L26

1. INTRODUCTION

The rapid development of digital technologies has fundamentally transformed the ways in which governments interact with citizens, businesses, and various stakeholders. Across the world, public institutions have increasingly integrated digital tools and platforms into their administrative processes, aiming to improve service efficiency, transparency, and responsiveness. Within this context, public digital services have emerged as essential

components of modern governance, particularly in economies striving to enhance their competitiveness and operational effectiveness in a digital environment. The integration of public digital services is not only a technical or operational shift but also a reflection of deeper institutional, political, and regulatory dynamics that shape the speed, scope, and quality of digital transformation.

In the European Union, the expansion of e-Government services has accelerated in recent years, particularly during the COVID-19 pandemic, when digital interactions became essential for maintaining public administration functions. The EU's Digital Decade strategy has set an ambitious goal for all key public services to be accessible online by 2030, both for citizens and businesses. However, the progress of digital transformation has been uneven across the region, influenced by varying institutional capacities, political priorities, and investment levels. While some member states have achieved significant advancements in providing digital public services for businesses — simplifying procedures for licensing, tax reporting, public procurement, and regulatory compliance — others continue to face systemic challenges related to regulatory fragmentation, infrastructure limitations, and policy incoherence.

In Bosnia and Herzegovina, the situation is particularly complex. As a country with a highly decentralized governance structure and multiple layers of political authority, Bosnia and Herzegovina has encountered significant barriers in implementing comprehensive digital public services, especially those intended for the business sector. Although certain administrative units have made isolated progress, the absence of a unified national digital strategy, outdated legislative frameworks, and limited institutional coordination have hindered the development of interoperable and business-friendly e-Government solutions. These institutional constraints affect the efficiency and accessibility of public services for businesses, directly influencing the operational environment and competitiveness of the private sector in Bosnia and Herzegovina's emerging digital economy.

Given these conditions, understanding the role of the institutional framework in facilitating or hindering the digitalization of public services for the business sector is crucial. A well-functioning institutional framework can enhance the availability, quality, and reliability of digital public services, thereby reducing administrative burdens, improving transparency, and fostering a more favorable business climate. Conversely, fragmented, inefficient, or outdated institutional arrangements can slow down digital transformation, restrict business access to essential services, and limit the broader economic benefits associated with digital public administration.

The subject of the research is the identification of the influence of the institutional framework on public digital services in the business sector in Bosnia and Herzegovina. The paper aims to identify and describe the impact of the institutional framework on the business activities in the public digital services in Bosnia and Herzegovina in the period from October 2022 to December 2023.

2. LITERATURE REVIEW

The digital economy, defined through the integration of digital technologies into economic and social systems, has profoundly transformed the delivery of public services, including

those aimed at the business sector. Shi et al. (2022) emphasize that digitalization enables more efficient, transparent, and business-oriented public services, creating new opportunities to improve the relationship between governments and economic actors.

According to the recent definition of the World Bank, the institutional framework is defined as a system of rules, norms and organizations that govern economic and social behavior (World Bank, 2023). Contemporary research confirms that digital transformation introduces significant changes not only within the internal processes of public sector organizations but also in their institutional and regulatory environments, which directly shape the accessibility and quality of digital public services for businesses. At its core, digital transformation implies a dual shift — within the administrative structures of organizations and within their external interactions with businesses and other stakeholders. Hanelt et al. (2021) argue that these changes are primarily driven by the development of digital technologies, which reshape the expectations of businesses regarding public service delivery, introducing new models of interaction, faster service provision, and improved usability.

While in the private sector, digital transformation has largely focused on the creation of new business models and the transition from analogue to digital production and services, within public administration the emphasis has been placed on understanding how digital technologies are changing and improving public institutions' organization and the way they deliver services, particularly those critical for the business sector.

Fischer et al. (2021) note that although many governments have yet to achieve full digitalization of public services and administrative procedures, there has been a visible increase in the use of digital technologies, particularly following the COVID-19 pandemic, which exposed inefficiencies in traditional bureaucratic processes. Enang et al. (2020) highlight that these efforts are expected not only to gradually improve, but to fundamentally transform how governments engage with businesses, citizens, and other stakeholders.

Haug et al. (2023) stress that while technology lays the groundwork for transformative initiatives, the true potential lies within the institutions themselves, shaped by their organizational structure and by the institutional environment in which they operate. Digitally induced change is thus conceived as a combination of incremental improvements and transformative reforms, demanding a strategic and coordinated approach, especially in complex governance systems such as that of Bosnia and Herzegovina.

In the context of the European Union, the implementation of public digital services has advanced considerably over the last decade, with the COVID-19 pandemic accelerating the shift toward digital public service provision as the default administrative channel. The EU's Digital Decade initiative (2021) has established an ambitious target for all essential public services to be accessible online by 2030, benefiting both citizens and the business sector (DESI, 2022). However, while certain member states such as Malta, Finland, and Croatia have made significant progress by allocating substantial resources to digitalization, overall advancement remains uneven — both between and within countries.

This challenge is particularly relevant for Bosnia and Herzegovina, where decentralized governance structures and fragmented institutional competencies have slowed the pace of digital transformation in the public sector. Market regulation requires government

intervention to balance the interests of all parties, limit the improper use of market power, and develop effective institutional and legal frameworks (Spence, 2021). The lack of coordinated digital strategies and insufficient legal and regulatory frameworks for e-Government services aimed at businesses continue to pose systemic obstacles.

Digital public services specifically designed for the business sector are essential for enabling more efficient market operations, reducing administrative burdens, and improving the overall business environment. According to the DESI (2022) report, the "Digital Public Services for Businesses" indicator evaluates the extent to which public services intended for enterprises are digitalized and their degree of cross-border interoperability.

While countries such as Ireland, Estonia, Malta, Luxembourg, Spain, Lithuania, and Finland lead this area, with nearly 100% of business-related public services available online, the average across the EU stands at around 85%. These digital services facilitate business operations by simplifying procedures for licensing, tax reporting, customs, public procurement, and regulatory compliance. In contrast, Bosnia and Herzegovina lags significantly behind these benchmarks, primarily due to institutional fragmentation, outdated regulatory provisions, and limited investments in advanced digital infrastructure.

The implementation of open data policies and interoperable digital platforms has become a critical tool for enhancing transparency, administrative efficiency, and competitiveness in the business environment. The European Commission estimates that digital public services could generate up to €50 billion in annual savings across the EU, largely by streamlining processes and reducing transaction costs for businesses. Enang et al. (2020), Hanelt et al. (2021), and Shi et al. (2022) emphasize that beyond operational efficiency, digital public services provide additional value to business users by improving functionality, reducing service delivery times, and increasing institutional accountability. Recent research shows that digitization facilitates more efficient, transparent public services aimed at citizens (Sharma et al., 2022). In Bosnia and Herzegovina, where businesses frequently encounter complex administrative procedures and fragmented institutional authority, the potential benefits of expanding digital public services are particularly significant.

The adoption of digital systems in areas such as public procurement, tax administration, and company registration has demonstrated substantial benefits in other contexts, including rationalized processes, improved transparency, and reduced opportunities for administrative malpractice. Moreover, digitalization in public administration provides the foundations for e-democracy and public participation by promoting data accessibility, openness, and business community engagement in policymaking. Contemporary technological solutions enable public administrations to address the increasingly complex needs of the business sector while simultaneously reducing operational costs and administrative inefficiencies. As the DESI report (2022) confirms, digital public services are evolving not only as instruments of bureaucratic modernization but also as integral components of the digital economy, contributing to improved public trust in institutions and a more dynamic business environment.

In the case of Bosnia and Herzegovina, addressing the institutional framework's shortcomings — particularly political fragmentation, incoherent regulatory policies, and insufficient coordination among public agencies — will be essential for unlocking the full

potential of digital public services in the business sector. Aligning national and entity-level policies, investing in interoperable infrastructure, and harmonizing legal frameworks with European standards remain strategic priorities for creating a digital public administration capable of supporting economic development and business sector competitiveness in the digital economy.

3. RESEARCH METHODOLOGY

As part of the primary research (field research), data were collected using the survey method, using a survey questionnaire as a technical means of data collection. The collection of primary data for this part of the research was carried out in the period from October 2022 to December 2023 and is part of a wider research that, included the business sector in Bosnia and Herzegovina.

Primary data was collected using the method of a controlled random sample. The sampling frame consisted of the entire set of companies registered with the State Bureau of Statistics of Bosnia and Herzegovina. From the register, a sample of 250 companies was selected using a stratified controlled radndom sampling procedure that involved dividing population into strata based on key characteristics such as sector and geographical location, and then randomly selecting companies within each stratum to ensure representativeness across these dimensions.

All selected companies received the survey, which was administered partly electronically via Google Forms, a platform for online surveys, and partly through personal visits to respondents. The dual administration mode was implemented to maximize participation, especially among the companies with varying levels of digital access. Out of the selected sample, 171 companies responded to the survey, representing a response rate of 68.4%. In some cases, surveys were conducted personally with company representatives responsible for digital technology use. The sample covered companies from 72 different local self-government units of which a total of 171 in Bosnia and Herzegovina, providing broad territorial-political coverage across Bosnia and Herzegovina. To assess representativeness, the sample was compared to the reference population values from the statistical register in terms of sectoral distribution, company size and geographical location, confirming that the sample closely matches the broader business sector.

The survey questionnaire, except for questions about the demographic characteristics of the respondents and the social structure and occupation of the respondents, is structured in the form of closed questions, whereby the respondents had the opportunity to evaluate their degree of agreement with certain statements through the offered answer form in the form of a five-point Likert response scale. A Likert scale with five intensities was used to measure attitudes and opinions in the questionnaire. Respondents expressed their agreement or disagreement with the statements stated in the survey questionnaire, where the degrees are properly distributed and numbered, namely: 1 = I completely disagree; 2 = Disagree; 3 = I have no opinion; 4 = I agree; 5 = I strongly agree. The second, admittedly smaller number of questions, related to dichotomous variables to which respondents had the opportunity to answer through the modalities "yes" and "no", and rounding one of the offered alternative answers.

The institutional framework variable was operationalized through three distinct indicators measuring perceptions of political structures, the legislative and legal system, and the communications regulatory agency in Bosnia and Herzegovina, all within the context of their support for digitalization initiatives encompassing business operations, e-business, and e-Government. These indicators were assessed using a five-point Likert scale, providing ordinal data reflecting respondents' degrees of agreement. For analytical purposes, these three items were aggregated into a composite index representing the overall institutional framework to capture the multidimensional nature of institutional support. The dependent variable, public digital services, was measured via a single item evaluating the extent of digitalization of public services at the municipal or cantonal level crucial for business operations, also rated on a five-point Likert scale.

The methods that will be used in the presented scientific research work to investigate and present the results of scientific research are inductive and deductive, methods of analysis and synthesis, comparative methods, and statistical methods. During the research, the analysis of relevant scientific research and studies in the form of books, textbooks, magazines, official publications, websites, as well as other relevant literature will be carried out. The inductive method will be applied in the reverse direction - to derive general propositions from individual facts. The deductive method will be used to derive appropriate concrete assumptions and conclusions from general statements. These two methods will be used to explain established and discover new knowledge and new laws, as well as to prove established theses and test hypotheses and predict future events.

The method of analysis will enable the explanation of the problem and the subject of research by breaking it down into simpler parts and researching each part separately concerning other parts, which will enable the observation, discovery, and study of the scientific truth about mutual relationships. The synthesis method will be used to combine the obtained research results into a single unit in which these results are mutually related.

The comparative method will be used to compare the same or related facts, phenomena, processes, and relationships, i.e. it will help to establish their similarities in behavior and intensity, as well as the differences between them. Following the usual research standards in the social sciences, the data obtained from the questionnaire will be processed using SPSS modern software package for statistical analysis. Bearing in mind that the research hypotheses were formulated in such a way as to test the influence (causality) of one variable on another, and not the connection (connection) between the defined variables, regression analysis was used in the paper. The method of description will be used to describe facts and their empirical confirmation but without scientific interpretation and explanation.

3.1. Research variables

The variables observed in the context of the empirical research are:

The independent variable relates to the Institutional framework. An institutional framework refers to the system of rules, regulations, norms, and organizations that shape and govern the behavior and interactions of individuals, groups, and institutions within a particular society or sector. It provides the foundation for organizing and structuring various aspects of social, economic, and political life.

The dependent variable is related to the digital economy which is operationalized through variable: Public Digital Services. Public Digital Services (often referred to as e-Government) are public services delivered to citizens, businesses, and administrations through digital technologies. Public Digital Services enable interactions with government bodies to be carried out online, either fully or partially, replacing traditional in-person or paper-based processes.

Indicators for measuring independent variables are the functions of the institutional framework, as follows:

- support of political structures at all levels for the digitization of society and the improvement of citizens' lives,
- support of the legislative and legal system for the digitization of society and the improvement of citizens' lives, and
- support of the regulatory agency for communications to the digitization of society and the improvement of citizens' lives.

To test the auxiliary hypothesis, the Public Digital Services variable was observed through one indicator:

- eGovernment Accessibility

The planned research will be based on the application of scientific methods of secondary and primary research.

4. RESULTS AND DISCUSSION

The findings indicate that institutional factors play a critical role in shaping the development and use of digital public services. Respondents reported insufficient political prioritization of digital transformation, outdated and unclear legislative frameworks, and weak regulatory enforcement, all of which hinder progress and limit investment in ICT infrastructure. Despite these challenges, the aggregate institutional framework index shows a significant positive effect on both the accessibility and perceived quality of digital services, confirming that stronger, more coherent institutions directly support digital advancements.

However, the overall availability of e-Government services, particularly at municipal and cantonal levels, remains low, limiting broader engagement from citizens and the business sector. These results suggest that increased political commitment, modernization of legislation, and stronger regulatory oversight are necessary to achieve integrated institutional reform and ensure that digital public services scale effectively and generate meaningful value.

Table 1. Summary of Institutional Determinants, Mechanisms, Outcomes, and Policy Implications

Institutional Determinants	**Mechanisms**	**Observed Outcomes**	**Policy Implications**
Political Structures	Policy support and prioritization	Insufficient support perceived	Strengthen political coordination
Legislative Framework	Regulatory processes	Legal barriers to digitalization	Reform legislation to enable e-Gov
Regulatory Agency	Enforcement of standards	Weak regulatory support	Enhance regulatory effectiveness
Institutional Framework (Index)	Combined institutional influence	Positive effect on service quality	Promote integrated reforms
Digital Public Services (DV)	Service digitalization efforts	Underdeveloped e-Gov services	Accelerate digital service rollout

Source: Authors

Inspecting the results of the research, 59.65% of respondents reside in the territory of the Federation of Bosnia and Herzegovina, 33.33% of them in the territory of Republika Srpska, and 7.02% in Brčko District of Bosnia and Herzegovina.

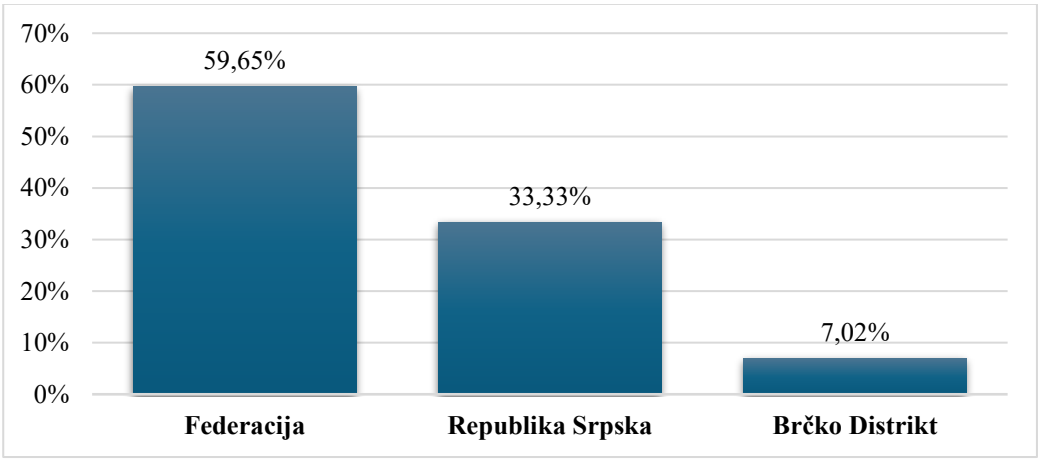


Fig. 1. Business sector respondents based on entity
Source: Authors' research

If the number of employees is considered according to whether it is an small, mediul or large enterprise, our research includes 66,08% of respondents are from small enterprises, and 19.30% of respondents are from medium enterprises and finally 14.62% are from large enterprises.

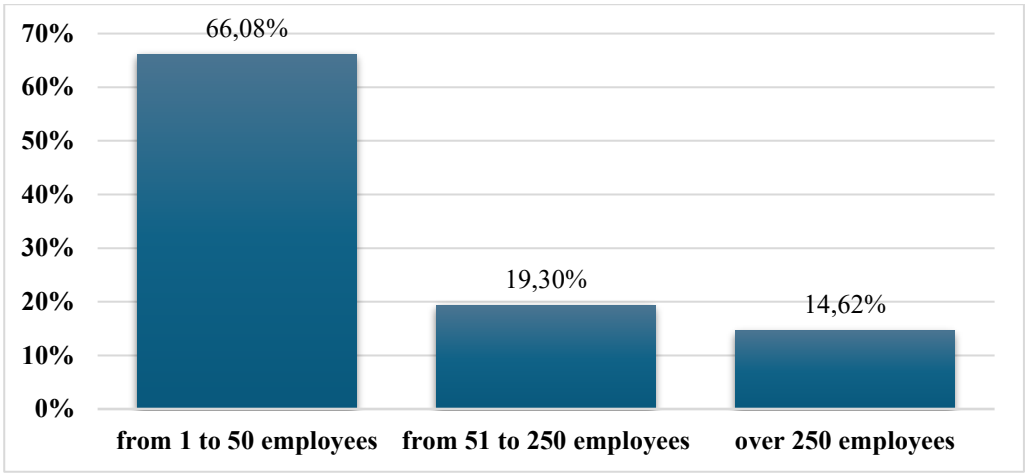


Fig. 2. Business sector respondents by number of employees
Source: Authors' research

The research results indicate a distinctly negative perception within the business sector in Bosnia and Herzegovina regarding the digitalization of public services and the institutional framework supporting it. As shown in the data, 80.12% of respondents strongly disagree that public institutions are adequately digitalized, while only 2.34% agree and 3.51% strongly agree. Similarly, perceptions of the institutional framework are predominantly unfavorable, with 52.63% strongly disagreeing that political structures support digitalization, 50.29% expressing the same view of the legislative system, and 38.01% toward the regulatory agency. Positive perceptions are minimal, with agreement and strong agreement levels not exceeding 16.96% for any of the assessed institutional components. These results highlight widespread dissatisfaction in the business community and underscore critical gaps in institutional support for the digital transformation of public services in Bosnia and Herzegovina.

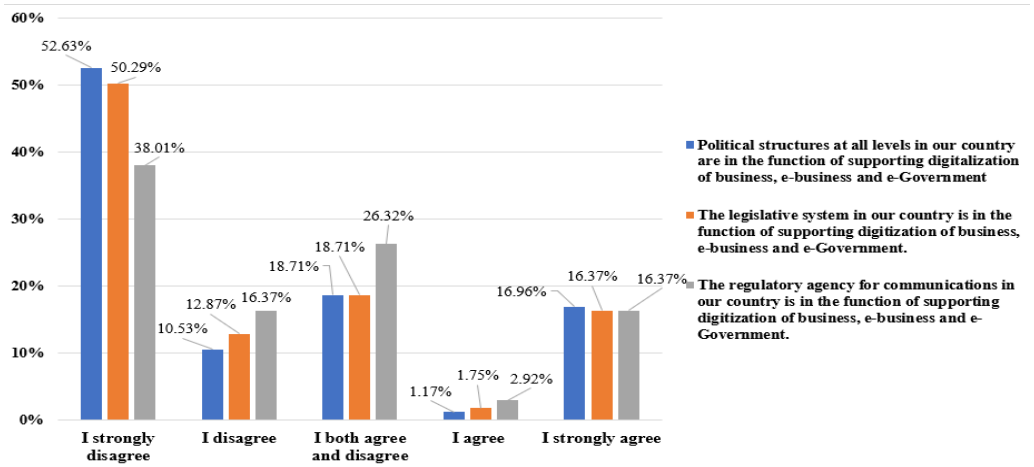


Fig. 3. Business sector perception of the institutional framework
Source: Authors' research

In regards to perception of the business sector in Bosnia and Herzegovina regarding the extent to which public institutions are digitalized (e-Government). The findings reveal a notably negative assessment, with 80.12% of respondents strongly disagreeing that public institutions are adequately digitalized. Additionally, 8.77% disagree, while 5.26% neither agree nor disagree. A marginal 2.34% agree, and only 3.51% strongly agree with the statement. These results indicate a pronounced dissatisfaction within the business community concerning the progress of e-Government initiatives, suggesting that public digital services remain largely underdeveloped and insufficiently responsive to the needs of the business sector in Bosnia and Herzegovina.

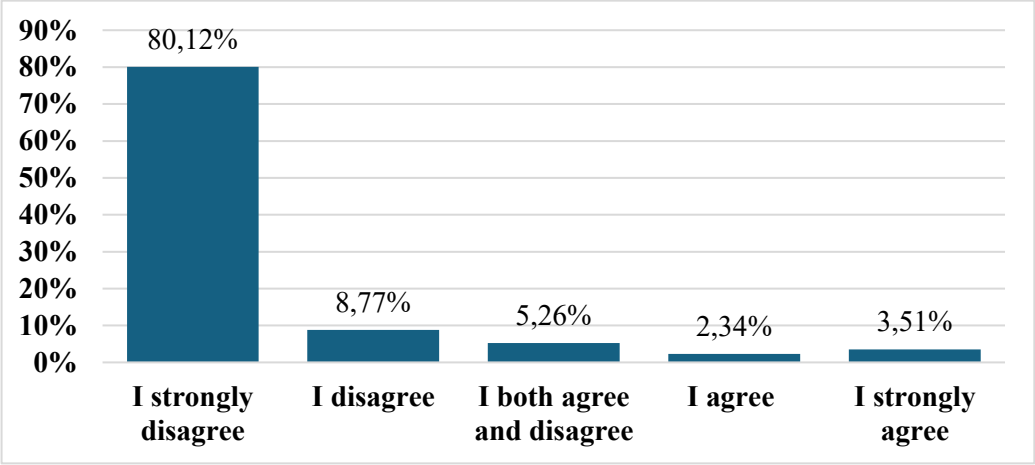


Fig. 4. Business sector perception of public institutions being digitalized
Source: Authors' research

Table 2. details regression coefficients, standard errors, significance levels, and model fit indicators examining the institutional framework's effect on digital public services. Significant contributions are found for the combined institutional index. This table substantiates the statistical relationships discussed in the text.

Table 2. Results of the regression analysis examining the influence of the institutional framework on the public digital services

	Summary of model[b]				ANOVA	Coefficients	
Model	R	Coefficient of determination	Corrected coeff. of determination	Standard error	Sig.	Beta	Sig.
1	0,464[a]	0,215	0,215	0,877	0,000	0,464	0,000

a. Predictor: INSTITUTIONAL FRAMWORK

b. Dependent variable: PUBLIC DIGITAL SERVICES (eGOVERMENT)

Source: Authors' research

Model-level statistics such as R, R^2, adjusted R^2, and standard error estimates are reported for the model examining the influence of institutional variables on the availability of digital public services. The values indicate a moderate level of explanatory strength, suggesting that institutional factors account for a meaningful but not exhaustive share of variance in digital

service development. These results help frame and contextualize the more detailed regression outputs presented in Table 3.

Table 3. Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error
1	.464[a]	.215	.215	.877

a. Predictors: (Constant), INSTITUTIONAL FRAMWORK

b. Dependent Variable: PUBLIC DIGITAL SERVICES

Source: Authors' research

The obtained results show the statistical significance of the coefficient of determination of the analyzed model, and a significant unique contribution to the prediction of the dependent variable. More precisely, the institutional framework makes a significant unique contribution to public digital services as a component of the digital economy.

In summary, the results of this research clearly demonstrate that the business sector in Bosnia and Herzegovina perceives the existing institutional framework as insufficiently supportive of the development and implementation of public digital services. The findings confirm that political structures, legislative frameworks, and regulatory bodies are viewed as key barriers rather than enablers of digital transformation. These perceptions reflect broader challenges in administrative coordination, policy prioritization, and regulatory responsiveness, indicating that significant institutional adjustments are required to improve the availability, quality, and efficiency of digital public services tailored to the needs of the business sector.

5. CONCLUSION

This research has explored the complex relationship between the institutional framework and the development of public digital services in the business sector in Bosnia and Herzegovina. The findings reveal a prevailing perception of institutional inefficiency and insufficient commitment to digital transformation processes among public authorities. Political structures, legislative bodies, and regulatory institutions are identified as key determinants shaping the environment in which digital public services are developed and delivered, yet these institutions are predominantly perceived as inadequately responsive to the growing digital needs of the business community.

The analysis confirms that digital transformation in the public sector is not merely a matter of technological advancement, but fundamentally a question of governance, institutional accountability, and administrative capacity. The availability, accessibility, and quality of public digital services are closely tied to the institutional environment in which they are designed and implemented. This environment encompasses political will, legislative coherence, and regulatory effectiveness — all of which, according to the perceptions captured in this study, are currently insufficient to meet the evolving demands of a modern, digitally oriented business sector.

Public digital services, when effectively developed, have the potential to enhance operational efficiency, reduce transaction costs, improve service transparency, and facilitate greater

interaction between businesses and government institutions. However, this potential remains largely untapped in Bosnia and Herzegovina due to evident institutional limitations. The fragmentation of decision-making structures, uneven policy implementation across administrative levels, and a lack of systematic regulatory oversight contribute to inconsistencies in the provision and functionality of digital public services. This creates an environment where businesses encounter significant administrative and procedural barriers in accessing the digital services that are increasingly indispensable for competitive and compliant operation in contemporary markets.

Moreover, the research points to a widespread perception of inadequate investment by public institutions in digital infrastructure and service development. The business community perceives that institutional efforts to modernize public service delivery through digital platforms remain sporadic, reactive, and insufficiently coordinated. This perceived lack of strategic prioritization hinders the capacity of the public sector to respond to the expectations of businesses seeking efficient, reliable, and user-oriented digital public services. The absence of visible institutional leadership in promoting and managing digital transformation processes contributes to skepticism within the business community regarding the public sector's readiness and capability to provide services aligned with the requirements of a digital economy.

In conclusion, this study underscores that the institutional framework in Bosnia and Herzegovina plays a pivotal role in either enabling or constraining the digitalization of public services in the business sector. The findings demonstrate a clear need for institutional reforms that strengthen administrative coordination, improve regulatory effectiveness, and foster a culture of transparency, accountability, and innovation within public sector institutions. Addressing these challenges is essential not only for enhancing the quality and accessibility of public digital services but also for ensuring that the business sector can fully participate in and benefit from the opportunities provided by digital economic development. The evidence presented confirms that advancing public digital services requires an integrated institutional response capable of aligning legal, regulatory, and administrative functions with the practical needs of the business community in Bosnia and Herzegovina's digital economy.

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THE ROLE OF ELECTRONIC PAYMENTS IN THE TRANSITION TOWARD A CASHLESS ECONOMY: EMPIRICAL INSIGHTS FROM BOSNIA AND HERZEGOVINA

ABSTRACT

In the digitalisation era, the financial sector's transformation has become a global force reshaping economic development by integrating technology, regulation, and user experience into a unified digital framework. This paper examines the impact of electronic payments on the transition to a cashless economy in Bosnia and Herzegovina, with a particular focus on trends, structural changes, and the dynamics of transformation during the period 2020–2024. Contemporary research increasingly recognises card payments as a driving force behind the emergence of cashless societies, emphasising their contribution to reducing reliance on physical cash and enhancing the transparency of financial flows. In this regard, payment cards are not merely a means of transaction, but also a tool for strengthening institutional infrastructure and modernising payment systems. Empirical data from Bosnia and Herzegovina further support this assertion, indicating a growing contribution of card payments to modernising the financial system. Card payments represent a key instrument of digital transformation in the financial sector, particularly in developing countries such as Bosnia and Herzegovina, where they facilitate the acceleration of the shift toward a cashless economy and promote broader financial inclusion. Using descriptive analysis, this study examines the total value of card transactions, the number of transactions performed, and the prevalence of various payment instruments-including ATMs, POS terminals, and internet transactions in Bosnia and Herzegovina. The results indicate a consistent growth in electronic payments in Bosnia and Herzegovina, with internet transactions recording the highest growth rate (over 40%), reflecting the rapid adoption of digital payment tools. These findings suggest that card payments are increasingly integrated into the daily lives of citizens and the operations of financial institutions and businesses, laying the foundation for a more stable, efficient, and transparent financial system. Accordingly, card payments in Bosnia and Herzegovina are not merely a technical innovation but a strategic lever for economic development, fiscal stability, and digital inclusion. Their growing adoption confirms that Bosnia and Herzegovina is gradually moving toward the model of a modern cashless society.

Keywords: *electronic payments, card payments, modern payment systems, trends and structural changes, Bosnia and Herzegovina.*

JEL: O33, O14, L86, E42

1. INTRODUCTION

The development of digital technologies and the transformation of financial services have led to the rapid expansion of digital payment instruments worldwide. Bosnia and Herzegovina, although still strongly reliant on cash transactions, has recorded a significant increase in the use of cards, the internet, and mobile payments over the past three decades. The topic is particularly relevant because cash continues to dominate despite the growth of digital channels, especially in smaller communities and the older population. The payment card market represents one of the most dynamic and fastest-growing industries in the contemporary financial landscape. This rapid development is primarily driven by the application of diverse new technologies integrated into the card industry, enabling the creation of numerous products and services that were entirely unknown less than thirty years ago. A payment card is an instrument used to pay for goods and services at locations and is equipped with devices that support such transactions. Possessing a payment card allows individuals to perform deposits and withdrawals at ATMs, depending on their needs. For privacy and security reasons, clients are protected by a unique personal identification number (PIN) linked to their card. In Bosnia and Herzegovina today, citizens pay for goods and services in cash, while only a small portion prefer using cards-unlike tourists, who generally use cards for most transactions. As a digital payment instrument, the card provides security to its holder and ensures transparency in tracking every transaction and account balance. Users can check their bank balance and monitor their spending patterns at any given time.

The key challenges include users' insufficient financial and digital literacy, limited infrastructure, and various regulatory and institutional barriers. Examining the factors influencing the adoption of card-based payments holds substantial strategic importance, as these instruments can contribute to modernising the payment system and reducing cash usage. The main objective of this paper is to analyse the state and trends of card payments in Bosnia and Herzegovina through a descriptive analysis of available statistical data for the period 2020–2024. In this context, the hypothesis is proposed that the growth in card payment usage in Bosnia and Herzegovina significantly contributes to reducing cash usage and modernising the payment system during the 2020–2024. This hypothesis is the foundation for further analysis of digital payment instruments' trends, challenges, and potential within the domestic context.

This study examines the development of card payments in Bosnia and Herzegovina during the observed period from 2020 to 2024. The focus is placed on reducing cash usage and modernising the payment system. Furthermore, the period from 2020 to 2024 provides insight into the dynamics of changes in the development of digital payment forms and evolving user habits within the Federation of Bosnia and Herzegovina. The paper is structured into several key sections, beginning with a review of previous research, followed by the research methodology, analysis and discussion of results, and concluding with recommendations and conclusions.

2. LITERATURE REVIEW

The body of literature examining the role of electronic payments in the development of a cashless society has been steadily growing. Many scholars have explored how the global

payments industry is transforming profoundly, driven by the shift from cash-based to digital transactions. According to the World Payments Report 2025 (Capgemini Research Institute, 2025), the key drivers of this transformation include regulatory support, the development of open finance, and the expansion of instant payment systems. These trends are reshaping the expectations of both consumers and businesses, while simultaneously creating a need for strategic adaptation within the financial services sector. Particular emphasis is placed on the synergy between open finance and instant payments as the foundation for long-term growth and competitiveness. These global dynamics provide a relevant framework for analysing local developments in Bosnia and Herzegovina. Although the domestic market remains heavily reliant on cash transactions, the increasing adoption of card payments between 2020 and 2024 indicates the beginning of a significant shift in consumer behaviour. The intensity of payment method usage is typically associated with demographic factors such as age, education, income, and gender (Borzekowski et al., 2008; Klee, 2008; Stavins, 2001).

While digital payments have already been widely adopted in developed economies, their growth trajectory is equally dynamic in developing countries. According to World Bank (2022) Findex data, the share of adults in developing economies using digital payments increased from 35% in 2014 to 57% in 2021. Examples such as Alipay and WeChat Pay in China, M-Pesa in Kenya, UPI in India, and Pix in Brazil illustrate how digital infrastructure can revolutionise retail payments and foster inclusive financial development. A study conducted in the Netherlands among 2,258 respondents (De Nederlandsche Bank, 2023) aimed to determine whether, and to what extent, cultural background from cash-based economies influences the adoption of digital payment instruments, and whether these habits are transmitted across generations. The study also sought to assess potential implications for payment system efficiency and policy design that supports payment digitalisation. The findings confirm that payment habits are shaped by cultural, institutional, and generational factors, indicating that digitalising payments requires a long-term and differentiated approach. The research draws upon the work of Bolt and Chakravorti (2008), Borzekowski et al. (2008), Klee (2008), Stavins (2001), as well as Jack et al. (2010), and Humphrey et al. (1996).

Research shows that citizens of Bosnia and Herzegovina are exhibiting increasing interest in digital financial services. Husejinović (2021) highlights that perceived security risks and a lack of perceived benefits are the main factors limiting the broader adoption of online banking. Similarly, market reports confirm that card usage is rising.

Although cash still holds a central role-particularly in rural areas and among older age groups-studies such as those by Arango and Taylor (2008) and Zandi et al. (2013) indicate that the digitalisation of payment systems, including card payments, generates multiple positive effects: from strengthening fiscal policy and combating the informal economy to enhancing financial inclusion, especially among vulnerable and unbanked populations. In developing countries such as Bosnia and Herzegovina, digitalising financial services increases financial inclusion and accelerates the transition toward a cashless society (World Bank, 2023). Regional studies suggest that transaction security and ease of use are the main drivers of card payment growth (Husejinović, 2021; World Bank, 2023).

Various types of payment cards are available in the Bosnian market. These cards enable

users to pay for goods and services, withdraw cash, and monitor their account balances. Payment cards allow for secure identification through PIN protection and transparency in transaction tracking, enhancing user trust and control over personal finances.

Market research and media reports confirm that citizens increasingly use cards, particularly in e-commerce. Nevertheless, according to Mastercard (2024), only 15% of the population uses card payments, compared to the EU average of 48%, while the average number of cards per capita in Bosnia and Herzegovina is 0.8, compared to 2.1 in the EU. These figures underscore the need to examine user motivation and the barriers preventing broader adoption of card and digital payments. Between 2020 and 2024, there was a notable increase in card payment volumes, intensified regulatory activity-particularly in Republika Srpska and rising public awareness of digital payment channels. A critical review of the existing literature reveals that prior research has predominantly focused on payment systems' technical and operational dimensions. At the same time, user behaviour, perceptions of security, and the impact of the regulatory environment remain underexplored. There is a clear need for deeper empirical and analytical research that connects institutional, technological, and psychological factors within the context of card payments and digital money.

Although card payments are growing in Bosnia and Herzegovina, the usage rate remains significantly below the European average (15% compared to 48% in the EU). Evidence suggests that security concerns, limited digital literacy, and regulatory inconsistencies are key obstacles. However, there is a lack of empirical data quantifying these factors and insufficient research linking them to specific user behaviour patterns.

3. METHODOLOGY OF THE EMPIRICAL RESEARCH

This study's methodology is based on descriptive and comparative analysis, with the objective of identifying key trends, challenges, and prospects in the development of card payments in Bosnia and Herzegovina. The research relies on secondary data sources, including official statistical reports of the Central Bank of Bosnia and Herzegovina (CBBiH) and the Banking Agency of the Federation of Bosnia and Herzegovina. The comparative analysis focuses on the period from 2020 to 2024, providing insight into the dynamics of change in the development of digital payment forms and the evolution of consumer behaviour within the Federation of Bosnia and Herzegovina. The descriptive analysis presents fundamental indicators, including the number and total value of card transactions and the channels through which these transactions are conducted (ATMs, POS terminals, and internet transactions).

The descriptive statistics applied in this research aim to quantitatively present the main characteristics of card payment trends in the Federation of Bosnia and Herzegovina during the observed period. The analysis is grounded in aggregated annual data obtained from the official statistical reports of the Central Bank of Bosnia and Herzegovina (CBBiH), encompassing total transaction values, the number of transactions, and their structural distribution across usage channels-ATMs, POS terminals, and internet transactions.

4. RESULTS AND DISCUSSION

4.1. Descriptive Statistics

Descriptive statistics were employed to summarise the main characteristics of the dataset, utilising measures of central tendency and dispersion. In addition, absolute and relative changes were calculated along with the Compound Annual Growth Rate (CAGR) to assess the intensity and stability of growth throughout the observed period.

Table 1 presents an overview of card transactions in the Federation of Bosnia and Herzegovina (2020–2024) and the corresponding usage channels.

Table 1. Card Transactions and Usage Channels in the Federation of Bosnia and Herzegovina (2020-2024)

Year	Total Transaction Value (BAM)	ATM Transactions (BAM)	POS Terminal Transactions (BAM)	Internet Transactions (BAM)	Number of Transactions
2020	11.540.000.000,00	8.160.000.000,00	2.770.000.000,00	181.000.000,00	113.910.000,00
2021	12.740.000.000,00	8.860.000.000,00	3.360.000.000,00	225.000.000,00	122.470.000,00
2022	14.050.000.000,00	9.800.000.000,00	3.880.000.000,00	370.000.000,00	136.050.000,00
2023	15.520.000.000,00	10.560.000.000,00	4.330.000.000,00	495.000.000,00	145.520.000,00
2024	18.430.000.000,00	12.440.000.000,00	5.240.000.000,00	815.000.000,00	186.380.000,00

Source: Author's calculation based on data from the Central Bank of Bosnia and Herzegovina (Central Bank of Bosnia and Herzegovina, 2020, 2021, 2022, 2023, 2024).

The obtained average value reflects the typical annual level of card payment activity in the Federation of Bosnia and Herzegovina. For instance, the arithmetic mean of the total transaction value amounted to approximately BAM 14.45 billion, indicating that this was the average annual volume of card payments realised during the analysed period. The average values of the observed variables, calculated using the arithmetic mean, are presented in the following table.

Table 2. Average Values of Card Transactions and Usage Channels (2020–2024)

Observed Variables	**Arithmetic Mean (BAM)**
Total Transaction Value	14,456,000,000
ATM Transactions	9,964,000,000
POS Terminal Transactions	3,916,000,000
Internet Transactions	417,200,000
Number of Transactions	140,866,000

Source: Author's calculation.

The arithmetic mean indicates that the total annual value of card transactions during the observed period was approximately BAM 14.45 billion, representing the average level of digital payment activity in the Federation of Bosnia and Herzegovina. ATM transactions averaged BAM 9.96 billion, while POS terminal transactions reached BAM 3.92 billion. Although considerably lower in value, internet transactions exhibited a dynamic upward

trend, averaging BAM 417.2 million, reflecting the rapid expansion of digital payment channels.

The average annual number of transactions amounted to 140.87 million, indicating a growing frequency of card usage. The variance (σ^2) and standard deviation (SD) analysis for all variables clearly demonstrates an overall upward trend in electronic transactions across the Federation of BiH. The total transaction value and the number of transactions show the most considerable absolute changes and deviations from the mean, reflecting a highly dynamic market. ATM and POS terminal transactions display a more stable and gradual growth pattern, with more minor deviations. In contrast, internet transactions show relatively high percentage volatility, signalling accelerated digitalisation and shifting payment behaviours. This combined interpretation reveals that the electronic money market in the Federation of BiH is not only expanding but also transforming, with a strong emphasis on digital and online payment channels. In contrast, traditional channels (ATMs and POS terminals) maintain steady, incremental growth. Using variance and standard deviation provides a quantitative assessment of these trends, underscoring the significance of behavioural shifts throughout the analysed period.

The total transaction value recorded an SD of BAM 2.39 billion and a coefficient of variation (CV) of 16.5%, indicating moderate relative variability and a predictable market expansion, with the highest absolute increase in 2024. ATM transactions, with an SD of BAM 1.61 billion and a CV of 16.2%, follow a similar trend, reflecting this segment's stability and steady growth, with proportional changes comparable to overall transaction trends. POS terminal transactions exhibit slightly higher relative variability (SD of BAM 0.843 billion, CV of 21.5%), suggesting that this segment grows progressively, but that absolute changes have a greater proportional impact on the average, as shown in Table 3.

Table 3. *Variance and Standard Deviation of Obs. Variables in the Period 2020–2024*

Variables	**Obs.Variables**	**Obs. Variables (BAM)**
Total Transaction Value	5.722	2.39 billion
ATMs	2.591	1.61 billion
POS Terminals	0.711	0.843 billion
Internet Transactions	0.0518	227.6 million
No. of Transactions	635.28	25.2 million

Source: Author's calculations based on data from the Central Bank of Bosnia and Herzegovina (Central Bank of Bosnia and Herzegovina, 2020, 2021, 2022, 2023, 2024).

4.2. Time Series Analysis

The time series analysis of card transactions in the Federation of Bosnia and Herzegovina for 2020–2024, based on absolute and relative changes and the Compound Annual Growth Rate (CAGR), indicates the cashless payments market's continuous growth and transformation. The total transaction value exhibits a stable and predictable increase up to 2023, with annual increments ranging from BAM 1.2 to 1.47 billion, while 2024 shows a significant jump of BAM 2.91 billion, reflecting the accelerated adoption of cards and expansion of digital payment channels (CAGR 12.6%). The ATM segment shows gradual and steady growth, with absolute BAM 700 to 940 million increases until 2023.

Table 4. Absolute Changes in Card Transactions and Usage Channels

Year	Total Value (Δ)	ATMs (Δ)	POS (Δ)	Internet (Δ)	No. of Transactions (Δ)
2021	1.200.000.000	700.000.000	590.000.000	44.000.000	8.560.000
2022	1.310.000.000	940.000.000	520.000.000	145.000.000	13.580.000
2023	1.470.000.000	760.000.000	450.000.000	125.000.000	9.470.000
2024	2.910.000.000	1.880.000.000	910.000.000	320.000.000	40.860.000

Note: Author's calculations.

Table 5. Absolute and Relative Changes in Card Transactions and Usage Channels

Year	Total Value Δ / %	ATMs Δ / %	POS Δ / %	Internet Δ / %	No. of Transactions Δ / %
2020	–	–	–	–	–
2021	1.200.000.000 / 10,4%	700.000.000 / 8,6%	590.000.000 / 21,3%	44.000.000 / 24,3%	8.560.000 / 7,5%
2022	1.310.000.000 / 10,3%	940.000.000 / 10,6%	520.000.000 / 15,5%	145.000.000 / 64,4%	13.580.000 / 11,1%
2023	1.470.000.000 / 10,5%	760.000.000 / 7,8%	450.000.000 / 11,6%	125.000.000 / 33,8%	9.470.000 / 7,0%
2024	2.910.000.000 / 18,8%	1.880.000.000 / 17,8%	910.000.000 / 21,0%	320.000.000 / 64,6%	40.860.000 / 28,1%

Note: Author's calculations.

In 2024, a more pronounced rise of BAM 1.88 billion is recorded, confirming that the traditional channel remains important while the digital infrastructure develops in parallel. POS terminal transactions grow gradually (BAM 450–590 million annually), with an acceleration in 2024 (+BAM 910 million), indicating an expansion of retail capacity and an increase in payment frequency, with a proportionally larger impact on the average (CAGR 14.2%). The most dynamic segment is internet transactions, which experience exponential growth: +BAM 44 million in 2021, +BAM 145 million in 2022, +BAM 125 million in 2023, and +BAM 320 million in 2024, with a high CAGR of 38%. This reflects the rapid digitalisation and a shift in consumer behavior toward online payments. The number of transactions continues to grow, with a sharp increase in 2024 (+40.86 million), confirming the expansion of the user base and the increasing frequency of card payments (CAGR 14%). The combination of absolute and relative changes and CAGR demonstrates a diversified growth pattern: stable traditional channels (ATMs) coexist with gradually increasing POS payments. In contrast, digital and internet channels experience exponential growth, reflecting the market transformation and the accelerated adaptation of consumers to cashless and online payment methods.

The CAGR of card transactions in the Federation of Bosnia and Herzegovina for the observed period 2020–2024 reveals significant differences across payment channels. The total transaction value grows moderately at 12.6%, whereas internet transactions experience

substantial growth of 38%, reflecting the accelerated digitalisation of payments. Traditional channels, POS terminals and ATMs grow more slowly (14.2% and 10.8%, respectively), indicating a gradual shift of users toward digital payment methods. The number of transactions increases steadily at 14%, although not proportionally to the value of online payments. These trends point to a structural market transformation: digital channels are set to dominate, while maintaining physical infrastructure remains essential for accessibility and continuity of services.

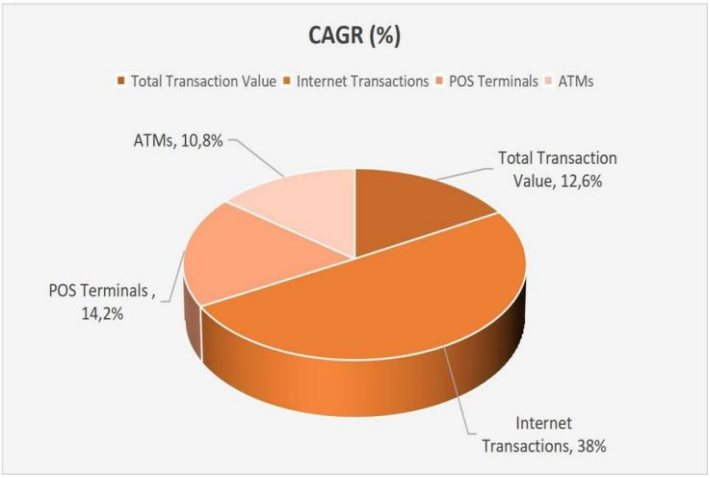


Fig. 1. Average Annual Growth Rate (CAGR) of Observed Variables (2020-2024)

Source: Author's calculations.

5. CONCLUSIONS AND RECOMMENDATIONS

The research on card and electronic payments in Bosnia and Herzegovina for the period 2020–2024 confirms the pivotal role of these instruments in the transition towards a cashless economy. The results indicate a continuous increase in total card transactions, with a particularly accelerated growth in internet payments (CAGR 38– 40%). At the same time, traditional channels, namely ATMs and POS terminals, exhibit stable but slower growth (10.8% and 14.2%, respectively). This trend confirms that card and digital payments not only streamline and expedite everyday transactions but also strategically contribute to the modernisation of the financial system, enhancing transparency and reducing dependence on cash, in line with global digitalisation trends (Capgemini Research Institute, 2025; Borzekowski et al., 2008; Klee, 2008).Empirical data clearly indicate a transformation in consumer behaviour: citizens increasingly utilise digital channels, particularly in the e-commerce segment, providing a foundation for enhanced financial inclusion and integrating new technologies into the payment ecosystem. However, the rate of card usage in Bosnia and Herzegovina remains significantly below the European average (15% compared to 48%), highlighting existing barriers such as low digital literacy, risk perception, and regulatory inconsistencies (Husejinović, 2021; World Bank, 2023). From a critical perspective, rapid growth in digital channels and slower development of traditional methods underscore the need for a balanced approach. While digital payments accelerate economic activity and modernisation, physical infrastructure remains crucial for accessibility and service continuity, especially in rural areas and among the elderly.

Recommendations for future development include enhancing education and digital literacy, regulatory support for instant payments and open finance initiatives, promotion of card payments through financial institutions' campaigns, maintenance of ATM and POS infrastructure, and further empirical research on consumer motivation and behaviour. In conclusion, card payments in Bosnia and Herzegovina represent a strategic instrument for the digital transformation of the financial sector, fiscal stability, and economic development. Their continued growth and integration into citizens' daily lives signify a gradual but substantial shift towards a modern cashless society, fostering a more stable, efficient, and transparent financial system.

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BENEFITS AND CHALLENGES OF USING CLOUD COMPUTING IN HIGHER EDUCATION

ABSTRACT

Higher education is one of the pillars of development and prosperity of any society. Its role has become even more critical in the contemporary era, characterized by a globalized economy and an increasingly mobile workforce driven by rapid technological advancements. Consequently, the integration of modern information technologies—such as artificial intelligence, cloud computing, and big data—into higher education is no longer optional but a necessity. One of the models that allows universities to access large amounts of information resources is Cloud Computing. This is particularly significant for developing countries, where cloud-based solutions facilitate quick and affordable access to modern educational tools. Built upon innovations such as virtualization and Internet technologies, cloud computing provides higher education institutions with enhanced opportunities for teaching, learning, and research.

The main goal of this paper is, on the one hand, to highlight the benefits of using Cloud tools in higher education, and on the other hand, to identify the problems and risks that arise when using these tools. To achieve this goal will be used data from a survey conducted across the majority of universities in the Republic of North Macedonia. Both qualitative and quantitative analyses will be presented, focusing on the advantages, problems, and risks of adopting cloud computing in higher education. A Likert scale was used to assess the benefits and challenges, while the analysis of these issues will provide an answer to the effect of using Cloud computing tools in higher education. The findings of this analysis contribute to a better understanding of the overall impact of cloud computing tools on higher education in the Republic of North Macedonia.

Keywords: *Cloud computing, high education, information resources, benefits, challenges.*
JEL: I23, I25, D83, L86

1. INTRODUCTION

Cloud computing emerged because of the need to increase the capacity and capabilities of existing information infrastructures, without investing in new hardware equipment and additional staff. It allows users to access advanced computing resources using only Internet. This achieves great flexibility, scalability and cost-effectiveness, since organizations and individuals only pay for the resources, they use.

One of the main advantages of cloud computing is its user-friendliness and the wide range of services it offers. These services can include additional data storage, information processing tools, access to various applications, etc. Users can quickly adapt their information infrastructure to current needs without spending time and money on purchasing new systems or training staff.

Definition of cloud computing comes from the National Institute of Standards and Technology (NIST): "Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Chandrasekaran, 2015; Mell & Grance, 2011). When analyzed the definitions, there is a consensus on few key points: Cloud Computing ensure on-demand access to a pool of computing resources, dynamically scalable services, device and media independency and easier maintenance of applications due to do not need to be installed on users' computers (Palaniappan, 2014). According to the NIST (National Institute for Standard and Technology) model for Cloud Computing, the five essential characteristics are: broad network access, rapid elasticity, measured services, on-demand self-service, resources pooling. Also, the three basic service models are: Infrastructure as a service (IaaS), Platform as service (PaaS), Software as a service (SaaS), while four types of cloud computing deployment models are: Public cloud computing, Private cloud computing, Hybrid Cloud computing, Community cloud computing (Huawei Technologies Co., Ltd., 2023; Marinescu, 2018; Mell & Grance, 2011).

The benefits offered by the Cloud Computing model can be of great importance in educational and teaching processes. This was especially evident during the COVID-19 pandemic, when the normal functioning of the education system was disrupted and teaching had to be quickly adapted to an online format. Thanks to cloud solutions, educational institutions were able to continue their work, providing teachers and students with access to teaching materials and communication in real time.

2. LITERATURE REVIEW

The emergence of Cloud computing in the world of IT has made a breakthrough and resulted in a revolutionary change in the way information and communication are treated (Helaimia, 2023). Cloud computing is delivering on demand computing resource from applications to data centers over the Internet. Therefore, we can say that cloud is a service over the Internet (Munjal, 2015). In this research, according to Munjal (2015), educational institutions can take the benefit of cloud computing and its services to fulfill their complex operations which will automatically reduce the cost and provide more powerful functional capabilities. The incorporation of cloud computing technology in education has created various opportunities

in the sector (Baldassarre et al., 2018; Kanj et al., 2025). Cloud computing has emerged as a viable solution for numerous areas, including education, owing to its dynamic scalability and the provision of virtualized resources as a service over the Internet (Alakuu & Dake, 2025). Cloud computing will enable learners to come out from the walled classrooms and explore the whole world (Tsalko & Nevmerzhytska, 2023).

In addition to the benefits, there are also certain problems in the implementation of the cloud concept in higher education (Dimauro et al., 2016; El Mhouti et al., 2018). The cloud computing adoption issues in the university may be reduced by knowing and understanding the influencing factors during the adoption process. For example, proper planning and conducting cloud adoption analysis based on the identified factors would help the organization to choose suitable deployment and service models as well as the cloud provider (Isa et al., 2020). Many cloud service providers offer publicly accessible cloud-based services, making them accessible to anybody with a subscription and a support plan (Singhal & Ahuja, 2023). Singhal and Ahuja emphasize that cloud provider takes fantastic care of all the heavy work when it comes to cloud computing, including growing both horizontally and vertically, maintaining the underlying hardware and architecture, and maintaining security.

3. MATERIAL AND METHODS

This paper will use data that are the result of a survey conducted at majority of the Universities in the Republic of North Macedonia. This questionnaire was implemented using Google Forms while the results were analyzed using Microsoft Excel. In addition, the survey contains different types of questions, and for certain types of questions, a Likert scale is used where respondents are asked to express their views and opinions. This paper will use qualitative and quantitative analysis of the questions that specifically relate to the benefits and challenges of using Cloud Computing in higher education. Two main hypotheses will be defined, from which several additional hypotheses will be derived. The ANOVA method will be applied in this study to confirm or reject these hypotheses. All analyses will be conducted using Microsoft Excel, one of the most powerful tools for data analysis.

4. RESEARCH RESULTS

For this research was created a questionnaire through Google Forms that containing different types of questions. It was sent to the academic staff of 12 largest universities in the Republic of North Macedonia, while 115 respondents answered the questionnaire, which is an appropriate and representative sample based on which relevant conclusions can be drawn. The first part of the questionnaire concerns the personal/demographic characteristics of the respondents (Zdraveski et al., 2024). Due to the limited size of the paper, we will present only those issues that are relevant to the research and that primarily relate to the benefits of using Cloud Computing and the challenges/problems faced by Cloud Computing users.

This paper explores the perceptions and opinions of academic staff regarding the benefits and capabilities of cloud computing. For this aim, a Likert scale was used to examine the perceptions of the respondents. The results of such research are shown in the following figure.

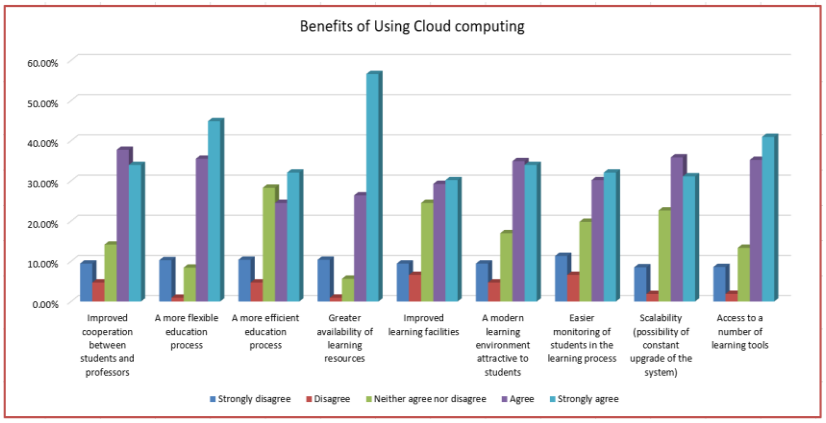


Fig. 1. Benefits of using Cloud computing model

According to the results, the majority of respondents recognize the benefits offered by the cloud computing model. More than 50% of respondents provided affirmative responses for all listed benefits, with the highest agreement observed for "Greater availability of learning resources" (83.02%), while the lowest agreement was observed for "A more efficient education process" (56.60%). These results show that the application of Cloud Computing in higher education can provide numerous benefits, which are also recognized by the academic staff of the universities in the Republic of North Macedonia. The benefits offered by this model can contribute to the improvement and modernization of teaching and learning processes.

In addition to the benefits and capabilities offered by Cloud Computing, this model also faces certain challenges and problems. The results obtained from this research regarding the challenges/problems faced by Cloud Computing are shown in Figure 2.

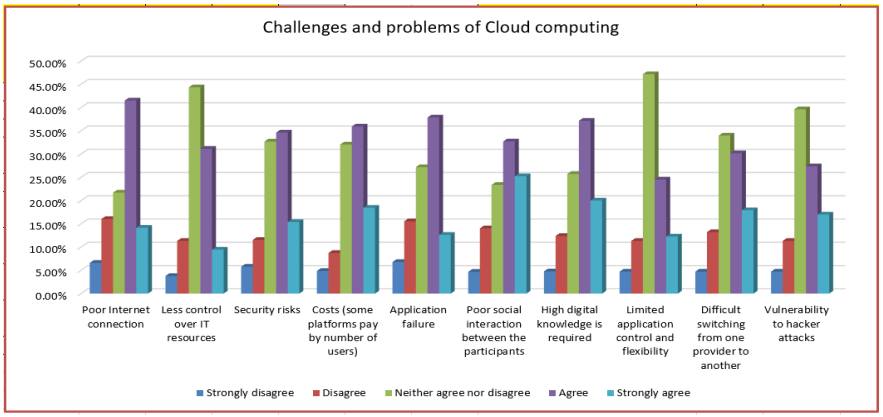


Fig. 2. Challenges and problems of using Cloud computing

According to the research findings, presented in Figure 2, the most significant challenges identified by the respondents are "Poor social interaction between participants" or 57.94% and "High level of digital knowledge required" or 57.14%. Other relatively important issues that may hinder the implementation of this model include "Poor internet connection"

(55.66%) and Costs associated with certain platforms that charge based on the number of users (54.37%).

In this paper, will be conducted data analysis using ANOVA-single factor for those variables that we consider important for the research. In this case, will be formulated two general hypotheses:

1. There are no statistically significant differences in benefits of using Cloud Computing between different scientific fields.
2. There are no statistically significant differences in challenges and problems of Cloud Computing between different scientific fields.

Within these general hypotheses, will be developed several sub-hypotheses, each addressing specific aspects of the benefits and challenges of Cloud Computing in relation to the scientific field of the respondents. Our thesis is that the variable Scientific Field is quite significant in terms of the benefits and challenges of Cloud Computing.

First general hypothesis: *There are no statistically significant differences in the benefits of using Cloud computing between different scientific fields.*

Several null hypotheses will follow from this general hypothesis:

- H0 - There is no statistically significant difference in the mean (average) of **Improved cooperation between students and professors** among the different Scientific Fields.
- H0 - There is no statistically significant difference in the mean (average) of **A more flexible education process** among the different Scientific Fields.
- H0 - There is no statistically significant difference in the mean (average) of **A more efficient education process** among the different Scientific Fields.
- H0 - There is no statistically significant difference in the mean (average) of **Greater availability of learning resources** among the different Scientific Fields.
- H0 - There is no statistically significant difference in the mean (average) of **Improved learning facilities** among the different Scientific Fields.
- H0 - There is no statistically significant difference in the mean (average) of **A modern learning environment attractive to students** among the different Scientific Fields.
- H0 - There is no statistically significant difference in the mean (average) of **Easier monitoring of students in the learning process** among the different Scientific Fields.
- H0 - There is no statistically significant difference in the mean (average) of **Scalability (possibility of constant upgrade of the system)** among the different Scientific Fields.
- Ho - H0-There is no statistically significant difference in the mean (average) of **Access to a number of learning tools** among the different Scientific Fields.

Anova: Single Factor	Improved cooperation between students and professo			
SUMMARY				
Groups	*Count*	*Sum*	*Average*	*Variance*
Strongly disagree	6	9	1.5	1.5
Disagree	6	5	0.833333	0.566667
Neither agree nor disagr	6	15	2.5	5.9
Agree	6	40	6.666667	49.46667
Strongly agree	6	36	6	33.6
ANOVA				
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	170.3333	4	42.58333	2.338887	0.08281918	2.758710
Within Groups	455.1667	25	18.20667			
Total	625.5	29				

Fig. 3. ANOVA- Improved cooperation students and professor/ Scientific field

Anova: Single Factor	A more flexible education process			
SUMMARY				
Groups	*Count*	*Sum*	*Average*	*Variance*
Strongly disagree	6	10	1.666667	1.066667
Disagree	6	1	0.166667	0.166667
Neither agree nor disagr	6	9	1.5	1.9
Agree	6	38	6.333333	37.86667
Strongly agree	6	48	8	80.4
ANOVA				
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F cr*
Between Groups	280.4667	4	70.11667	2.887836	0.042914	2.7
Within Groups	607	25	24.28			
Total	887.4667	29				

Fig. 4. ANOVA - A more flexible education process/Scientific field

Anova: Single Factor	A more efficient education process					
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Strongly disagree	6	10	1.666667	1.066667		
Disagree	6	5	0.833333	0.566667		
Neither agree nor disagree	6	30	5	35.2		
Agree	6	26	4.333333	18.66667		
Strongly agree	6	34	5.666667	28.26667		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	108.6667	4	27.16667	1.621568	0.199993	2.75871
Within Groups	418.8333	25	16.75333			
Total	527.5	29				

Fig. 5. ANOVA- A more efficient education process/Scientific field

Anova: Single Factor	Greater availability of learning resources					
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Strongly disagree	6	11	1.833333	0.966667		
Disagree	6	1	0.166667	0.166667		
Neither agree nor disagree	6	6	1	0.8		
Agree	6	28	4.666667	25.46667		
Strongly agree	6	60	10	108.8		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	382.4667	4	95.61667	3.510157	0.020907	2.75871
Within Groups	681	25	27.24			
Total	1063.467	29				

Fig. 6. ANOVA- Greater availability of learning resources/Scientific field

Anova: Single Factor	Improved learning facilities					
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Strongly disagree	6	9	1.5	2.3		
Disagree	6	7	1.166666667	0.566666667		
Neither agree nor disagree	6	26	4.333333333	11.46666667		
Agree	6	31	5.166666667	39.36666667		
Strongly agree	6	31	5.166666667	33.36666667		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	94.13333	4	23.53333333	1.351454824	0.278910957	2.75871
Within Groups	435.3333	25	17.41333333			
Total	529.4667	29				

Fig. 7. ANOVA- Improved learning facilities/Scientific field

Anova: Single Factor	A Modern learning environment attractive to studen					
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Strongly disagree	6	9	1.5	1.5		
Disagree	6	5	0.833333	1.366667		
Neither agree nor disagre	6	18	3	4.4		
Agree	6	37	6.166667	41.36667		
Strongly agree	6	36	6	48.8		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	148.3333	4	37.08333	1.903011	0.14127	2.758710
Within Groups	487.1667	25	19.48667			
Total	635.5	29				

Fig. 8. ANOVA- Modern learning environment attractive to students/ Scientific field

Anova: Single Factor	Easier monitoring of students in the learning p					
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Strongly disagree	6	11	1.833333	3.766667		
Disagree	6	7	1.166667	1.366667		
Neither agree nor disagre	6	21	3.5	9.1		
Agree	6	32	5.333333	25.86667		
Strongly agree	6	34	5.666667	43.46667		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F c*
Between Groups	97.666667	4	24.41667	1.460909	0.243829	2.758
Within Groups	417.83333	25	16.71333			
Total	515.5	29				

Figure 9. ANOVA- Easier monitoring of students in learning process/Scientific field

Anova: Single Factor	Scalability (possibility of constant upgrade of the sy					
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Strongly disagree	6	8	1.333333	1.4666667		
Disagree	6	2	0.333333	0.2666667		
Neither agree nor disagre	6	24	4	16		
Agree	6	40	6.666667	49.466667		
Strongly agree	6	31	5.166667	28.166667		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F cr*
Between Groups	166.666667	4	41.66667	2.1845509	0.0999622	2.75
Within Groups	476.833333	25	19.07333			
Total	643.5	29				

Figure 10. ANOVA- Scalability/Scientific field

Anova: Single Factor	Access to a number of learning tools					
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Strongly disagree	6	8	1.333333	1.466667		
Disagree	6	2	0.333333	0.266667		
Neither agree nor disagree	6	15	2.5	3.5		
Agree	6	37	6.166667	25.36667		
Strongly agree	6	42	7	63.6		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	210.4667	4	52.61667	2.792817	0.048016	2.758
Within Groups	471	25	18.84			
Total	681.4667	29				

Figure 11. ANOVA- Access to a number of learning tools/Scientific field

The results of the ANOVA test show a statistically significant difference among the groups in relation to A more flexible education process (Figure 4), Greater availability of learning resources (Figure 6) and Access to a number of learning tools (Figure 11). Since the calculated F-value is greater than the critical value and the p-value is below 0.05, the null hypothesis is rejected in all three cases or there is statistically significant difference in the mean regarding these benefits. This indicates that respondents from different scientific fields do not share the same perceptions regarding all three benefits. In other words, these benefits vary significantly depending on the scientific field. In all other cases null hypothesis not rejected. This indicates that the differences in group means are not large enough to be considered statistically significant. In other words, respondents from different scientific fields share relatively similar perceptions regarding all benefits where hypothesis is accepted.

Second general hypothesis: *There are no statistically significant differences in the Challenges and problems of using Cloud computing between different scientific fields.*

Several null hypotheses will follow from this general hypothesis:

- H0 - There is no statistically significant difference in the mean (average) of **Poor Internet connection** among the different Scientific Fields.
- H0 - There is no statistically significant difference in the mean (average) of **Less control over IT resources** among the different Scientific Fields.
- H0 - There is no statistically significant difference in the mean (average) of **Security risks** among the different Scientific Fields.
- H0 - There is no statistically significant difference in the mean (average) of **Costs (some platforms pay by number of users)** among the different Scientific Fields.
- H0 - There is no statistically significant difference in the mean (average) of **Application failure** among the different Scientific Fields.
- H0 - There is no statistically significant difference in the mean (average) of **Poor social interaction between the participants** among the different Scientific Fields.
- H0 - There is no statistically significant difference in the mean (average) of **High digital knowledge is required** among the different Scientific Fields.

- H0 - There is no statistically significant difference in the mean (average) of **Limited application control and flexibility** among the different Scientific Fields.
- Ho - There is no statistically significant difference in the mean (average) of **Difficult switching from one provider to another** among the different Scientific Fields.
- Ho - There is no statistically significant difference in the mean (average) of **Vulnerability to hacker attacks** among the different Scientific Fields.

Anova: Single Factor	Poor Internet connection			
SUMMARY				
Groups	*Count*	*Sum*	*Average*	*Variance*
Strongly disagree	6	7	1.166667	3.766667
Disagree	6	16	2.666667	9.466667
Neither agree nor disagree	6	23	3.833333	4.566667
Agree	6	44	7.333333	48.66667
Strongly agree	6	15	2.5	7.9
ANOVA				
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	131.6667	4	32.91667	2.213133	0.09653
Within Groups	371.8333	25	14.87333		
Total	503.5	29			

Fig. 12. ANOVA-Poor Internet connection/Scientific field

Anova: Single Factor	Less control over IT resources					
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Strongly disagree	6	4	0.666667	1.466667		
Disagree	6	12	2	7.6		
Neither agree nor disagree	6	46	7.666667	26.26667		
Agree	6	33	5.5	33.1		
Strongly agree	6	10	1.666667	3.866667		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F c*
Between Groups	210	4	52.5	3.630705	0.018252	2.7
Within Groups	361.5	25	14.46			
Total	571.5	29				

Fig. 13. ANOVA-Less control over IT resources/ Scientific field

Anova: Single Factor	Security risks				
SUMMARY					
Groups	*Count*	*Sum*	*Average*	*Variance*	
Strongly disagree	6	6	1	2.4	
Disagree	6	12	2	12.4	
Neither agree nor disagree	6	34	5.666667	20.26667	
Agree	6	35	5.833333	29.36667	
Strongly agree	6	16	2.666667	5.866667	
ANOVA					
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	115.8667	4	28.96667	2.060218	0.11641
Within Groups	351.5	25	14.06		
Total	467.3667	29			

Fig. 14. ANOVA-Security risks/ Scientific field

Anova: Single Factor	Costs (some platforms pay by number of users)				
SUMMARY					
Groups	*Count*	*Sum*	*Average*	*Variance*	
Strongly disagree	6	5	0.833333	1.366667	
Disagree	6	9	1.5	1.9	
Neither agree nor disagree	6	33	5.5	13.9	
Agree	6	36	6	35.6	
Strongly agree	6	19	3.166667	20.56667	
ANOVA					
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	128.5333	4	32.13333	2.190909	0.099188
Within Groups	366.6667	25	14.66667		
Total	495.2	29			

Fig. 15. ANOVA-Costs/ Scientific field

Anova: Single Factor	Application failure				
SUMMARY					
Groups	*Count*	*Sum*	*Average*	*Variance*	
Strongly disagree	6	7	1.166667	2.566667	
Disagree	6	16	2.666667	9.466667	
Neither agree nor disagree	6	28	4.666667	3.866667	
Agree	6	39	6.5	53.9	
Strongly agree	6	13	2.166667	6.966667	
ANOVA					
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	109.5333	4	27.38333	1.783543	0.16371
Within Groups	383.8333	25	15.35333		
Total	493.3667	29			

Fig. 16. ANOVA-Application failure/ Scientific field

Anova: Single Factor	Poor social interaction between the participant				
SUMMARY					
Groups	*Count*	*Sum*	*Average*	*Variance*	
Strongly disagree	6	5	0.833333	2.566667	
Disagree	6	14	2.333333	3.866667	
Neither agree nor disagree	6	25	4.166667	12.56667	
Agree	6	35	5.833333	33.36667	
Strongly agree	6	27	4.5	13.5	
ANOVA					
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	92.13333	4	23.03333	1.748482	0.170965
Within Groups	329.3333	25	13.17333		
Total	421.4667	29			

Fig. 17. ANOVA-Poor social interaction between participants/ Scientific field

Anova: Single Factor	High digital knowledge is required			
SUMMARY				
Groups	*Count*	*Sum*	*Average*	*Variance*
Strongly disagree	6	5	0.833333	2.566667
Disagree	6	12	2	6
Neither agree nor disagree	6	27	4.5	10.7
Agree	6	39	6.5	36.7
Strongly agree	6	21	3.5	21.9
ANOVA				
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	116.1333	4	29.03333	1.864298	0.14818
Within Groups	389.3333	25	15.57333		
Total	505.4667	29			

Fig. 18. ANOVA-High digital knowledge/ Scientific field

Anova: Single Factor	Limited application control and flexibility			
SUMMARY				
Groups	*Count*	*Sum*	*Average*	*Variance*
Strongly disagree	6	5	0.833333	0.966667
Disagree	6	12	2	6.4
Neither agree nor disagree	6	49	8.166667	32.56667
Agree	6	26	4.333333	23.46667
Strongly agree	6	13	2.166667	8.566667
ANOVA				
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	201.6667	4	50.41667	3.502779	0.021083
Within Groups	359.8333	25	14.39333		
Total	561.5	29			

Fig. 19. ANOVA-Limited application control and flexibility/ Scientific field

Anova: Single Factor	Difficult switching from one provider to anc			
SUMMARY				
Groups	*Count*	*Sum*	*Average*	*Variance*
Strongly disagree	6	5	0.833333	1.366667
Disagree	6	14	2.333333	15.06667
Neither agree nor disagree	6	36	6	27.2
Agree	6	31	5.166667	19.36667
Strongly agree	6	19	3.166667	19.76667
ANOVA				
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	105.6667	4	26.41667	1.595852	0.20644
Within Groups	413.8333	25	16.55333		
Total	519.5	29			

Fig. 20. ANOVA-Difficult switching from one provider to another/ Scientific field

Anova: Single Factor	Vulnerability to hacker attacks			
SUMMARY				
Groups	*Count*	*Sum*	*Average*	*Variance*
Strongly disagree	6	5	0.833333	0.966667
Disagree	6	12	2	6.4
Neither agree nor disagree	6	47	7.833333	42.96667
Agree	6	25	4.166667	17.76667
Strongly agree	6	16	2.666667	5.866667
ANOVA				
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Between Groups	175.6667	4	43.91667	2.96868	0.03902
Within Groups	369.8333	25	14.79333		
Total	545.5	29			

Fig. 21. ANOVA- Vulnerability to hacker attacks/ Scientific field

According to the results of ANOVA testing for the challenges Less control over IT resources (Figure 13), Limited application control and flexibility (Figure19), Vulnerability to hacker attacks (Figure 21) it can be concluded that the hypothesis is rejected, i.e., there are statistically significant differences in the mean values of these variables (calculated F-value is greater than the critical value and the p-value is below 0.05). This suggests that respondents from various scientific fields hold differing perceptions of the three identified challenges, or challenges vary significantly across scientific fields. In all other cases, the null hypothesis is not rejected, indicating that there is no statistically significant difference in the mean values regarding the challenges associated with the use of Cloud Computing in higher education institutions.

5. CONCLUSION AND RECOMMENDATION FOR FURTHER RESEARCH

Cloud computing has proven to be a highly effective tool for facilitating remote learning and teaching in recent years. Its advanced capabilities allow educational institutions, especially universities to maintain educational activities without any problems while offering a range of additional benefits that enrich the overall learning experience.

In this paper, we applied ANOVA testing to determine whether there are statistically significant differences between the means of three or more independent groups. In the case where hypothesis rejected regarding the benefit of use Cloud computing in higher education conclusion is that different groups perceive these benefits differently. These differences may arise due to the specific requirements, methodologies, or technological resources associated

with each discipline. Consequently, it can be concluded that the scientific field has a significant impact on how respondents evaluate benefits, A more flexible education process, Greater availability of learning resources and Access to a number of learning tools. When the hypothesis not rejected (accepted) can be concluded that observed variations among the groups may be due to random differences rather than real disparities between scientific field. Therefore, it can be concluded that the scientific field does not have a significant influence on respondents' opinions about these benefits where hypothesis not rejected.

Regarding the challenges and problems of Cloud Computing in cases where the hypothesis is rejected, it suggests that respondents do not share the same level of agreement regarding the examined statement. This indicates that the participants do not share uniform perceptions regarding the analyzed statement, and that the variable has a measurable effect on their opinions. In the case where hypothesis not rejected indicate that the differences observed between the groups are not statistically meaningful and are likely due to random variation. Therefore, it can be concluded that the respondents, regardless of their level of agreement, hold relatively similar opinions toward the analyzed variable.

According to the results of our research, it can be concluded that the benefits of using Cloud Computing in the education and teaching process are far greater than the challenges and problems. This finding supports the growing adoption of modern technological models such as Cloud Computing within higher education institutions. By leveraging the advantages that Cloud Computing provides, universities can overcome many of the long-standing barriers they have faced in implementing and enhancing the educational and teaching process. In addition, many of the challenges will be overcome in the future, which would mean that the positive effects of using Cloud computing by universities in the Republic of North Macedonia would be even greater.

Further research could focus on a sample that would include a larger number of universities and a larger number of respondents in order to determine whether the observed differences in respondents' perceptions of cloud computing persist in larger populations. Further analysis could examine how these perceptions evolve over time as universities increasingly adopt new technologies and modern educational models to enhance the teaching and learning process. It is also important to investigate the factors that influence respondents' perceptions such as digital literacy, technological readiness, teaching methods, etc. The use of different models of Cloud Computing in certain segments of the teaching and learning process could also be investigated and how all this could affect learning outcomes. As a separate direction for further research, it would be valuable to conduct a comparative analysis between the Republic of North Macedonia and EU member states, given the country's aspiration for membership. Such a comparison would help identify broader international trends in higher education and determine how Macedonian universities can adapt to them.

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ACCOUNTING AND AUDIT

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ADAPTING SWEDISH GOOD PRACTICES: A COMPARATIVE STUDY OF SUSTAINABILITY REPORTING IN LISTED COMPANIES AND IMPLICATIONS FOR BOSNIA AND HERZEGOVINA

ABSTRACT

The aim of this study is to explore how Swedish sustainability reports can serve as a reference point for Bosnia and Herzegovina in building a more coherent and comparable reporting system. This study focuses on sustainability reports from Swedish listed companies aligned with the CSRD as a benchmark for Bosnia and Herzegovina in 2024. By conducting a comparative and content analysis highlight how the structured and detailed form of Swedish reports can inform the development of BiH's practices, which at present lack consistency and formalization. The findings suggest that implementing the CSRD could accelerate BiH's transition toward systematic and internationally comparable reporting. The paper concludes on how Swedish experiences and reporting practices can be adapted to the Bosnian context.

The findings indicate that Swedish reports are characterized by a high degree of standardization, sectoral comparability, and integration with European sustainability frameworks, while Bosnian reports show inconsistency and limited stakeholder orientation. The study concludes that gradual adoption of the CSRD, accompanied by institutional support and sector-specific guidelines, could accelerate Bosnia and Herzegovina's transition toward systematic, transparent, and internationally comparable reporting. Swedish experiences thus offer concrete lessons for designing a more coherent sustainability reporting system in Bosnia and Herzegovina.

Keywords: *Sustainability reporting, content analysis, corporate sustainability reporting directive.*
JEL: M40, M41

1. INTRODUCTION

Sustainability reporting has developed considerably over the past decades, evolving from occasional environmental disclosures in the 1970s and 1980s, mainly focused on pollutant emissions and regulatory compliance, towards comprehensive reports that include economic, social, and governance dimensions of corporate performance. Early reports were largely descriptive and lacked methodological consistency, which limited comparability across companies and industries (Gray et al., 1996, p. 42; Tilt, 2007, p. 183). A major turning

point occurred in the late 1990s with the establishment of the Global Reporting Initiative (GRI), which introduced a common framework for disclosing sustainability indicators such as energy consumption, carbon emissions, labour practices, and community impact. This framework laid the foundation for the modern model of sustainability reporting based on the principles of economic, social, and environmental accountability, often referred to as the Triple Bottom Line (Elkington, 1998, p. 45).

Following the introduction of the GRI framework, the global focus on sustainability strengthened after 2015 through major initiatives such as the Paris Agreement and the UN Sustainable Development Goals (SDGs). These policies emphasized measurable climate commitments and greater corporate accountability. In response, the European Commission adopted the Action Plan on Financing Sustainable Growth in 2018, aiming to align financial systems with sustainability goals, integrate climate risks into investment decisions, and enhance corporate transparency (Hummel & Jobst, 2024, p. 326).

In recent years, the European Union has moved from encouraging voluntary sustainability disclosures to making them a legal requirement. The Non-Financial Reporting Directive (Directive 2014/95/EU, 2014) was the first systematic attempt to ensure that large public-interest entities disclose comparable information on environmental, social, and governance matters (La Torre et al., 2018, p. 599). This framework was later expanded through the Corporate Sustainability Reporting Directive (Directive (EU) 2022/2464, 2022), which widened the range of companies required to report, introduced the European Sustainability Reporting Standards (ESRS), and incorporated the principle of double materiality, meaning that firms must report both how sustainability issues affect them and how their activities affect society and the environment (EFRAG, 2023).

Parallel to these EU initiatives, companies are also expected to navigate several other reporting systems, including the Global Reporting Initiative (GRI), Sustainability Accounting Standards Board (SASB), Task Force on Climate-related Financial Disclosures (TCFD), Carbon Disclosure Project (CDP), and the UN Sustainable Development Goals (SDGs). The establishment of the International Sustainability Standards Board (ISSB) and EFRAG's Project Task Force reflects recent attempts to reduce inconsistencies among these frameworks and to create a more coherent reporting environment (Ferjančič et al., 2024, p. 7).

2. PREVIOUS RESEARCH

Sustainability reporting differs widely across Europe. Countries like Sweden have strong, standardized, and mandatory reporting rules, while many transitional economies, including Bosnia and Herzegovina (BiH), are behind. In BiH, sustainability reporting is mostly voluntary, fragmented, and not well established, with little involvement from stakeholders and low use of international reporting standards. Ljutić et al. (2024) conclude that there is a significant lag in the Western Balkan countries regarding the alignment and harmonization of corporate sustainability reporting with the European Sustainability Reporting Standards (ESRS). Although ESRS are mandatory for companies under the Corporate Sustainability Reporting Directive (CSRD) within the EU, their level of implementation in the Western Balkans region remains very limited. The main reasons for this are the lack of institutional and regulatory preparedness in Western Balkan countries for the effective implementation

of ESRS, as well as limited resources, expertise, and awareness among companies in the region about the requirements and standards of sustainability reporting. As BiH moves closer to EU integration, it will be important for companies to align their reporting with the CSRD and ESRS to ensure transparency, comparability, and accountability.

This study looks at how Sweden's experience with sustainability reporting can guide the creation of EU-compatible reporting frameworks in BiH. It focuses on practical issues such as adapting regulations, preparing institutions, and engaging professionals in the reporting process.

Early academic literature identified sustainability reporting as a largely voluntary and fragmented practice that served more as a communication or public relations instrument than as a formal governance mechanism (Rahi et al., 2022, p. 21; Rivo-López et al., 2025, p. 4). The lack of standardized frameworks led to inconsistencies in disclosure quality and limited comparability across firms.

The introduction of the GRI marked a critical step toward standardization, enhancing both the scope and credibility of sustainability disclosures (La Torre et al., 2018, p. 613). Firms adopting GRI-aligned reporting practices were found to experience greater stakeholder trust, improved internal sustainability management, and enhanced corporate accountability. Since the late 1990s, interest in sustainability reporting has increased sharply due to rising stakeholder expectations, global sustainability commitments, and growing regulatory requirements. Studies show that most of the world's largest corporations now publish sustainability reports, with the majority adhering to GRI standards (Bais et al., 2024, p. 8).

In Bosnia and Herzegovina, the disclosure of information on socially responsible activities, particularly in the banking sector, is still developing. Financial reporting in BiH is increasingly incorporating corporate social responsibility (CSR), focusing on companies' social, environmental, and stakeholder-related activities. However, banks in BiH, despite being profitable, show limited CSR engagement compared to their parent institutions abroad (Kulašin et al., 2018, p. 472).

Research also indicates that new sustainability reporting regulations, such as the EU Corporate Sustainability Reporting Directive (CSRD), are expected to significantly impact companies' operations, financial performance, and stakeholder relations in BiH. There is broad agreement among businesses on the importance of sustainability reporting for enhancing transparency and long-term performance. Overall, these findings suggest a growing awareness and willingness among companies to integrate sustainability practices into their reporting and operations (Serdar Raković, 2024, p. 87).

Research indicates that sustainability reporting and assurance are still relatively weak in Central and Eastern Europe, largely due to insufficient regulations, limited experience, and low demand from stakeholders. The EU's CSRD aims to close these gaps by broadening reporting requirements and strengthening both regulatory frameworks and professional expertise. However, smaller companies, particularly SMEs, often struggle with low awareness and limited resources (Krasodomska, 2025, p. 109). These challenges are especially relevant for Bosnia and Herzegovina, where strong institutional support, training,

and simplified reporting standards will be essential for the successful implementation of the CSRD.

In contrast, Sweden is widely recognized as a leader in corporate sustainability reporting, driven by both government initiatives and voluntary corporate practices. Swedish companies using the GRI guidelines vary in their approach: some, like ITT Flygt and SAS, produce reports closely aligned with environmental and economic indicators, while others, such as Electrolux and AB Volvo, use the guidelines mainly as inspiration without fully integrating social or economic aspects. Companies are motivated to use GRI to enhance credibility, structure their reports, allow for external verification, and support internal learning, with some tailoring reports to different audiences or focusing on specific sustainability areas like social issues (Swedbank) or animal welfare (Hedberg & von Malmborg, 2003, p. 159). The Swedish government has actively promoted CSR through strategies for sustainable development, state ownership policies, and the appointment of a CSR Ambassador, integrating sustainability into trade and foreign policy. Since 2007, state-owned companies have been required to publish sustainability reports in accordance with the Global Reporting Initiative (GRI) guidelines, following a "comply or explain" principle. Studies show that these requirements have increased awareness and commitment to sustainability, led to more structured reporting processes, and raised the priority of sustainability issues among management and boards, although the impact on actual business practices has been more limited (Hąbek & Wolniak, 2013, p. 45).

The study by Pham et al. (2021, p. 16) highlights a generally positive relationship between sustainability practices and financial performance among Swedish companies, particularly for indicators like EY, ROA, ROE, and ROCE. Inclusion in the DJSI was shown to enhance firm value, while voluntary disclosures like CSRD mainly support reputation and legitimacy. The findings suggest that sustainability initiatives can serve both as an industry "best practice" and as a potential source of competitive advantage, though outcomes vary across specific measures. The authors recommend stronger government oversight and more qualitative reporting to further improve business sustainability, while noting the need for broader and longer-term studies to validate these results.

In Sweden, sustainability considerations in real estate valuation are increasingly recognized, particularly environmental factors such as energy performance, flood risk, and soil contamination, which can affect net operating income and market value. However, integration of ESG factors in valuation reports remains limited due to a lack of standardized data, measurement tools, and clear market signals, with banks and tenants currently driving much of the focus on sustainability (Palm, 2025, p. 259).

3. METHODOLOGY

This study uses a qualitative comparative approach, based on previous content analysis, to look at how companies report on sustainability in Sweden and Bosnia and Herzegovina. Research (Ferjančič et al., 2024, p. 2) indicates that sustainability reporting has become a central focus in corporate reporting studies. Advances in technology and methodology have further elevated the importance of content analysis, enabling automated examination of large volumes of corporate disclosures.

The main goal is to see how Swedish practices, which follow the European sustainability reporting regulation, can help BiH create clearer and more comparable sustainability reports. A qualitative method is suitable because it allows a detailed look at both the content and context of these reports. Comparing the two countries helps identify similarities, differences, and lessons that BiH could apply, as well as potential challenges.

The selection of companies for this comparative study was informed by the need for cross-country and cross-sector comparability (Table 1). This approach allows for a nuanced understanding of how sustainability reporting practices differ across various sectors and national contexts. Sweden was selected as a benchmark because it has strong EU sustainability rules and a tradition of transparent reporting. Bosnia and Herzegovina were chosen as a developing context with emerging sustainability practices and weaker regulations.

Table 1. Research Sample

No	Sector	Company – Sweden	Company – B&H
1	Industry	Volvo	Famos
2	Technology	Ericsson	BH Telecom
3	Retail	H&M	Hercegovina Auto
4	Construction	Skanska	Doboj putevi
5	Banking	SEB	ASA Banka
6	Energy	Vattenfall	Elektroprivreda BiH

Source: authors' processing

The primary data for this study were collected from the corporate sustainability and annual reports of the selected listed companies in Sweden and BiH for the 2024. These companies are recognized as sector leaders, which is why they were chosen for the content analysis in this study. The companies were selected to enable a comparison of how sustainability issues are reported in Sweden and Bosnia and Herzegovina. The sample includes six sectors that are important to both economies: industry, technology, retail, construction, banking, and energy. For each sector, one Swedish and one Bosnian company with comparable activities were chosen.

For the content analysis, we first collected all available corporate sustainability reports from the selected companies in both Sweden and Bosnia and Herzegovina. The analysis was conducted using the tool Taguette, which allowed us to systematically code the data and identify recurring themes and associated keywords for each theme (inductive approach) - Table 2.

The data were classified according to three criteria for each keyword:

- Coverage – indicating whether a topic was fully covered, partially covered, or not covered at all
- Emphasis – showing whether a topic was highlighted, simply mentioned, or not mentioned.
- Evidence – specifying whether the information was supported with numbers, descriptive only, or absent.

Table 2. Codes, Topics, and Keywords Used in Content Analysis

Code	Topic	Key words
R	Regulation	EFRAG
		European Commission
		Local regulation
		EU directive
		GRI
		SASB
		CSRD
E1	Climate footprint	Emissions
		Energy
		Carbon
		Gas
		Electricity
E2	Climate risk and policy	Climate
		Climate change
		Climate risks
		Climate actions
S1	Customers service	Customers
		Service
		Products
S2	Employee engagement and feedback	Survey
		Employee
		Employee engagement
		Feedback
S3	Health and safety	Safety
		Health
		Wellbeing
		Mental
S4	Stakeholders engagement	Stakeholders
		Key stakeholders
G1	Local communities	Communities
		Needs

Authors' creation based on: Ferjančič et al. (2024), Correa-Mejía et al. (2024), and Sharma (2025)

The data were classified according to three criteria for each keyword:

- Coverage – indicating whether a topic was fully covered, partially covered, or not covered at all
- Emphasis – showing whether a topic was highlighted, simply mentioned, or not mentioned.

- Evidence – specifying whether the information was supported with numbers, descriptive only, or absent.

From these coded and classified data, key recommendations for implementing sustainability reporting in Bosnia and Herzegovina were derived using a summative approach, focusing on the most relevant and transferable practices observed in Swedish companies.

To further support and clarify the analysis, descriptive statistics were included, comparing the frequency of specific sustainability themes across sectors and countries. Additionally, a word cloud was generated to visualize the frequency of keywords in the reports, providing an intuitive overview of the most emphasized topics and enabling a clearer understanding of the main focus areas within sustainability reporting in both countries.

4. RESEARCH RESULTS AND DISCUSSION

The data were obtained from publicly available company documents, including annual reports, sustainability reports, ESG reports for 2024.

Swedish companies primarily publish annual and/or sustainability reports in line with international frameworks and regulation while BiHs companies mainly don't report about sustainability information or report within their annual reports (Table 3).

Table 3. Reporting type

Company	Reporting type
Volvo	Annual report 2024
Ericsson	Sustainability and corporate responsibility report 2024
H&M	Annual and sustainability report 2024
Skanska	Annual and sustainability report 2024
SEB	Sustainability review 2024
Vattenfall	Annual and sustainability report 2024
Famos	Financial report – not available sustainability information 2024
BH Telecom	Annual report 2024
Hercegovina Auto	Financial report – not available sustainability information 2024
Doboj putevi	Financial report – not available sustainability information 2024
ASA Banka	ESG report 2024
Elektroprivreda BiH	Report om enviromental protection 2024

Source: Authors' processing

To visualize the frequency of key sustainability words related to identified topics across all companies, a word cloud was generated (Figure 1). This graphical representation highlights the most frequently mentioned words, with larger words indicating higher coverage and emphasis in the reports.



Fig. 1. Word Cloud of Key Terms in Sustainability Reports

Source: Authors' processing

4.1. Reporting Frameworks and Regulatory Alignment (R)

The findings show that Swedish companies are well aligned with international sustainability frameworks, especially the Global Reporting Initiative (GRI), which remains the most commonly used and integrated standard. While references to CSRD and EFRAG are emerging, GRI is still the dominant framework.

In contrast, few companies in Bosnia and Herzegovina mention any recognized reporting standard, revealing an early and fragmented stage of sustainability reporting (Figure 2. - Regulation).

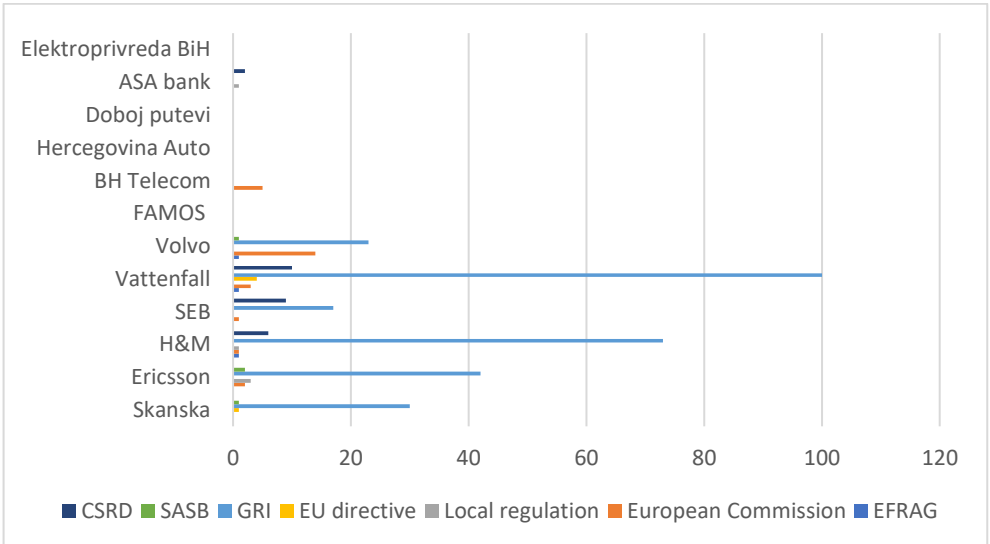


Fig. 2. Regulation

Source: Authors' processing

The qualitative content analysis confirms that Swedish companies demonstrate more structured and consistent integration of sustainability reporting frameworks compared to BiH companies. In particular, GRI appears as the dominant and most comprehensive framework in Swedish reports, often fully covered, highlighted, and supported with concrete evidence. Regulations such as CSRD and another EU directives are mentioned only partially, suggesting that while awareness of new EU standards is growing, their practical implementation is still in progress.

In contrast, B&H companies show minimal or no reference to any established reporting frameworks or regulatory bodies. Mentions of local regulation, CSRD, or GRI are sporadic and largely descriptive, without clear evidence of application or integration into strategies. This absence reflects early-stage development of sustainability practices.

4.2. Environmental Reporting (E1 & E2)

The results clearly show a major gap between these companies in how often and how environmental topics appear in their sustainability reports. Swedish companies show high reporting frequency on key terms such as emissions, energy, carbon, and climate change. In contrast, BiH companies show very limited references to these terms, often with zero or minimal mentions (Figure 3 - Environmental).

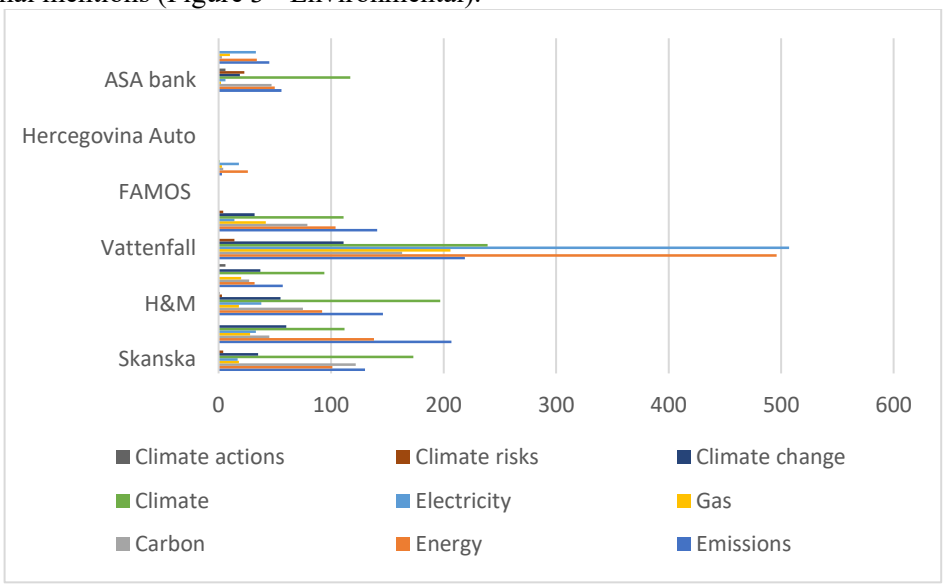


Fig. 3. Environmental

Source: Authors' processing

Swedish companies consistently address climate risks and actions, suggesting that climate strategy is integrated into their broader sustainability and business planning, explaining not just "what to do" but also "how to do it." The reports often provide concrete actions and detailed descriptions of processes behind the reporting. Reporting in BiH companies is largely descriptive, highlighting issues without supporting evidence or explanation of the measures taken. The few mentions of energy and emissions, such as in Elektroprivreda BiH, are mostly partial.

4.3. Social reporting (S1-S4)

Swedish companies show high coverage of customer-related topics, with frequent mentions of customers, services, and products, often supported with calculating or concrete activities. Companies like Volvo, Vattenfall, and Ericsson stand out for consistently highlighting their practices. In contrast, most BiH companies provide little to no information on customer service, with only BH Telecom and Elektroprivreda BiH giving minimal coverage.

Swedish companies report extensively on employees, surveys, and feedback, indicating a strong focus on employees' engagement. BiH companies show minimal reporting, with some references from BH Telecom and ASA Banka, but coverage is generally partial and descriptive. Swedish companies provide detailed reporting on safety and health, showing high coverage and emphasis. Reporting on wellbeing and mental health is limited even in Sweden, but still more present than in BiH, which companies rarely mention safety or health, and wellbeing and mental health are almost entirely absent.

Swedish companies systematically address stakeholder relationships and key stakeholder groups, although the frequency is lower than for customer or employee topics, but very few mentions in ASA Banka and BH Telecom (Figure 4 – Social).

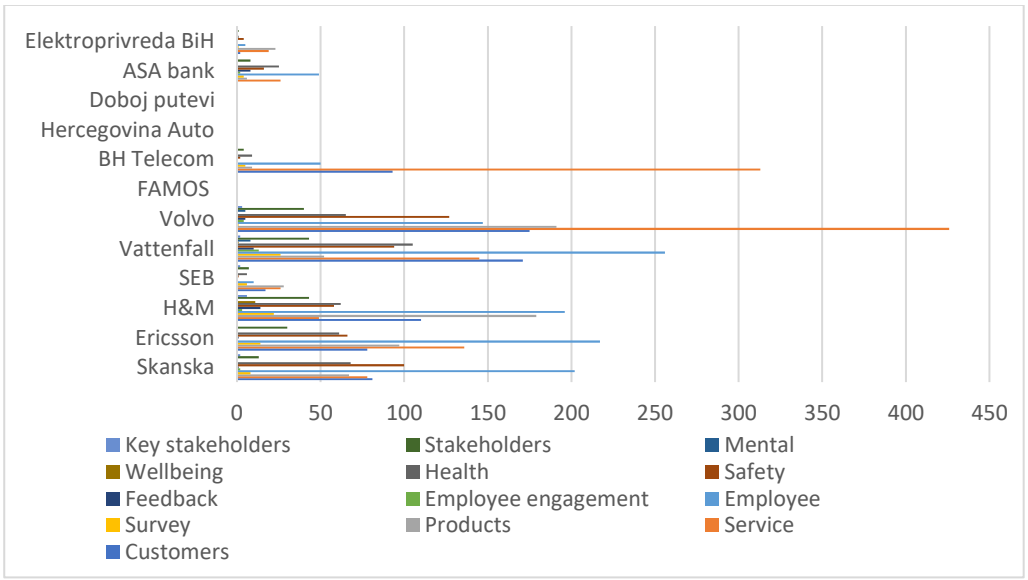


Fig. 4. Social reporting

Source: authors' processing

4.4. Governance reporting (G1)

The analysis of community-related topics (Figure 5 – Governance) in sustainability reports shows that Swedish companies provide moderate to full coverage.

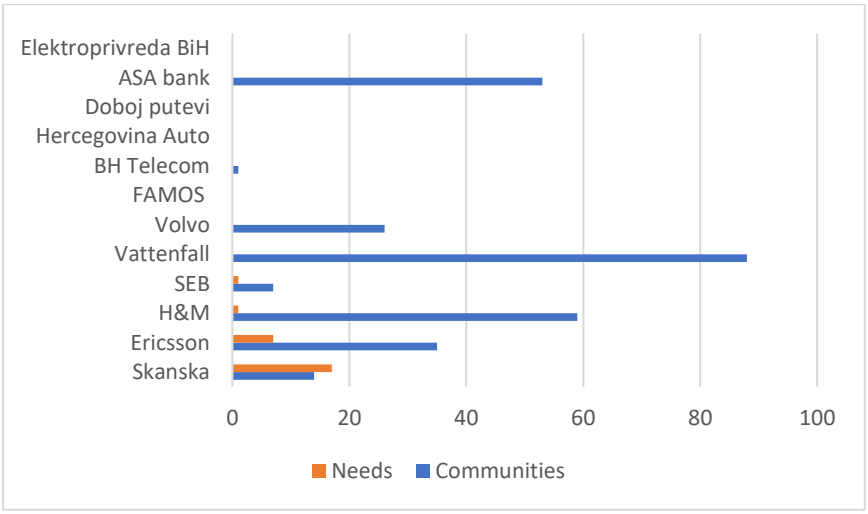


Fig.5. Governance reporting

Source: authors' processing

Skanska, Ericsson, H&M, Vattenfall, and Volvo highlight community initiatives and provide supporting evidence, indicating an active engagement with local communities and structured reporting of their activities. SEB provides partial coverage with descriptive information, showing some attention to community needs, while some of BiH companies offer little to no reporting. ASA bank shows full coverage and highlights its community efforts, reflecting sector-specific engagement.

5. CONNCLUSION

The analysis of sustainability reporting practices in BiH companies reveals key deficiencies: limited references to recognized reporting frameworks, predominantly descriptive environmental data without quantitative indicators, a focus on employee issues without measurable indicators in the social dimension, and weak ESG governance due to insufficient internal knowledge and unclear responsibilities. Environmental data in existing reports are mostly descriptive, with few quantitative metrics on emissions, energy use, or carbon footprint. Implementing systematic tracking and reporting of these indicators would improve transparency, enable compliance with international standards, and support evidence-based decision-making. In the social dimension, reporting is predominantly focused on employee issues, without the inclusion of measurable indicators or key performance metrics. Incorporating employee surveys and activities would strengthen internal accountability and provide a clearer picture of HR management. Governance also represents weak points, as internal ESG knowledge is limited and responsibilities are often unclear. Building internal capacity and assigning clear ESG roles would institutionalize sustainability management and integrate it into corporate decision-making. BiH companies should demonstrate more systematic and evidence-based reporting on community involvement.

The comparative analysis demonstrated that Swedish sustainability reporting models can serve as a valuable reference framework for BiH. While Swedish reports are highly

standardized, sectorally comparable, and integrated with European sustainability frameworks, BiH reports show inconsistency and limited stakeholder orientation.

In conclusion, gradual adoption of the CSRD directive with institutional support and sector-specific guidelines could accelerate BiH's transition toward systematic and internationally comparable reporting. Concrete steps include: implementation of GRI or CSRD frameworks, systematic tracking of quantitative environmental indicators, strengthening internal capacities, and clear allocation of ESG responsibilities.

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THE TRANSFORMATION OF THE ACCOUNTING PROFESSION IN THE DIGITAL AGE: AN ANALYSIS OF XBRL STANDARDS AND FINANCIAL REPORTING VISUALIZATION TOOLS

ABSTRACT

This paper examines the transformation of the accounting profession, focusing on the evolving role of accountants in the digital era. As digital technologies automate traditional accounting tasks, the profession must redefine its relevance within modern organizations. Accountants are increasingly expected to combine financial expertise with technological competence, participating in the development of accounting information systems and using digital tools for the preparation, analysis, and visual presentation of financial data. These changes reinforce the importance of collaboration between accountants and management in data-driven decision-making processes.

The paper presents empirical findings on the digital readiness of accountants in the Federation of Bosnia and Herzegovina (FBiH). It analyses their competencies, the extent of organizational support for digital training, and the adequacy of the educational framework in preparing them for technological transformation. The results provide insights and recommendations aimed at strengthening the strategic position of accountants in the digital environment. Moreover, the study highlights the blurred boundaries between accounting and information technology, where new responsibilities lack clear professional ownership. It argues that accountants should view digitalization not as a threat, but as an opportunity to expand their professional influence and reaffirm their role in shaping the future of the accounting profession.

Keywords: *role of accountants, digital environment, XBRL standards, visualization tools.*
JEL: M40, M41, M48

1. INTRODUCTION

The accounting profession is undergoing an intensive transformation driven by the dynamic development of digital technologies. The transformation of accountants' tasks is progressing more rapidly than the educational framework that should prepare them for their new role in practice. Digitalisation enables the automation of many routine processes that previously consumed much of accountants' time. This primarily refers to the recording of business transactions and the archiving of accounting documentation, but also to reporting, both internally to company management and externally to tax authorities, statistical agencies,

banks, business partners, and others. Such developments have reshaped the traditional role of accountants in modern organisations. No longer merely interpreters of historical data, accountants are increasingly becoming active participants in processes of strategic planning and business decision-making.

Modern technologies, such as the XBRL standard for digital financial reporting, have enhanced the precision, interoperability, and accessibility of data, significantly improving communication between companies, regulators, and investors. At the same time, software tools for data visualisation (e.g., Power BI, Tableau and similar systems) enable accountants to transform traditional financial statements into interactive and graphically enriched representations that provide management with clearer insights into business performance. These changes influence not only the technical aspects of accounting work but also redefine the identity and status of accountants as key partners in the management process.

The role of the accountant in the digital age can no longer be reduced to the mere use of ready-made software solutions. Instead, active involvement is expected in the design, development, and implementation of accounting information systems, as well as the ability to lead and manage multidisciplinary teams. This, in turn, raises the issue of the competence framework required of accountants: in addition to traditional accounting knowledge, they must possess an understanding of digital taxonomies, reporting standards, visualisation tools, and the fundamentals of information technologies.

The aim of this paper is to analyse the level of digital readiness of accountants in the Federation of Bosnia and Herzegovina (FBiH) and to investigate the extent to which the existing educational and professional framework meets the requirements of the contemporary business environment. Special emphasis is placed on the application of the XBRL standard and software tools for the visualisation of financial reports, as two key elements of the digital transformation of accounting. The findings are intended to serve as a foundation for improving curricula, designing programmes of continuing professional education for accountants (CPE), and creating strategies for personal professional development that will enable accountants to position themselves as leaders of digital transformation within the economic system.

2. LITERATURE REVIEW

The role of accountants is undergoing a profound transformation in the digital era, shifting from traditional number-crunching towards strategic business partnering and data analysis (Mujiono, 2021; Jayashree & Jayakani, 2024). This transformation is driven by technological advancements, organisational culture, global trends, and the influence of parent companies (Samanthi & Gooneratne, 2023).

Accountants are now expected to be agile learners, adopting technologies such as artificial intelligence (AI), blockchain, and big data analytics (Abdullah & Almaqtari, 2024; Jayashree & Jayakani, 2024). Within the context of Robotic Process Automation (RPA), accountants increasingly assume roles as identifiers, explainers, trainers, sustainers, and analysers (Kokina et al., 2020).

In order to adapt, accountants must develop new technical skills and enhance their digital literacy. This paradigm shift highlights the importance of embedding emerging technologies and non-financial reporting into accounting education to adequately prepare future professionals for their evolving roles (Samanthi & Gooneratne, 2023). Accountants must therefore strengthen their digital skills to adapt to new technologies and to improve organisational decision-making (Alassuli et al., 2025). Larios Soldevilla et al. (2025) propose the integration of technological, soft, and cognitive skills into educational programmes in order to prepare accountants for the challenges of the digital age. Similarly, Vysotskaya and Prokofieva (2024) evaluate the effectiveness of management accounting courses incorporating data and analytics, with a focus on student perceptions. Their findings suggest that the integration of data analytics into curricula enhances students' understanding of accounting practices and prepares them to utilise advanced tools in professional contexts.

In addition, Nofel et al. (2024) conduct a systematic review of the use of the Internet of Things (IoT), blockchain, and XBRL in accounting information systems. The authors emphasise the importance of integrating these technologies to improve the quality of digital financial reporting, highlighting the necessity for accountants to understand and apply these tools in practice.

Accountants are now expected to grasp technological innovations, engage in the development of accounting information systems, and utilise digital software solutions for financial reporting, planning, and analysis (Popović & Božić, 2025). This evolution reinforces the necessity of enhanced interaction between accountants and management, accompanied by a strengthened role in strategic decision-making. The implementation of technologies such as XBRL requires the collaboration of accounting and IT professionals, with accountants increasingly assuming leadership in software development and implementation (Popović & Božić, 2025).

Prior research therefore stresses that accountants should not be passive users of software tools but should actively participate in their design, development, and implementation, while adopting a more strategic and analytical role within organisations. This requires familiarity with, and active use of, advanced digital solutions, including the XBRL standard, data visualisation tools such as Power BI and Tableau, AI, blockchain, big data analytics, and IoT. Accountants must be agile learners, continuously upgrading their skills and knowledge whilst closely following technological trends.

In the case of Bosnia and Herzegovina, however, the practical use of such digital solutions remains limited. According to Jupić and Gadžo (2025), only 21% of companies currently apply AI tools in accounting processes, while a mere 20% of respondents report using advanced document management systems (DMS) or cloud-based solutions. Furthermore, 57% of accountants still manually re-enter data from bank statements, with only 12% making use of automated file imports for posting, and just 6% indicating that their accounting software independently recognizes and records bank statements.

3. RESEARCH OBJECTIVES, METHODOLOGY, AND DATA SOURCES

The aim of this study is to examine how digital transformation, particularly through the adoption of the XBRL standard and report visualisation tools, is reshaping the traditional

role of accountants. Special attention is given to identifying new tasks and responsibilities arising from the automation of routine activities, as well as the necessity of understanding the technological aspects of accounting systems.

One objective is to emphasise the importance of accountants' active participation in the development and implementation of software solutions, and their role as project leaders in collaboration with IT specialists. Furthermore, the research aims to highlight the need to strengthen communication between accountants and management through the effective presentation of financial reports using modern technologies.
This study seeks to provide both scientific insights and practical guidance, enabling accountants to successfully adapt to the demands of the digital era and maintain a central role in contemporary business processes.

Primary data were collected through an online survey questionnaire, focusing on the level of digital readiness of accountants in the Federation of Bosnia and Herzegovina (FBiH), organisational support for training in digital technologies, and the adequacy of the educational framework in meeting the contemporary needs of accountants. The questionnaire employed a five-point Likert scale to measure respondents' attitudes and perceptions, ranging from "strongly disagree" to "strongly agree."

The research population consisted of accountants in the FBiH, and the sample comprised 41 respondents who completed the questionnaire appropriately. The structure of the sample according to years of professional experience in accounting is as follows: 11 respondents, or 26.83%, have up to 5 years of experience; 5 respondents, or 12.19%, have between 5 and 10 years; 11 respondents, or 26.83%, have between 10 and 15 years; 8 respondents, or 19.51%, have between 15 and 20 years; and 6 respondents, or 14.63%, have more than 20 years of professional experience in accounting.

4. RESEARCH RESULTS AND DISCUSSION

4.1. Digital Transformation and Its Effects on Accounting

Digital transformation is significantly altering the way accounting functions are performed, introducing new technologies that automate traditional processes and enhance work efficiency. Accounting, as one of the core business functions, is not exempt from these changes.

The automation of routine tasks, such as data entry, calculations, and reporting, reduces the need for manual work, while accountants' focus is shifting towards data analysis, result interpretation, and advisory roles within the business. This transformation requires accountants to acquire new technical skills and to develop a comprehensive understanding of digital tools that support contemporary accounting systems.

Although e-invoices in XML format and the XBRL reporting standard have not yet been officially implemented in Bosnia and Herzegovina, their eventual adoption will necessitate that accountants adapt to new tasks involving digital documentation and the digital format of financial statements. In this context, we examined the frequency with which accountants currently utilise various software solutions in practice (see Table 1).

Table 1. Frequency of Use of Various Software Solutions by Accountants in Practice

Type of Software	Never (score 1)	Rare (score 2)	Occasionally (score 3)	Often (score 4)	Daily (score 5)	Avg	Std. dev
Financial and Inventory Accounting Software	1	1	4	5	30	4.51	0.94
ERP Software	8	3	16	3	11	3.15	1.41
Financial Reporting Software	2	5	16	5	13	3.54	1.19
Data Analysis Software (Excel, statistical packages, etc.)	1	1	14	8	17	3.95	1.03
Data Visualisation Software (Power BI, Tableau, QlikView, etc.)	7	13	9	8	4	2.73	1.23
AI Tools for Accounting Assistance	18	8	6	5	4	2.20	1.34
Cloud Technology	7	9	12	4	9	2.95	1.36

Source: Authors' own elaboration based on collected data

Regarding the question of whether accountants are preparing for the implementation of e-Invoices in XML format, which is anticipated in Bosnia and Herzegovina as early as 2026, 30 ispitanika ili 73,17% of respondents stated that they are not preparing, while only 11 respondents ili 26,83% reported that they are actively preparing for their introduction. Given the approaching deadline, the question arises as to when accountants and their software solutions, in collaboration with the tax authorities, will be fully operational.

It can be concluded that digital transformation in accounting in the Federation of Bosnia and Herzegovina (FBiH) is progressing gradually. Accountants regularly use basic software for financial and inventory accounting, whereas ERP systems and financial reporting software exhibit moderate adoption.

Data analysis tools are increasingly becoming daily assistants for accountants in analytical and advisory functions, while data visualisation software, AI tools, and cloud technologies remain limited in use, reflecting the relatively slow transition to advanced digital solutions. These findings indicate that the profession is currently in a transitional phase. Basic digitalisation is present, but the full integration of modern technologies requires further training, investment in infrastructure, and adaptation to new standards such as XBRL, e-Invoices, Power BI, and similar tools, in order for accountants to fully assume strategic and analytical roles within business operations.

4.2. Active Role of Accountants in the Development and Implementation of Software Solutions

Software in accounting represents a powerful tool that enables faster and more efficient data processing. However, without the knowledge and engagement of accountants, it remains merely an empty platform. Accountants bring the entire accounting process to life through

data entry, interpretation, and linking to specific business events, tasks that require human judgment, knowledge, and experience. While IT specialists serve as technical executors in software development, it is the accountant who defines functionality by understanding accounting processes, legal requirements, and everyday practical challenges. During the development process, accountants collaborate with IT teams as business process analysts, translating practical knowledge into technical specifications. Active involvement in software development provides accountants with the opportunity to enhance their own skills, understand the technical aspects of their work, and contribute to creating intuitive and reliable systems tailored to both business needs and legal regulations.

The research findings regarding the current role of accountants in the selection, design, testing, and upgrading of software solutions are presented in Table 2.

Table 2. Accountants' Involvement in the Selection and Development of Software Solutions

Involvement in the Selection and Development of Software Solutions	**Never (score 1)**	**Rarely (score 2)**	**Occasionally (score 3)**	**Often (score 4)**	**Daily (score 5)**	**Avg**	**Std Dev**
Selection of Software Solutions in Business Operations	13	5	6	6	11	2.97	1.57
Designing Software Solutions	16	9	7	3	6	2.35	1.41
Testing of Software Solutions	13	7	4	9	8	2.97	1.57
Upgrading Software Solutions	11	5	9	8	8	3.24	1.56

Source: Authors' own elaboration based on collected data

The results from the table clearly indicate that accountants in the Federation of Bosnia and Herzegovina still have a limited role in the processes of creating and improving accounting software solutions, even though their knowledge and experience constitute a fundamental basis for the functionality of these tools. Most accountants are involved in the selection of software solutions, yet nearly one-third of respondents never participate in decision-making. Even more concerning is that almost half of the participants report never being involved in the design of software solutions, while engagement in testing and upgrading is somewhat higher, but still insufficient.

These findings confirm that accountants largely remain passive users rather than active creators of digital tools, which carries the risk that software solutions may not be adequately tailored to the practical needs of business or the specific legal framework. In light of accelerated digitalisation, the future of the profession requires proactive involvement of accountants in all stages of software system development, from defining functional requirements to testing and enhancement. By taking a more active role in the development of digital tools, accountants can directly contribute to the creation of intuitive and reliable systems that simultaneously meet business practice requirements and legal regulations, thereby improving the quality of financial reporting and strengthening their competitiveness in the labour market.

4.3. XBRL Technology and Its Application in Accounting

One of the key aspects of digital transformation in accounting is the adoption of the XBRL (eXtensible Business Reporting Language) standard, which enables automated, accurate, and standardised financial reporting. XBRL facilitates the exchange of data between companies, regulatory authorities, and investors, significantly enhancing transparency, accuracy, and processing efficiency.

A central component of the XBRL system is the taxonomy, which defines which information must be reported and how it should be structured. Each data item in a report is tagged with a unique identifier, allowing for consistent labelling and automated data processing. The taxonomy consists of schema files (.xsd) that define reportable concepts (e.g., Revenues, Net Income, Assets) and linkbase files (.xml) that specify relationships between these concepts, including presentation hierarchies, calculation rules, and references to accounting standards such as IAS and IFRS. Official taxonomies (IFRS, US GAAP, ESEF) are published by regulatory authorities and used in XBRL software to generate validated and comparable reports (Jupić, 2025).
XBRL software libraries are programming tools that enable the validation, parsing, manipulation, and generation of XBRL documents. Libraries such as Arelle, XBRLAPI, and Altova allow users to automatically verify report compliance with the taxonomy, analyse content, and generate documents ready for submission to regulatory authorities (Ramanan et al., 2024). XBRL Certified Software refers to software verified by XBRL International to ensure compliance with official specifications and interoperability between different tools (XBRL International, n.d.).

We investigated the extent to which accountants in the Federation of Bosnia and Herzegovina are familiar with the XBRL standard for financial reporting. Of the total respondents, 48.78% of accountants were not familiar with XBRL, while 36.58% had limited knowledge of the technology. Only 12.19% understood the basic concepts related to XBRL, and merely 2.43% had practical experience using XBRL software.

These findings reflect the current stage of digital transformation among accountants in the FBiH, where knowledge and practical application of XBRL remain limited. Although the XBRL standard enables automated and standardised financial reporting, enhances transparency, and facilitates data analysis, the majority of accountants are not yet prepared for its active implementation.

The results clearly indicate the need for education, training, and the introduction of practical tools and software libraries that enable the validation and generation of XBRL documents. Given the advantages, such as reduced errors, accelerated processes, and easier compliance with regulatory requirements, the development of competencies in this area is crucial for the effective digital transformation of the accounting profession in Bosnia and Herzegovina.

4.4. Report Visualisation Tools and Their Application in Accounting

The development of technology and process automation in accounting is bringing significant changes to the daily work of accountants. Automation enables many manual, repetitive, and time-consuming tasks to be performed much more quickly and efficiently. Instead of spending hours manually entering data or verifying document accuracy, a large portion of these tasks can now be completed automatically through software solutions. This reduces the likelihood of human error and frees accountants from routine duties.
By being relieved of manual tasks, accountants can focus on more complex and strategic activities, such as actively participating in the development of accounting information systems, analysing data, interpreting financial statements, and providing management consultancy. Tools that assist accountants in presenting reports, statements, and various calculations in a clear, organised, and accessible manner are now widely used in practice, with Microsoft Power BI, Tableau, and QlikView being the most common.

The desktop version of Power BI is free to download and use, making it suitable for accountants' needs in smaller firms. Power BI utilises the VertiPaq in-memory engine, which enables rapid data retrieval and visualisation, even with large datasets. Accountants primarily work with Excel spreadsheets, SQL databases, ERP systems, and external services such as Google Analytics. Within Power BI, accountants create data models, define relationships between tables, apply DAX (Data Analysis Expressions) formulas for calculations, and design visual representations. Data is loaded into the Power Query Editor, where transformations can be applied, including merging tables, filtering, cleaning duplicates, and creating new columns or measures. Visualisations rely on pre-defined visuals such as bar and line charts, pie charts, scatter plots, tables, matrices, and key performance indicator (KPI) cards. What sets Power BI apart, however, is the interactivity of these visuals.

When a user clicks on a specific segment of a chart (e.g., revenue by region), all other visuals on the dashboard automatically filter to reflect that selection. Additionally, Power BI allows the creation of custom visuals through the Microsoft AppSource library or by developing bespoke solutions using R and Python scripts. This provides virtually limitless possibilities for advanced analytics and enables tailored solutions to meet individual business needs.

Compared to Power BI, Tableau offers greater flexibility as it supports a wide range of connectors to various data sources. Users can connect directly to Excel spreadsheets, CSV files, Google Sheets, SQL Server, Oracle, MySQL, PostgreSQL databases, as well as cloud services (Parthe, 2023). Tableau provides two primary modes for working with data**:** Live Connection and Extracts**.** In the Live Connection mode, data remains in the original source, and Tableau sends queries directly to that database each time a user creates a visualisation or applies a filter. This is particularly useful for large, frequently updated databases, although performance depends on the speed of the underlying system. Extracts, on the other hand, are static copies of data imported into Tableau and stored in an optimised format (.hyper file). Once connected to a data source, the data enters the Data Pane within Tableau Desktop. Here, users can define the data structure, add calculated fields, change field types, and perform basic transformations such as filtering, aggregation, or table merging.

Tableau supports two types of table connections: Joins and Blending. Joins are used when tables originate from the same data source and are connected via a common key (e.g., client ID). Tableau supports various join types (inner, left, right, full outer), allowing flexible data combination. Data Blending, by contrast, is employed when data comes from different sources and cannot be directly joined. In this case, one table acts as the primary source and the other as secondary, with data combined at the visualisation level. This feature is particularly useful for accountants who wish to integrate, for example, internal financial data from an ERP system with external indicators, such as macroeconomic statistics.

The technical aspect of data modelling in Tableau is distinctive, as it utilises the Data Relationship model concept. For visualisation, Tableau relies on a drag-and-drop interface, which facilitates rapid and intuitive creation of interactive reports. The free version of Tableau is Tableau Public, though it has the limitation that all visualisations created are publicly accessible.

Beyond technical proficiency, effective presentation of financial information to management and other decision-makers is equally important. Managers often do not possess in-depth accounting knowledge; therefore, accountants must convey key insights from financial statements clearly, concisely, and comprehensibly. Effective data presentation supports timely and well-informed business decisions. Consequently, today's accountant must be not only an expert in accounting but also skilled in technology and communication. Continuous professional development in software and presentation skills has become essential. Automation relieves accountants of mundane tasks but simultaneously places greater emphasis on analytical and communication capabilities, positioning the accountant as a strategic partner in business processes.

Given the importance of this topic, we investigated the extent to which accountants in practice use data visualisation tools. When asked whether they had experience with digital reporting tools (Power BI, Tableau, QlikView, etc.), 85.37% of respondents indicated no experience, while only 14.63% reported having practical experience with these tools. Regarding training in digital technologies, 53.65% of respondents stated they had not received any training, 41.46% had attended a few sessions, and only 4.87% reported regular training. Furthermore, when asked whether their organisation provides paid training related to digital technologies**,** 63,41% responded negatively, with only 36,58% receiving organisational support for professional development in this area.

4.5. Challenges and Recommendations for the Education and Professional Development of Accountants

Traditional education is often insufficient to prepare accountants for active participation in the development and implementation of accounting systems, as well as for effective communication with management using modern digital tools. Therefore, it is essential that educational programmes adapt their curricula to include content in information technology, digital reporting, and data analytics.

One of the main challenges is the shortage of professionals who possess expertise in both accounting and IT. Accountants need to develop technical competencies, such as understanding software solutions and programming languages, alongside soft skills

including communication, teamwork, and project management. Professional development should be a continuous process that keeps pace with technological trends and enables accountants to remain competitive in the labour market.

Regarding the attention given to digitalisation topics in accounting during seminars within continuous professional education (CPE), respondents indicated that 12.20% perceived no attention to these topics, 43.90% reported very little attention, 31.70% described it as moderate, and 12.20% considered it significant. No respondents stated that such topics were consistently covered in CPE. Concerning self-directed learning on digitalisation topics, 7.32% did not engage, 63.41% occasionally read about them, 21.95% read frequently, and 7.32% actively engaged with various aspects of digitalisation. Among them, 87.80% used online portals and social media, and 51.20% attended webinars. Of all respondents, 24.40% conducted independent research, while only 17.10% acquired knowledge on digitalisation topics through professional conferences.

When asked whether they believed they had sufficient knowledge to independently implement a new digital tool in accounting practice, 36.59% stated they did not, 43.90% were unsure, and only 19.51% claimed to possess adequate knowledge for independent implementation.

Accountants were neutral on whether existing education programs meet the needs of the digital age (weighted score: 2.98). They agreed, however, that professional associations and universities should enhance digital education for accountants (weighted score: 4.49) and that accountants need to continuously develop their digital and analytical skills (weighted score: 4.42) (Table 3).

The research highlights the main barriers (ranked by frequency) to the adoption of digital tools: lack of knowledge and implementation costs (53.7%), insufficient technical support (43.9%), inadequate integration with other legal entities, banks, and tax authorities (43.9%), employee resistance (34.1%), lack of time to transition to new tools (31.7%), security risks and data protection (29.3%), unreliable internet and infrastructure (9.8%), and other reasons (2.4%).

Table 3. Education programmes meet the needs of the digital age

Existing education programmes meet the needs of the digital age	**Strongly Disagree (score 1)**	**Disagree (score 2)**	**Neutral (score 3)**	**Agree (score 4)**	**Strongly Agree (score 5)**	**Avg**	**Std Dev**
Existing education programmes meet the needs of the digital age	4	8	17	9	3	2.98	1.04
Professional assns and universities need to do more to educate accountants for the digital age	0	1	4	10	26	4.49	0.77
Accountants must continuously	0	0	7	10	24	4.42	0.77

improve their digital and
analytical skills

Source: Authors' own elaboration based on collected data

It is recommended that specialised workshops, seminars, and certification programmes be used to strengthen knowledge of digital tools, the XBRL standard, data visualisation software, and related technologies. Given that organisations fund CPE but are often unwilling to finance other training not recognised as formal CPE or contributing points for maintaining licensure, collaborative initiatives with IT specialists and active participation in software development projects can significantly enhance practical skills. This approach will better prepare accountants for emerging professional requirements, enabling them to assume a key role in the digital transformation of business operations. Furthermore, it is important to establish partnerships between universities and professional associations to adapt syllabi to contemporary technological trends.

5. CONCLUSION

Digital transformation is irreversibly reshaping the accounting profession, requiring accountants to reassess their role and adapt to new business conditions. The automation of routine and manual tasks reduces traditional responsibilities but simultaneously creates opportunities for the development of new competencies and functions. Key emerging responsibilities for accountants include understanding technological solutions, actively participating in the development of accounting systems, and enhancing communication with management through the presentation of financial reports.

The research findings reveal that the accounting profession in the Federation of Bosnia and Herzegovina faces significant challenges, including insufficient educational coverage of digital topics, a lack of practical skills for independently applying digital tools in accounting, yet a clear willingness to learn and improve. Consequently, it is desirable that continuous professional education places much greater emphasis on digitalisation topics. Likewise, universities should adapt their curricula to equip students with the skills necessary to independently apply digital accounting tools.

It can be concluded that digital transformation in accounting in the Federation of Bosnia and Herzegovina (FBiH) is progressing gradually. Accountants regularly use basic software for financial and inventory accounting, whereas ERP systems and financial reporting software exhibit moderate adoption. Data analysis tools are increasingly becoming daily assistants for accountants in analytical and advisory functions, while data visualisation software, AI tools, and cloud technologies remain limited in use, reflecting the relatively slow transition to advanced digital solutions. These findings indicate that the profession is currently in a transitional phase. Basic digitalisation is present, but the full integration of modern technologies requires further training, investment in infrastructure, and adaptation to new standards such as XBRL, e-Invoices, Power BI, and similar tools, in order for accountants to fully assume strategic and analytical roles within business operations.

These findings also confirm that accountants largely remain passive users rather than active creators of digital tools, which carries the risk that software solutions may not be adequately tailored to the practical needs of business or the specific legal framework. In light of

accelerated digitalisation, the future of the profession requires proactive involvement of accountants in all stages of software system development, from defining functional requirements to testing and enhancement. By taking a more active role in the development of digital tools, accountants can directly contribute to the creation of intuitive and reliable systems that simultaneously meet business practice requirements and legal regulations, thereby improving the quality of financial reporting and strengthening their competitiveness in the labour market.

Given these insights, it is recommended that specialised workshops, seminars, and certification programmes be introduced to strengthen accountants' knowledge of digital tools, the XBRL standard, data visualisation software, and related technologies. Since organisations often fund continuing professional education (CPE) but are reluctant to finance other training that does not yield CPE credits, collaborative initiatives with IT specialists and active participation in software development projects could significantly enhance accountants' practical skills. Furthermore, establishing partnerships between universities and professional associations is essential to align syllabi with contemporary technological trends.

Finally, the study's results should be interpreted in light of its main limitation, the relatively small sample of surveyed accountants, which may restrict the generalisability of findings to the broader accounting population. Future research should therefore involve a larger and more diverse sample, possibly incorporating qualitative methods such as interviews or focus groups, to obtain deeper insights into the digital transformation of the accounting profession.

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TRADITIONAL VERSUS AGILE APPROACH TO INTERNAL AUDITING

ABSTRACT

Internal auditing has been continiously evolving and adapting throughout its existence. Traditionally, it was conceived as an assessment of financial information, including an assessment of the efficiency and effectiveness of the internal control system. The modern approach to internal auditing focuses on the adequacy of risk management, control and corporate governance. Internal auditing is now expected to introduce new auditing approaches that should provide flexibility, enable faster provision of information on regulatory compliance, and focus on adequate risk prediction and strategic management of the organization. This approach would have a timely response and ensure the adaptation of internal auditing to dynamic changes in both the internal and external business environments. The agile approach to auditing is still in its infancy and we cannot say that it is sufficiently applied in practice, but it is expected that it could improve the quality of internal auditing. The purpose of this research is the comparison and systematization of the characteristics of traditional and agile approaches to performing internal auditing and the identification of the contribution of internal auditing. The study utilized the methods of description, systematization and classification, analysis, synthesis, induction and deduction, comparison, statistical methods, and proof.

Keywords: *traditional internal auditing approach, agile internal auditing approach, scrum.*
JEL: M42, M48

1. INTRODUCTION

Many users of internal audit services are preoccupied with the question of what to expect from internal auditing and are interested in the direction in which it is developing, as well as whether it is capable of responding to the increasingly complex demands placed upon it. In order for an internal auditor to achieve appropriate audit results that will meet the expectations of relevant stakeholders, it is essential to approach the design and application of a suitable methodology for conducting internal audit engagements within specific circumstances with particular care. The agile approach to internal auditing does not represent

a replacement for the traditional, standard approach, but rather an adaptation to contemporary business conditions. Within this framework, the focus shifts from a strictly planned and reactive orientation to a proactive, iterative, and collaborative mode of operation. The agile approach to internal auditing emphasises discipline, objectivity, speed, and flexibility, which ensures better identification, understanding, and response to risks in real time, while enhancing the efficiency and relevance of the audit work. The empirical research on the state of internal auditing in this paper will examine the benefits of both the traditional and the agile approaches to internal auditing, specifically within the context of Bosnia and Herzegovina.

2. PREVIOUS RESEARCH

The traditional approach to internal auditing is based on predefined plans, formal procedures, and detailed documentation, as suggested by Tušek et al. (2014). However, although it ensures consistency and control, research has demonstrated that the traditional approach is slow and lacks adaptability to change (Golchev et al., 2015). With the advancement of digitalisation, the emergence of the agile approach has highlighted flexibility, quicker responsiveness, and continuous communication with management (Deloitte, 2017). Tušek (2022) points out that the transition to the agile approach fosters greater proactivity and collaboration with management but also requires a shift in organisational culture. According to the latest Global Internal Audit Standards (The Institute of Internal Auditors, 2024), the agile approach represents the recommended direction for the development of contemporary internal auditing.

2.1. Traditional Approach To Internal Auditing

Internal auditing contributes to the overall stability and sustainability of an organization by providing assurance about its operational efficiency, reliability of reporting, compliance with laws and/or regulations, protection of assets, and promotion of an ethical culture. This, in turn, encourages public confidence in the organization and the wider systems of which it is a part (The Institute of Internal Auditors, 2024, p. 7). The Global Standards for Internal Auditing have been in effect in Bosnia and Herzegovina since January 9, 2025. The Global Standards for Internal Auditing, consist of 5 domains (areas), linked to 15 principles, and a total of 52 standards.

The five domains and 15 standards include:

1. identifying the purpose of internal audit;
2. ethics and professionalism, which cover the following aspects:
   - ✓ demonstrating integrity,
   - ✓ maintaining objectivity,
   - ✓ demonstrating competences,
   - ✓ exercising due professional care,
   - ✓ maintaining confidentiality;
3. managing the internal audit function, which includes:
   - ✓ authorization by the board (or audit committees),
   - ✓ independent positioning,
   - ✓ oversight by the board;

4. leading the internal audit function, which includes:
   - ✓ strategic planning,
   - ✓ resource management,
   - ✓ effective communication,
   - ✓ quality improvement;
5. performing internal audit services, which includes:
   - ✓ effective engagement planning,
   - ✓ conducting engagement work,
   - ✓ communicating engagement results and monitoring action plans.

The traditional approach to internal auditing involves performing specific activities (services or engagements), that can be classified into two main categories: assurance engagements and consulting activities. In recent times, in addition to them, auditing by request is also included.

In accordance with the International Standards for the Professional Practice of Internal Auditing and the Code of Ethics, the entire process of conduting internal audit engagements can be divided into four key stages (Wright, 2019):

a) internal audit planning,
b) critical examination and evaluation of operations,
c) communication of results and
d) follow-up actions taken in response to the results.

All phases of the internal audit process are closely interrelated. Regardless of their varying duration and complexity in development, each phase have equal importance and impact on the overall quality and result of the audit. Starting from the traditional paradigm of internal auditing, the most well-known and generally accepted classification of internal audit function plans is the one that starts from the time criterion, as a division criterion. “Internal audit function plans include (Pickett, 1997): a long-term or strategic plan, which is usually drawn up for a three- or five-year period and (2) a short-term plans, which is usually drawn up for a one-year period or less often for shorter periods (quarterly or monthly). Based on these overarching plans, individual audit engagement plans are developed for each specific auditing. These plans are also referred to as functional plans" (Tušek, 2022, p. 26).

The traditional approach to internal auditing involves the activities of the internal auditor, which on the one hand can be interconnected and conditional, and on the other hand, are continuous throughout the entire audit process, that is, during all phases. In order for the performance of internal auditing to be purposeful, internal auditors must approach the performance of all activities in detail and precisely during the audit engagement. In the case of a selective approach or complete omission of certain auditing activities and procedures, the expected results of improvements in the company's business will not be achieved. Unfortunately, such behaviour is not entirely uncommon.

In the context of recent demands and challenges faced by the internal auditing profession, which relate to the collection and formation of audit evidence and internal auditor working documents, electronic working papers, remote internal audit (Remote Internal Audit) and the application of computer-assisted audit methods and techniques or so-called CAAT's

(Computer Assisted Audit Techniques) are increasingly being mentioned (Tušek, 2022, p. 28).

When communicating the results of the internal auditing function's engagement, it is necessary to accept and apply the recent requirements of the International Framework for the Professional Practice of Internal Auditing. “Recently, the internal auditor has been asked by the supervisory board, auditing committee, senior management and other stakeholders to formulate and provide appropriate opinions, as part of the internal audit report (Anderson & Dahle, 2009), which is the result of the individual audit engagement performed, but also to provide so-called overall opinions that relate to the adequacy of corporate governance, risk management and control of the organization as a whole” (Tušek, 2022, p. 28).

2.2. Agile Approach to Internal Auditing

Agile internal auditing is a modern approach to the internal auditing process, based on the principles of agility, i.e. flexibility, collaboration, continuous improvement and rapid response to change. This approach originates from agile methodologies developed in the IT industry, which have over time proven to be effective in other business functions as well, including internal auditing (Wright, 2019).

The term agile refers to the "ability to move quickly and easily" or to move "intelligently with speed." Agile applications in internal auditing aim to enhance the performance and value of internal audit acitivities. This is achieved through team collaboration to deliver services and advice in a timely manner (Joshi, 2021, p. 14) An agile approach to internal audit is defined by Deloitte as "the mindset of the audit function, which will adapt to focus on stakeholder needs, accelerate audit cycles, provide timely insights, reduce wasted effort and generate less documentation" (Deloitte, 2017).

According to Wright, the agile approach is an innovative approach that applies the values, principles, and practices of software development to improve internal audit engagements. In other words, an agile approach to internal audit seeks to shift the audit focus and update its scope.

The agile approach to internal auditing represents a continuous adaptation of the internal audit process to new business conditions, identified risks, stakeholder requirements, necessary corrective measures, etc. Its implementation requires consideration of the internal and external environment, especially business activities, organizational culture, etc. Therefore, this approach to internal auditing implies speed, transparency and cooperation between stakeholders, self-organizing and cross-functional teams, and continuous change. However, the agile approach to internal auditing may pose significant challenges for audit teams, as some internal auditors may resist change.

The core principles of agile auditing are: flexibility, efficiency and stakeholder engagement. This ensures that internal auditing becomes flexible, value-focused and user-oriented, without losing integrity, objectivity and compliance with professional standards.

“For internal audit functions to fulfill their mission, purpose, and roles as defined in the internal auditing charter, as well as the growing demands placed on them, across the diverse types of businesses and industries in which they operate, it is critical that internal auditors:

- provide deeper insights into strategic business issues, problems and risks
- they promptly react to changes in priorities and growing issues and problems
- become forward-looking and more proactive in anticipating risk
- focus on risk-based planning and execution of internal audit engagements
- simplify work papers
- design and deliver impressive, relevant, timely, readable and visually well-designed reports
- they use the appropriate resources they have at their disposal when carrying out a particular project
- improve existing and acquire new specialized competencies, especially in the cyber and analytics fields." (Tušek et al., 2014, p. 14)

The agile approach to internal auditing is accompanied by techniques , such as Scrum, Kanban, (Golchev et al., 2015, p. 56), Lean and others, which require a change in way of thinking and practising, which will result in improved efficiency and flexibility of the audit process. This approach implies that audit teams must embrace flexibility and collaboration, while stakeholders must be open to more frequent and iterative updates. The effective application of these techniques requires training of existing staff to acquire the necessary knowledge and skills, in terms of using tools and technologies, which support agile methodologies, such as project management software and collaboration platforms (promoting better collaboration), continuous improvement and timely provision of insights, which should result in more relevant audit findings.

“Scrum is a popular method for introducing agility, and it can provide internal audit with a foundation for agile auditing of processes, owing to its simplicity and flexibility. However, Scrum is more than merely a methodology, it requires changes in organisational culture, mindset, and behaviour. By clearly identifying desired results and outcomes related to governance and business operations, Scrum enables auditors to continuously improve their reports as a product, and consequently, the overall working environment. Given that organizations, teams, and individuals are complex adaptive systems that constantly shift expectations regarding how project objectives should be achieved, there are other agile techniques such as Kanban, but Scrum emphasizes short iterations of work” (Jeremić et al., 2021, p. 64).

The agile approach to auditing makes sense if we have experienced auditors or auditors who have technical competence. Since agility represents flexibility, a common obstacle to adopting agile practices lies in contracts and legal obligations that are contrary to agility, as they tend to be rigid agreements. For example, if a project involves several legal entities that are remunerated based on the number of the days worked, applying agility may become problematic.

Table 1. Results of applying agile frameworks and internal audit methods

Results	Impact on the change in the way of thinking of internal auditors	Impact on the change in the process of conducting internal audits
1. Clearer results internal audit engagements	✓ *internal auditors, by applying appropriate audit methods, should confirm or refute hypotheses and support a particular standpoint.*	✓ *the internal audit engagement or project aims to produce a result that directs the performance of the engagement and the communication of its results.*
2. Increased engagements in internal auditing	✓ *while maintaining objectivity, internal auditors in cooperation with interest - influencing groups, should determine priority areas, issues, problems and risks.*	✓ *internal auditors identify necessary resources and focus their work on the factors that determine business success and create enterprise value.*
3. Improved documentation of internal audit engagements	✓ *internal auditors should not prepare overly comprehensive report that include explanations of all steps taken in each phase of the process and extensive justification with exhaustive documentation.*	✓ *following guidelines and principles of agile internal audit frameworks and methods, internal auditors can design and deliver shorter, timely reports, with less words, more visuals*

Source: Adapted from Deloitte (2017), as cited in Tušek and Halar (2020, p. 35).

The agile approach to internal auditing is essentially about identifying and eliminating - or at least mitigating - the adverse effects of identified obstacles. The steps towards removing such barriers and becoming agile include (Spiros, 2022, p. 5):

- ✓ recruiting or training highly skilled auditors,
- ✓ keeping auditors motivated,
- ✓ removing irrelevant administrative barriers, such as rigid phase separation (planning, fieldwork, reporting),
- ✓ enabling auditors to perform their duties, without counterproductive constraints and providing assistance when required,
- ✓ refraining from the bling adoption of an agile framework, unless it can be demonstrated that such a framework will specifically enhance efficiency and effectiveness. If such a framework is adopted, it is crucial to ensure that improvements are actually achieved.

2.3. Comparison Of Traditional And Agile Approaches To Internal Auditing

The traditional approach to internal auditing most commonly entails pre-planned, formalized and time-consuming activities. This approach is characterized by a list of steps, thorough control and compliance with regulations, but also sluggishness, inflexibility and poor responsiveness to new risks that accompany a dynamic business environment. In contrast, the agile approach to internal auditing involves conducting shorter audits with an emphasis on assessing business processes and promptly resolving risks. The agile approach to internal audit encourages communication and collaboration, enabling teams to work iteratively on key priorities and to resolve issues as they arise (Wright, 2019).

A comparison of the key characteristicts of traditional and agile approaches to internal auditing is explained in Table 2.

Table 2. Comparison of key characteristics of the traditional and agile approaches to internal auditing

Characteristic	**Traditional audit approach**	**Agile audit approach**
Focus	**objectives** of internal auditing	defining the value expectations or the value proposition of internal auditing
Sequence of engagement	**linearty** of the audit process phases	**sequential** nature of the audit work cycles
Relationships with clients/users	organizational independence and individual objectivity	**collaborative relationships** for the purpose of: ✓ of using subject expertise ✓ facilitating achievement ✓ agreement on observations ✓ accelerating timely ✓ risk response
Audit observations/findings/ conclusions	focused on risks and internal controls, with a possible limited degree of change introduced by **management of the internal audit functions** **revisions** **sterility**	- **compliance** with business **strategies** and related goals - **collaborative** discovery
Planning	**semi-flexibility** of the internal audit plan (Master Plan)	**iterativeness** and gradual planning of internal audit engagements
Ownership	exclusive ownership of the audit team	**team-based** ownership
Resource management	**main engagement budget** (exceedances approved as required)	managing resources within time-constrained work iterations
Risk assessment	identification and assessment of risks in relation to business objectives	**multiple levels of assessment** related to business goals
Update status	- **ad hoc** basis - according to the approach defined in the specific	- **daily review meetings** - **gradual considerations** with the audit client and other key stakeholders

Characteristic	Traditional audit approach	Agile audit approach
	methodology of the internal audit in each engagement	
Documentation	**completeness** and thoroughness at a high level, ensuring the protection of the audit trail	- **rationalization** - value-based - **80/20 rule**– the expectation that 20% of internal auditors' activities will result in 80% of the results
Professional standards	compliance with the International Framework for Professional Practice of the global Institute of Internal Auditors	compliance with the International Framework for Professional Practice of the global Institute of Internal Auditors

Source: Adapted from The Institute of Internal Auditors Australia (2020), as cited in Wright (2019) and Tušek and Halar (2020, p. 63).

The Institute of Internal Auditors (IIA), in relation to the agile approach to internal auditing, states that the control function within auditing is shifting towards a consultative and strategic role, thereby adding value and enhancing business performance. The agile approach to internal auditing still presupposes the existence of an annual activity plan, but that it is used as a framework, and that there is room to update priorities and tactics in accordance with the current needs of the organization.

3. RESEARCH METHODOLOGY

The empirical research was conducted in Bosnia and Herzegovina. The operational objectives of the study are to identify: the extent of internal auditing implementation, approaches to practicing internal auditing, the contribution of internal auditing to business operations, as well as the specificities, weaknesses, and benefits of individual approaches. For the purposes of the empirical part of the research, primary data were collected using a survey method, based on a random sample, and SPSS was used for processing and analyzing the collected data. The survey questionnaire was sent to 200 email addresses of the subjects. The questionnaire contained 26 closed-ended questions, which, in addition to simple yes/no questions, included questions that allowed respondents to express different degrees of agreement, using the Likert scale. A completed questionnaire was returned by 78 respondents, which is a response rate of 39%, and the responses were obtained from subjects belonging to primary, secondary, tertiary, quaternary, and quinary sectors. We received responses from the Federation of Bosnia and Herzegovina, the Republika Srpska, and the Brčko District. The data collection period was from March to June 2025. A limitation in our work is the low awareness and adoption of the agile approach and the resistance of internal auditors. Below, we will present the results of the conducted research.

4. RESULTS AND DISCUSSION OF THE EMPIRICAL RESEARCH ON THE STATE OF INTERNAL AUDITING IN BOSNIA AND HERZEGOVINA

The following section presents the results of the conducted research.

Table 3. Registration of entities

Your entity is registered in	Number of respondents	% of respondents
Federation of Bosnia and Herzegovina	73	93.59%
Republic of Srpska	4	5.13%
Brcko District	1	1.28%
TOTAL	78	100%

Source: author's processing

Out of a total of 78 responses received, most of them came from the Federation of FBiH, 93.59%, representing 73 respondents, followed by Republika Srpska with 5.13%, or 4 respondents, and Brčko District 1.28%, i.e. 1 respondent.

Table 4. Activity respondent

Activity	Number of respondents per activity	% of respondents by industry
Primary activity	3	3.85%
Secondary activity	21	26.92%
tertiary activity	50	64.10%
Quaternary activity	3	3.85%
quintal activity	1	1.28%
TOTAL	78	100%

Source: author's processing

In response to the question regarding the sector of activity to which the respondents' entities belong, the following results were obtained: the tertiary sector (which includes tourism, hospitality, trade, transport, banking, service crafts, and other service activities) was the most represented, accounting for 64.10% of respondents. It was followed by the secondary sector (which includes industry, construction, mining, energy, manufacturing crafts, and similar activities) with 26.92%.

The primary sector (comprising agriculture, livestock breeding, fisheries, and forestry) and the quaternary sector (including education, science, healthcare, culture, the military, police, public administration, and sports) each accounted for 3.85%, while the quinary sector (covering software development, IT support, data management, and other technologies) represented 1.28% of the total sample.

Table 5. Implementation of internal audit

Conducting internal audits	number of respondents	% of respondents
Internal audit is implements	38	48.72%
Internal audit is does not Implement	40	51.28%
TOTAL	78	100.00%

Source: author's processing

From Table 5. we observe that 48.72%, i.e. 38 respondents, conduct an internal audit, and of them, as many as 92.11%, i.e. 35 respondents, believe that in Bosnia and Herzegovina,

the traditional form of practicing internal audit is more common than agile, which can be seen from Table 6.

Table 6. Approach to practicing internal audit in Bosnia and Herzegovina

Practice approach	Number of respondents	% of respondents
Traditional	35	92.11%
Agile	3	7.89%
TOTAL	38	100.00%

Source: author's processing

Table 7. Contribution of internal audit

Internal audit contribution	Number of respondents	% of respondents
Project success	36	46.15%
Ensuring additional value for users	44	56.41%
TOTAL	78	

Source: author's processing

From Table 7. we see approximately equal percentages, which reflects the contribution of internal audit. In this, 44 of them give a slight advantageproviding added value for users with56.41%, while the contribution of internal audit through project success rate is 46.15%. Since the Cronbach's alpha coefficient measures the internal consistency, or reliability, of a set of items in a survey, we will use this statistic to determine whether a set of items consistently measures the same characteristic. Cronbach's alpha quantifies the level of agreement on a standardized scale of 0 to 1.

Table 8. Cronbach's alpha

Scale reliability in the frequency approach				
			Confidence interval 95%	
Coefficient	Value	Standard error	Lower limit	Upper limit
Cronbach's alpha	0.930	0.011	0.908	0.953

Source: author's processing

The value of Cronbach's alpha is at the level of 0.930, which means that the measuring scale is reliable. It indicates high internal consistency between questions. A standard error of 0.011 indicates the existence of a small deviation. At the level of the calculated Cronbach's alpha, it can be concluded that the Likert scale is reliable within this research.

In the traditional approach to internal audit, respondents believe that almost all specifics are equally important, with a slight preference for internal audit planning, with an arithmetic mean of 4.44.which on a scale of 1 to 5 represents a high level of agreement, i.e. it gives us information that the respondents believe that Internal audit planning is very important in the process of conducting an internal audit.. The mode represents the most frequent answer, and

in this case it is 5, while the median represents the central value and is 5, so we can conclude that the respondents always carry out planning in the internal audit process.

Table 9. Specifics traditional approach to internal audit

Claim	Arithmetic mean	Std. dev.	Mode	Median
Internal audit planning	4.44	0.92	5	5
Critical examination and assessment of business	4.26	0.90	5	4
Announcement of results	4.30	0.65	4	4
Monitoring the handling of the results	4.13	0.83	5	4

Source: author's processing

Table 10. Weaknesses of the traditional approach to internal audit

Claim	Arithmetic mean	Std. dev.	Mode	Median
budget	4.12	0.71	4	4
lack of audit staff	4.16	0.92	5	4
limited time	4.04	0.83	4	4
long production cycle	3.86	0.90	4	4
learning and usage difficulties	3.48	1.01	3	3
too much bureaucracy and documentation	4.21	0.88	5	4
lack of flexibility	4.05	1.03	5	4

Source: author's processing

Among the weaknesses of the traditional approach to internal auditing, the most prominent is excessive bureaucracy and documentation, with arithmetic mean 4.21, mode 5 and median 4, so we can conclude that the surveyed respondents partially or completely agree that excessive bureaucracy and documentation make the internal audit process difficult.

This is followed by a shortage of audit staff, with an arithmetic mean of 4.16, a standard deviation of 0.92, a mode of 5, which represents the most frequent answer, and a median of 4, which represents the central value, so we can conclude thatthe respondents partially or completely agree that the shortage of staff also represents a pronounced weakness of the traditional approach to internal auditing.

Among the specific features of the agile approach to internal auditing, the most notable isdeeper insight into strategic business issues, problems and risks with an arithmetic mean of 4.52,which on a scale of 1 to 5 represents complete agreement with the statement, i.e. it gives us information that the respondents believe that deeper insight into strategic business issues, problems and risks of utmost importance in the internal audit process.

Table 11. Specificities of the agile approach to internal auditing

Claim	Arithmetic mean	Std. Dev.	Mode	Median
Deeper insight into strategic business issues, problems and risks	4.52	0.80	5	5
Prompt reaction to changes in priorities, and growing issues and problems	4.27	0.90	5	5
Future orientation and proactiveness in predicting risks	4.21	0.86	5	4
risk-based planning and performance of internal audit engagements	4.45	0.68	5	5
Improving internal audit engagement documentation	4.16	0.71	4	4
Design and delivery of impressive, relevant, timely, readable and visually quality designed reports	4.32	0.83	5	5
Use of available resources when carrying out a particular project	4.42	0.77	5	5
Improving existing and acquiring new technical competencies	4.31	0.77	5.00	4.00

Source: author's processing

The mode represents the most common answer, and in this case it is 5, while the median represents the central value and is 5, and we can conclude that the respondents fully agree that the agile approach achieves a more complete coverage of all strategic issues, problems and risks in the internal audit process.

Table 12. Benefits of an agile approach to internal auditing

Claim	Arithmetic mean	Std. Dev.	Mode	Median
Faster adaptation to the external and internal environment (faster response to changes, priorities)	4.40	0.84	5	5
Improving operational performance	4.25	0.75	5	4
Audit quality	4.53	0.66	5	5
Audit client satisfaction	4.40	0.69	5	5
Effective fight against uncertainty	4.26	0.85	5	4
Increasing transparency	4.34	0.87	5	5
Improving communication	4.35	0.81	5	5

Source: author's processing

Respondents believe that the most significant benefit of an agile approach to internal auditing is reflected in the quality of the audit, with an arithmetic mean of 4.53, standard deviation 0.66, mode 5 and median 5, so we can conclude thatrespondents fully agree that the application of an agile approach in internal auditing contributes to its quality. After that, they attribute a great benefit of this approach faster adaptation to the external and internal environment (faster response to changes, priorities) with an arithmetic mean of 4.40, and audit client satisfaction, also with an arithmetic mean of 4.40, mode 5 and median 5, as the most common responses and central values, which is that they fully agree with both

statements.While examining the relationship between the use of internal control within the company and the perception of the future orientation of internal auditing, the provision of assurance and advisory services related to anticipated business risks and advisory engagements, of a strategic, financial and operational nature, we obtained the following results.

Table 13. Dependence between the use of internal audit and the perception of its future orientation

χ^2	number of degrees of freedom	P-value
0.920	1	0.337

Source: author's processing

The result p>0.05 tells us that there is no dependence between the use of internal audit within a company and the perception of its focus on the future, providing engagements with research of beliefs and advisory services regarding anticipated risks in business and advisory engagements, of a strategic, financial and operational nature.

Table 14. Correlation between internal audit approach and work methods

Correlation matrix			
Variable		Access to internal audit	How it works
1. Access to internal audit	Spearman's correlation coefficient	—	
	p-value	—	
2. How it works	Spearman's correlation coefficient	0.386	—
	p-value	< .001	—

Source: author's processing

A p-value of <0.001 tells us that there is a statistically significant relationship, meaning that there is a connection between the approach to internal audit and the willingness to take risks or follow precisely established rules. However, from the above correlation, it can be seen that there is a weak connection of strength - 0.386. Spearman's correlation coefficient tells us that an agile approach to internal audit does not necessarily result inlearning from mistakes and quickly solving tasks, and neither the traditional one of exclusively following defined rules, working hard on their implementation, nor the high level of caution, ensuring fewer mistakes.

5. CONCLUSION

Internal auditing is very important for every organization, as it provides oversight in business operations. In line with new trends, the task of internal auditing is to focus on enterprise risk management, business process assurance and regulatory compliance. When the organization

is exposed to new and significant risks, internal auditing should be able to update its plan and provide assurance and insight into the needs of stakeholders. Therefore, an agile audit approach is considered an effective methodology for performing audit responsibilities, as it increases flexibility in audit planning, execution and reporting.

The advantage of an agile approach to internal auditing is evident in complex audits, which require a competent team, or experienced auditors, who operate in shorter audit cycles and offer rapid exchange of information with clients or decision-makers, thereby managing to remain competitive in the market.

Based on the results of the conducted research, we determined that internal auditing is implemented in 48.72% of respondents, and among them, as many as 92.11% of respondents believe that the traditional form of internal auditing is more prevalent in Bosnia and Herzegovina compared to the agile approach. The surveyed respondents see the contribution of internal auditing in providing additional value to users at 56.41%, while 46.15% see its contribution through project success.

Through empirical research, we confirmed that the most significant benefit of the agile approach to internal auditing is reflected in the improvement of internal audit quality and the added value for the enterprise. The research identified the advantages, benefits, drawbacks, and limitations of both approaches to internal auditing. Ultimately, we can say that the agile approach can respond more quickly to changes in the environment and the business entity, but its implementation is largely influenced by perception, personal commitment, and the approach of personnel, that is, their willingness to follow existing rules and established routines, or their tendency toward rapid changes, adaptation, and monitoring new trends, while taking risks. Based on the presented research results, we can conclude that the benefits of the agile approach are recognized by respondents, but it is still insufficiently represented in Bosnia and Herzegovina.

Open questions regarding the adoption of an agile approach to internal auditing are related to technological obstacles and frequent resistance from internal auditors, even though by adopting this methodology, they could enhance their reputation and significance.

Since this study did not deal with the size of the surveyed subjects, the recommendation for future research is to examine the significance of adopting and the success of the agile approach to internal auditing by considering the culture in enterprises, taking into account their size and competence.

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MENAGEMENT AND ENTREPRENEURSHIP

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SACRIFICE READINESS FOR CLIMATE CHANGE: EVIDENCE FROM ECONOMICS AND BUSINESS STUDENTS IN SOUTH EAST EUROPE

ABSTRACT

This paper examines the characteristics of economics and business students, aiming to predict their willingness to make lifestyle sacrifices to promote environmental sustainability and mitigate climate change. We use the survey data from 416 business students from five countries in the region of South East Europe (SEE). Results of statistical analysis show that gender (female) and the level of studies (higher study levels) can be associated with stronger expectations of lifestyle sacrifices, with the marginal role of self-reported belonging to the social class. We did not find any specific country differences within the SEE region. Our results provide a starting point for future empirical research on accepting pro-environmental change in higher education and suggest that behavioral trade-offs can be associated with gender effects and exposure to higher education curriculum.

Keywords: *climate change, lifestyle sacrifices, economics and business students, South East Europe (SEE).*
JEL: Q54, D91, I23

1. INTRODUCTION

Contemporary consumers are increasingly forced to change their habits, accept higher consts and inconveniences, due to different circumstances, such as rising inflation, unstable geopolitical environment, disruptions in the supply chains, etc. (Diaz et al., 2024; Badran et al., 2025); One of the less analyzed factors concerns the climate change-related sacrifices of their living standards or habits, consumers might be willing to accept, as to contribute to the protection of the natural environment (ISSP Research Group, 2020). Framing pro-environmental actions through the view of consumer sacrifice (in relation to the expected social standards) provides an alternative to the established empirical studies of consumers' pro-environmental intentions and behavior.

Our approach is empirically supported by several extant studies, which include framing of conversion from attitudes to behavior through the sacrifice lens (Diekmann & Preisendörfer, 2003), while personal sacrifice in expectations of living standards and behavioral patterns has been validated by Davis et al. (2011).

The sample for this empirical study consists of economics and business students, who will not only act as future consumers but also organizational and policy decision-makers, who will have leadership roles in shaping organizational responses to climate risks (Alfirević et al., 2024; Alfirević et al., 2025).

This paper is among the first empirical studies examining the pro-environmental consumer and higher education issues from the sacrifice lens in the SEE region. We examine which student characteristics relate to perceived sacrifices due to climate change, concerning their expected standard of living and lifestyle. Building on extant international evidence that women report higher environmental concern (Zelezny et al., 2000; Xiao & McCright, 2015) and that education relates to greater environmental concern (Franzen & Vogl, 2013), we test whether gender and higher education study levels are associated with sacrifice readiness, adjusted statistically for country and relevant socio-economic experiences.

2. THEORETICAL BACKGROUND

Public-opinion research has long argued that analyses of environmental attitudes should look beyond abstract concerns when addressing societal challenges, such as climate change. A practical viewpoint is especially relevant for empirical studies, examining what people are prepared to give up in terms of their expected lifestyles and consumption limitations, in order to promote the declared pro-environmental values. Namely, attitudes matter less when perceived costs for personal lifestyle and convenience appear (Stern, 2000); however, depending on personal and demographic characteristics (Franzen & Vogl, 2013), as well as on perceived social fairness (Mestre-Andrés et al., 2019).

The International Social Survey Program (ISSP) has conducted international empirical research on consumers' willingness to pay higher prices and/or higher taxes, and accept reduced living standards to protect the environment (ISSP Research Group, 2020). From a theoretical viewpoint, such an empirical approach, using the concept of sacrifice readiness, is supported by the values-beliefs-norms (VBN) theory, which presumes that values precede beliefs and together shape human behavior (Stern, 2000). In this context, general pro-environmental values influence actual behavior, but only when they are translated into specific beliefs about making sacrifices in expected lifestyles and consumer convenience to protect the natural environment.

Therefore, we modified the ISSP's survey approach (ISSP Research Group, 2020) and formulated a single item to assess students' readiness to make personal sacrifices to prevent climate change, considering their expected standard of living and overall lifestyle during their lifetime. Franzen and Vogl (2013) analyze ISSP data from 33 countries and show that environmental concern generally rises with economic development. They also find that personal sacrifice tracks overall concern but still adds distinct information, responding to both individual factors and national context (e.g., GDP, institutional trust).

The extant literature has extensively analyzed individual (i.e., personal and demographic) factors. Gender matters, with women scoring consistently higher on environmental concern and related orientations in different empirical studies (Xiao & McCright, 2015; Zelezny et al., 2000). Potential explanations of the effect might include gendered socialization, or other relevant effects, which are visible both in attitudes, as well as in consumption and lifestyle patterns. Namely, studies of household carbon footprints show that, on average and controlling for compositional factors, Spanish households with a larger share of male members have higher carbon footprints and intensity, especially concerning choices in transport and food consumption (Osorio et al., 2024). In addition, the consumption choices in transport and nutrition are empirically documented as relevant in different national contexts (Berland & Leroutier, 2025), pointing to the generalizability of gender effects in climate-related consumer choices.

Education also reliably correlates with environmental concerns and willingness to accept climate-related sacrifices in consumption. In different empirical samples, education has been positively associated with general pro-environmental concerns and the readiness for consumption sacrifices, in order to preserve the natural environment (Franzen and Vogl, 2013). Explanations for this effect could include access to relevant scientific information, civic awareness, and social norms supporting collectivism and collective action (e.g., Scandinavian acceptance of high taxation rates, in order to foster the provision of public goods). Studies of policy acceptance similarly report that more educated respondents tend to accept higher prices, if they are associated with natural preservation and perceived as fairly socially distributed (Franzen & Vogl, 2013; Fairbrother, 2016; Maestre-Andrés et al., 2019).

The extant higher education literature tries to evaluate the effects of sustainability content and teaching approaches, although integration of the topic and different academic teaching and learning approaches seems to be uneven (Aktas et al., 2015; Thürer et al., 2018). There is ample empirical evidence of improvement in sustainability knowledge and engagement when novel teaching and learning methods are applied. They are related to experiential learning, and include different approaches, such as community and service-learning, project-based learning, or "serious games "and simulations (Lozano et al, 2015; Molderez & Fonseca, 2018; Mabalay, 2025). Outcomes of educational interventions might lead to sustained lower self-reported carbon emissions, especially in transport and dietary choices (Cordero et al., 2020). Graduate and postgraduate study cycles of higher education might be more appropriate for the application of experiential learning, since students have already mastered the fundamental concepts. However, engagement of first-cycle students also matters, as structured exposure to sustainability content and innovative teaching methods seems to be the key to successful introduction of sustainability to higher education (Aktas et al., 2015; Cordero, Centeno, and Todd, 2020; Thürer et al., 2018). Due to the presented arguments, we include the level of study as a relevant predictor of students' sacrifice readiness.

Willingness to accept higher costs and prices for socially and environmentally beneficial policies is also shaped by the perceptions of social trust and fairness. International empirical research indicates that social trust increases support for environmental taxation, including higher taxes, when respondents perceive the efficient use of tax funds for environmental objectives (Fairbrother, 2016; Fairbrother, 2019). The levels of perceived fairness also

influence the acceptance of carbon pricing (Maestre-Andrés et al., 2019), leading to conclusions about potential country effects. Such differences could be expected only if the institutional frameworks and social norms result in variations related to the perceptions of trust and fairness. Since the SEE countries seem to be fairly aligned regarding these social indicators (Radević et al., 2022), we do not expect any significant effects across the countries in the SEE region. The extant research supports our expectations regarding country effects, as Fairbrother (2016) shows that trust relationships to pay environmental taxes are consistent and primarily undermined by social distrust (Fairbrother, 2019). These findings could be valuable for higher education in the SEE region, which has low levels of social trust and readiness for collective action (Pavičić et al., 2017; Radević et al., 2022).

Policy research shows that concerns about who bears the cost of climate policy also matter. People worry carbon pricing is unfair or regressive, and that these distributional concerns reduce public support unless public policies address them (Carattini, 2018; Maestre-Andrés et al., 2019). When governments explicitly protect lower-income groups from carbon taxes, acceptance of carbon pricing tends to rise. Although our student sample has a narrow income spread, this literature helps explain why we decided to include the perceived social class into the analysis.

Finally, the climate-policy literature helps explain why students' indicators of civic experience (related to volunteering, civic activism, and donations to civic organizations) might not show as significant, once we control for the gender effect and the policy framing of who should bear the climate change costs (Drews & van den Bergh, 2016). Still, we include the civic background indicators in our analytic strategy to seek alternative robust explanations for the empirical trends.

3. METHODS

3.1. Design and sample

We analyzed a cross-sectional survey of economics and business students from five countries in the Southeast European region. Recruitment was conducted through announcements at the internal Moodle Learning Management System for large compulsory courses at participating HEIs. Participation was voluntary, and participants were anonymous. We used listwise deletion for multivariate models, so sample sizes differ across statistical analyses, mirroring our approach used in prior studies in the field (Alfirević, Rendulić, and Mlaker Kač, 2025; Alfirević, Klepić, and Mihaljević Kosor, 2025).

3.2. Measures

We measured sacrifice readiness with a single survey item and converted the responses to z-scores, thereby standardizing the dependent variable across the sample. Our main predictors were gender (1 = male, 2 = female) and study level, recorded according to Bologna cycles and also transformed into a z-score to capture a linear progression across cycles. Due to the previously discussed theoretical arguments, we also use z-standardized age and perceived social class as additional covariates. To capture the country context, we used five dummy variables to represent each of the SEE participating countries (Slovenia, Croatia, Bosnia and Herzegovina, Serbia, and Montenegro).

We also added a set of binary background indicators to capture students' experiential profiles: prior social or political activism, volunteering, donating, general work experience, management experience, and entrepreneurial experience. These simple indicators enable us to check whether a civic (activism) background or professional exposure to managerial and entrepreneurial experience explains variation in readiness. To provide a narrative description of our results, we created a three-category staging variable from the original item: Low (1.00–2.99), Mid (3.00–3.99), and High (4.00–5.00). The grouped variable is used only in the crosstabulations and chi-square tests described below.

3.3. Analytic strategy

We estimated a general linear model (GLM) in SPSS 28 software package with the z-standardized sacrifice-readiness score as the dependent variable. Gender, country, and the set of binary background indicators were entered as fixed factors, while age, perceived social class, and study level (all z-score standardized) were entered as covariates. The potential national influence was modeled through dummy variables to obtain within-country adjusted comparisons. For inference, we report F statistics, exact p-values, and partial eta-squared effect sizes, and we present estimated marginal means for gender with Bonferroni-adjusted pairwise comparisons.

To complement the model with an easily interpretable profile, we examined the descriptive association between the three-level transformed variable and study level using crosstabulation, evaluating overall association with the Pearson chi-square test and testing for eventual statistical significance using the linear-by-linear association statistic.

4. RESULTS

We used the general linear model (GLM) to test whether gender, study level, self-reported social class, country, and civic experience predict the students' readiness for lifestyle sacrifices, in order to prevent climate change. We assumed linearity and additivity, as well as residual homoskedasticity, which was checked using the Levene test. Its results show slight heteroscedasticity across cells ($F(162, 253) = 1.27$, $p = .044$), which calls for cautious interpretation of statistical results. The omnibus test shows that the overall model is significant at 1% level ($F(15, 400) = 2.10$, $p = .009$), although its predictive power is relatively low ($R^2 = .073$, adjusted $R^2 = .038$).

In GLM, tests of between-subjects effects are reported in units of standard deviation (SD) of the dependent variable (see Table 1). Results show that the standardized study level was positively associated with the sacrifice expectations ($F(1, 400) = 9.51$, $p = .002$, partial Eta squared = .023). Thus, students at higher study cycles anticipated greater lifestyle sacrifices. Perceived social class was marginally significant ($p = .055$), while standardized age proved to be insignificant ($p = .666$).

Table 1. Tests of Between-Subjects Effects for Sacrifice Expectations (GLM with Country Fixed Effects)

Predictor	df_effect	df_error	F	P	Partial eta squared
Gender	1	400	7.379	.007	.018
Study level (standardized)	1	400	9.507	.002	.023
Perceived social class (standardized)	1	400	3.707	.055	.009
Age (standardized)	1	400	0.186	.666	<.001
Country	5	400	0.388	.857	.005
Social Activism	1	400	1.182	.278	.003
Volunteering	1	400	3.203	.074	.008
Donating	1	400	0.298	.586	.001
Work experience	1	400	1.104	.294	.003
Management experience	1	400	0.569	.451	.001
Entrepreneurship experience	1	400	0.295	.587	.001

Note. DV is a standardized value of the item stating: "During my lifetime, I will have to make sacrifices in my everyday life because of climate change".

For the dummy variables, tests of between-subject effects in Table 1 report the contrast for the group, not possessing the background experience (coded as 0), versus the reference group with the background experience (coded as 1) in SD units of the dependent variable. In this group of predictors, civic activism and background (work, managerial, and entrepreneurial) experience indicators were not significant (activism, p = .278; donating, p = .586; volunteering, p = .074; work experience, p = .294; management experience, p = .451; entrepreneurship, p = .587).

Although the effects of those predictors were small and inconsistent, it is interesting to note that students with civic donations and volunteering experience tend to have slightly higher sacrifice perceptions, with a marginally negative effect for students with a social activism background. There were no meaningful country-specific effects (F(5, 400) = 0.39, p = .857, partial eta squared = .005), which can be an interesting guideline for further research, showing that the business students across the SEE region can be treated as a relatively homogeneous group.

Gender had a significant effect on the predicted lifestyle sacrifices (F(1, 400) = 7.38, p = .007, partial eta squared = .018). Women perceived higher lifestyle sacrifices than men (with the estimated marginal means for women M= -0.07, SE = 0.12 and M = -0.38, SE = 0.14 for men). We also tested for the pairwise difference, using the Bonferroni adjustment (p = .007). Results show a statistically significant mean difference of -0.318 SD units (see Table 2).

Table 2. Estimated Marginal Means and Pairwise Comparison for Gender

Group	Mean_z	SE	95% CI (lower, upper)
Men	-0.384	0.141	[-0.661, -0.108]
Women	-0.067	0.116	[-0.294, 0.161]

Note. Pairwise comparison (Bonferroni-adjusted): Men vs Women, mean difference = -0.318 (SE = 0.117), p = .007; 95% CI [-0.547, -0.088].

In addition to the gender effect, we also examined the study-level effects to enhance robustness. We first transformed the dependent variable (sacrifice readiness) into three categories (high sacrifice level: 4-5, mid-level: 3-3.99, and low-level: 1-2.99). We conducted a crosstab analysis to obtain a descriptive profile of sacrifice readiness across the three study levels (see Table 3). The chi-square test value of 16.64 (p = .002) shows the distribution of readiness stages differs by study level. In contrast, the value of linear-by-linear association (chi-square = 5.84, p = .016) confirms a monotonic trend, with higher study cycles possessing higher readiness for lifestyle sacrifices.

Table 3. Sacrifice-Readiness Categories by Study Level and Chi-Square Test

Study level	Low (%)	Mid (%)	High (%)	n
BA (1st cycle)	19.7	38.6	41.8	249
MA (2nd cycle)	12.9	25.0	62.1	140
Postgrad/PhD (3rd cycle)	21.4	23.8	54.8	42
Total	17.6	32.7	49.7	431

Note. Pearson chi-square (4, N = 431) = 16.64, p = .002; linear-by-linear association = 5.84, p = .016. Percentages represent row percentages at the study level.

5. DISCUSSION

Two consistent empirical findings can be identified from the results, described in the previous section: women reported higher readiness than men, and higher study cycles reported higher readiness than lower cycles. Perceived social class had a marginal positive association, while country differences were negligible after controls. Civic background experience indicators proved to be insignificant predictors.

The gender gap is aligned with the empirical evidence of women's higher environmental concern (Zelezny et al., 2000; Xiao & McCright, 2015), as well as gendered consumption profiles, which lead to higher carbon emissions (Carlsson Kanyama et al., 2021; Osorio et al., 2024). Our results concerning the higher willingness of (post)graduate students to bear the environmental costs are consistent with the extant research, linking education to higher environmental concern and willingness to pay (Franzen & Vogl, 2013) and with the idea that

business-school curricula and academic maturity can support readiness to accept trade-offs (Aktas et al., 2015; Beamond et al., 2024).

There are several practical implications of our empirical research for business schools and their partners. Firstly, as readiness to accept climate-related sacrifices improves among economics and business students as they progress to higher study cycles, the introduction of sustainability content should begin at the first cycle, with a focus on graduate study levels. At this point in their higher education, students are also more prepared for experiential learning, such as carbon-budgeting projects, decarbonization tasks, and case studies.

Second, the gender difference points to the need for audience-aware teaching. Men in our sample reported lower readiness on average, so instructors should vary examples and activities to show how costs and benefits are distributed across different lifestyles and roles. Small changes can reframe consumer sacrifices as professional and collective choices, not only moral ones.

Since country effects are weak, regional co-operation proves to be essential for effective academic teaching and learning about climate change. The same teaching materials and approaches can be used across institutions of higher business education in the region, with some minor translation(s) and language editing, without loss of relevance. This finding can contribute to significantly lower costs of sustainability teaching in the regional business school.

We also found that the civic and professional background does not predict sacrifice readiness, once other predictors were included. Practically, this suggests that curriculum design is more significant than trying to reach specific student target groups, which certain types of educational interventions could potentially reach. Since volunteering proved to be a marginally positive, but still statistically insignificant, predictor, the business schools might consider the value of structured service-learning or community projects in their specific environment.

Finally, sacrifice readiness itself can be a valuable, easy-to-communicate metric for program evaluation. It complements knowledge and attitude measures and can be tracked across student cohorts.

This study has multiple limitations. Our study design is cross-sectional, so observed associations are not causal. A higher study level may co-vary with unobserved factors that also influence readiness to make climate-related sacrifices in consumption and lifestyle. The sample comprises business and economics students from a set of cooperating business schools in a single region. Due to non-probability sampling, the results are not representative of all students or countries in the region. We did not model program-level or institution-level features (e.g., mandatory sustainability courses, pedagogical approach, accreditation), so there could be variations across business schools, depending on their involvement and interventions used in the field of introducing sustainability teaching. Finally, we did not include measures of social desirability or impression management that could inflate self-reports, nor did we test measurement invariance across countries for the staging thresholds.

Future research tasks should address the limitations of the current, initial study, which argues that the climate sacrifice is a relevant starting point, to be considered both in the sustainability teaching and interventions in higher education in business and economics. Therefore, researchers might wish to consider the sacrifice readiness concept further and develop a brief scale for its measurement, extending our simple empirical strategy, based on a single item. Sacrifice readiness should be linked to the analysis of higher education curriculum, evaluated based on the intensity of sustainability content and innovation of teaching and learning approaches. Empirical results should track change over time by using cohort or panel designs, and integrate qualitative insight, with short interviews with students and business school faculty. Researchers should also consider using the professional intention as a relevant predictor, along with other indicators of lifestyle trade-offs, including carbon pricing for different consumer items.

6. CONCLUSION

We have conducted initial research on the readiness of economics and business students in the SEE region to accept lifestyle trade-offs due to climate change. Using a GLM approach with fixed country effects, we found small but consistent associations: women reported higher readiness than men, and students in higher study cycles reported higher readiness than those in earlier cycles of higher education. Perceived social class showed a marginal positive association, while country differences were negligible once other predictors were included. These results align with the extant literature, which links educational efforts to the development of environmental concerns and acceptance of carbon-based pricing (Franzen & Vogl, 2013; ISSP Research Group, 2020). We have identified multiple practical implications for regional business schools and recommendations for future research, as the initial results demonstrate that sacrifice readiness could be an interesting starting point for framing educational interventions.

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AI ADOPTION, WORK-WELLBEING, AND INNOVATIVE WORK BEHAVIOR: IS THERE A LINK?

ABSTRACT

Artificial intelligence (AI) has become the new normal. It changed the way jobs are done, how decisions are made, and how information is used. Numerous studies have investigated the effects of AI, examining both its positive and negative aspects. Among the positive aspects, we observed an increase in productivity, enabling faster business operations and making operational and transactional activities more efficient. This allowed us to dedicate more time and effort to strategic and creative tasks. However, on the dark side of AI usually there is fear among employees, their resistance to the adoption of AI, and a lack of understanding of the concept. Prior research found that AI is related to different aspects of employees' attitudes and behaviors, like engagement, well-being, and even innovative work behavior. Having in mind the abovementioned, this research aimed to investigate the relations between the adoption of AI (AIAD), work-wellbeing (WWB), and innovative work behavior (IWB).

The methodology of the research included the implementation of the PLS SEM technique on a sample of 266 employees in the Republic of Serbia. The data were gathered in spring 2025 via an electronic questionnaire. The results pointed out that there are positive effects of AI on IWB, with a mediating role of WWB. Employees who adopt AI on a higher level express higher innovative work behavior when they feel higher work wellbeing. At the end, the paper offered theoretical and practical implications, and future directions for research.

Keywords: *Artificial intelligence, Work well-being, Innovative work behavior, PLS SEM, Serbia.*
JEL: M12, M50

1. INTRODUCTION

Artificial intelligence (AI) has become the new normal. It changed the way jobs are done, how decisions are made, and how information is used. Numerous studies have investigated the effects of AI, examining both its positive and negative aspects. Empirical evidence demonstrates that AI tools significantly enhance productivity by automating repetitive tasks, accelerating workflows, and improving output quality (Brynjolfsson et al., 2025; Noy & Zhang, 2023). These improvements allow employees to devote more time to creative and strategic work, which can stimulate innovative work behavior (Verma & Singh, 2022; Zhang

et al., 2025). In particular, the use of AI has been found to increase self-efficacy and job crafting behaviors, both of which are antecedents of innovation at work (Zhang et al., 2025).

However, on the dark side of AI usually there is fear among employees, their resistance to the adoption of AI, and a lack of understanding of the concept. Prior research found that AI is related to different aspects of employees' attitudes and behaviors, like engagement, well-being, and even innovative work behavior. Research on employee perceptions of smart technologies (STARA) highlights growing fears related to job insecurity, loss of control, and technological obsolescence (Brougham & Haar, 2018). Such fears can manifest as resistance to AI adoption and may negatively affect work well-being through heightened stress or reduced psychological safety (Pereira et al., 2023; Valtonen et al., 2025).

The overall impact of AI on employee outcomes therefore appears to be indirect, enhancing well-being when AI augments autonomy and resources, yet diminishing it when AI intensifies work demands or uncertainty (Pereira et al., 2023). Successful implementation depends on organizational strategies that align AI adoption with supportive leadership, training, and participative communication to harness productivity and innovation benefits while safeguarding employee well-being.

Having in mind the aforementioned, the main aim of this research was to investigate the relationships between the adoption of AI (AIAD) at the workplace, work-wellbeing (WWB), and innovative work behavior (IWB). The methodology of the research included the implementation of the PLS SEM technique on a sample of 266 employees in the Republic of Serbia. The data were gathered in spring 2025 via an electronic questionnaire, and most respondents were highly educated employees.

The structure of the paper contains five sections. After the introduction, the second section presents the body of knowledge in innovative work behavior, employee work well-being and AI. The third section explains the methodology, data, sample, and analytical approach, while the fifth section presents the results of PLS SEM analysis. Finally, in the conclusion section, we provided the main conclusions, theoretical and practical implications, and a few limitations of the research and directions for future studies.

2. THEORETICAL BACKGROUND

Due to the high uncertainty, unpredictability, and competitive business environment, companies need to find new and different approaches to ensure their survival and development on the market. It is essential to innovate and improve businesses, products, services, processes, and technologies (De Jong & Den Hartog, 2008). To achieve this, companies need to foster innovative behavior of their employees. Innovative work behavior (IWB) is a complex behavior of employees that generates, introduces, and applies innovative ideas. IWB offers capabilities for retaining competitive advantage and maintaining organizational sustainability (AlEssa & Durugbo, 2022). Individual employees need to be both willing and able to innovate if a continuous flow of innovations is to be realized (De Jong & Den Hartog, 2008). IWB consists of idea generation, idea promotion, and idea realization (Jannsen, 2000, p.288). According to the last author cited, "these extrarole behaviors refer to discretionary employee actions which go beyond prescribed role expectations, and are not directly or explicitly recognized by the formal reward system"

(Janssen, 2000, p. 288). Innovative work behavior is seen as a specific, dynamic, and multifaceted phenomenon, involving proactive behavior with a special emphasis on novelty (Gašić et al., 2025). Also, it is understood as the intentional creation, introduction, and application of new ideas within a work role, group, or organization (Bos-Nehles & Veenendaal, 2019; Yasir & Majid, 2020), as a multifaceted four-dimensional construct that includes problem recognition, idea generation, advocacy, and idea realization (Abstein et al., 2014; Gašić et al., 2025).

Prior research found that the use of AI could enhance creativity and IWB in a company (Dong et al., 2025; Verma & Singh, 2022; Ivcevic & Grandinetti, 2024; Zhang et al., 2025). AI adoption can promote IWB by enhancing knowledge workers' challenging stress appraisal, while inhibiting IWB by fostering their hindering stress appraisal. Individual learning ability can moderate the relationship between AI adoption and stress appraisal, which further influences IWB (Dong et al., 2025). A study based on a sample of 486 high-tech employees showed that both AI-job autonomy and AI-job characteristics positively affected IWB. AI-enabled jobs make substantial emotional, intellectual, and cognitive demands on high-tech employees (Verma & Singh, 2022). As noted by Zhang et al. (2025), the use of AI can encourage IWB in two complementary ways, i.e., by strengthening employees' sense of competence and autonomy and by altering the structure of their tasks and feedback. In practice, AI systems often handle repetitive work and provide analytical support, allowing workers to focus more on problem-solving and idea generation. These tools can also increase confidence, as employees rely on data-based insights to make informed decisions. Moreover, AI can enhance autonomy when it assigns or suggests tasks intelligently. For instance, in creative projects, AI-generated drafts act as starting points, helping individuals refine their ideas and combine efficiency with creativity. Based on these findings, we proposed our first hypothesis:

H1: AI use is positively related to innovative work behavior.

As it is mentioned, AI raised some concerns among employees (Brougham & Haar, 2018). Fear of losing job, ethical issues, and privacy concerns are just some of the most mentioned dark sides of the usage of AI (García-Madurga et al., 2024). However, if AI usage is well planned, well understood, and used to enhance all those elements like autonomy, speed, decision making, validity of results, etc., it could lead to even higher work well-being. Work well-being is defined as a part of overall employee well-being, encompassing satisfaction and engagement with work domains, responsibilities, and overall experience at work (Zheng et al., 2015). García-Madurga et al. (2024) found that the primary uses of AI include monitoring mental health, delivering individualized wellness programs, and detecting psychosocial risk factors, pointing to the rising role of AI in employee well-being. Also, they found that AI affects employees' mental health and overall wellness. Notable enhancements in well-being are found, while others draw attention to potential drawbacks, for example, stress increases linked to technologies for monitoring, tracking, and data collection of employees. Finally, the analysis highlighted promising research paths, such as combining AI with other emerging technologies and formulating ethical frameworks to govern its impact on employees. These insights help establish a basis for further investigation and add to the ongoing debate about how AI should be integrated in workplace settings (García-Madurga et al., 2024, p. 399). Valtonen et al. (2025) investigated 207 employees in Finnish and international firms with headquarters in Finland. The results revealed that AI adoption

does not exert a direct effect on employee well-being; rather, its influence is mediated through work-related dimensions such as task optimization and workplace safety. These findings emphasize the strategic significance of implementing AI in ways that improve job characteristics valued by employees, thereby maximizing its positive impact on well-being. From a practical standpoint, the study highlights that AI initiatives should lead to concrete advancements in task efficiency, data protection, and occupational health. When these factors are properly managed, AI adoption can foster greater employee well-being and support more effective human–AI collaboration within organizations. Similarly, the study findings of Arboh et al. (2025) revealed that health workers' AI awareness positively impacts work wellbeing. However, this effect is not direct; instead, it is mediated by their informal learning behavior at the workplace. Other research also revealed how AI can affect work well-being. For example, by automating routine and repetitive tasks, AI reduces workload and time pressure, allowing employees to focus on more meaningful and creative aspects of their jobs (Rožman et al., 2023). Moreover, AI enhances perceived competence and autonomy by providing real-time feedback, decision support, and flexible task management systems that strengthen employees' confidence and self-efficacy (Zhang et al., 2025). All research results and mechanisms suggest that AI use, when strategically implemented, can enhance employees' work well-being by improving competence, autonomy, safety, and fairness in the workplace. Based on the aforementioned, we drew our second hypothesis:

H2: AI use is positively related to work well-being.

As we saw, AI can enhance employees' work well-being by automating repetitive tasks, providing real-time feedback, and offering decision-support systems that improve efficiency and reduce cognitive overload (Zhang et al., 2025; Parker & Grote, 2022). Through these mechanisms, AI promotes perceptions of competence and autonomy, two of the three key dimensions of psychological well-being identified by self-determination theory (Ryan & Deci, 2000; Vansteenkiste et al., 2006). Higher levels of work well-being, in turn, foster IWB and employee creativity (Nangoy et al., 2019; Miao & Cao, 2019), such as idea generation, experimentation, and implementation (Amabile & Pratt, 2016). Thus, work well-being could be seen as a mediating mechanism that explains how AI influences innovative work behavior. Namely, AI adoption or use should enhance organizational performance, in terms of reduced costs and increased efficiency, increased work wellbeing and employees' attitudes towards work, indirectly fostering IWB. In this sense, AI does not automatically generate innovation; rather, its positive effects on creativity and proactive behavior emerge when AI adoption contributes to a healthier, more autonomous, and psychologically supportive work environment. Finally, our third hypothesis is:

H3: Work well-being mediates the relationship between AI use and innovative work behavior.

3. METHODOLOGY

Our research is a cross-sectional quantitative study done in the Republic of Serbia in 2025. The main elements of the methodology section are explanations of the questionnaire, variables, and the sample.

3.1. Questionnaire

To investigate the proposed relation, we used standardized questionnaires for all of our constructs. The first part of the questionnaire consists of demographic questions (gender, education, age, managerial position), while the second part contains questions related to AI, WWB. And IWB. To investigate the AI adoption and innovative work behavior, we used questions from the questionnaire used in Dong et al. (2025).

Questions for AI adoption were (Dong et al., 2025, p. 146):

- "AIAD1_1 I need AI to provide information resources to get the work done,
- AIAD2_1 I need AI to help me do my work,
- AIAD3_1 I need to interact with the AI frequently at work,
- AIAD4_1 I can use AI to do my work independently,
- AIAD5_1 I see AI as my work partner,
- AIAD6_1 My collaboration with AI at work is friendly,
- AIAD7_1 AI supports my work,
- AIAD8_1 I was able to have human-like communication with AI at work."

Questions for IWB were (Dong et al., 2025, p. 146):

- "IWB1 I often use new processes, techniques, and methods in my work,
- IWB2 I often come up with creative ideas and thoughts at work,
- IWB3 I often communicate and convey my new ideas to my coworkers at work,
- IWB4 In my work, I will find ways to obtain the resources needed to realize new ideas,
- IWB5 In my work, I will make suitable plans to realize new ideas,
- IWB6 Overall, I am an innovative person in my work."

In case of work well-being, we used Zheng et al. (2015, p. 644) scale of 6 questions:

- "WWB1. I am satisfied with my work responsibilities.
- WWB2. In general, I feel fairly satisfied with my present job.
- WWB3. I find real enjoyment in my work.

- WWB4. I can always find ways to enrich my work.
- WWB5. Work is a meaningful experience for me.
- WWB6. I feel basically satisfied with my work achievements in my current job."

All questions were in form of Likert scale from 1 (not at all) to 5 (agree in total).

3.2. Sample

The research was conducted in spring 2025, from July to September, via an electronic questionnaire. We used LinkedIn to gather as many answers as possible. 266 valid responses were gathered. We acquired informed consent from our respondent (Berber et al., 2025) through the questionnaire. Each respondent got an explanation of the questionnaire, the theme, the aim, and the subject of the research. The sample description is given in Figure 1.

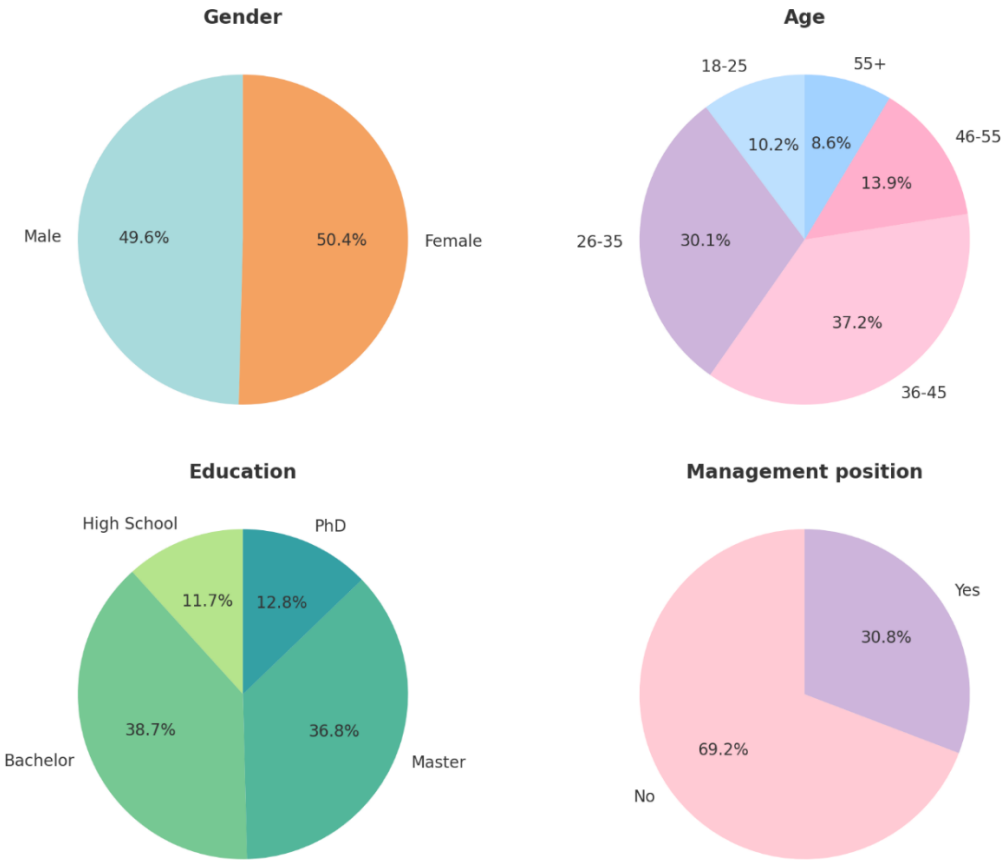


Fig. 1. Demographic structure of respondents (n=266)
Source: Author's calculation (Berber et al., 2025)

The sample consists of 50% males and females in the sample, mostly in the Y generation, and more than 60% of respondents are in the age group from 26 to 45 years of age. Most of

the respondents are highly educated persons, with BSc and MSc degrees (about 75%), while only 11.7% have a high school degree. About 30% of respondents are in managerial positions, while the rest of the sample are employed without managerial positions.

Although the sample is relatively small, only 266 responses, by using the rule "ten times more" (Hair et al., 2019), where the sample needs to be at least ten times higher than the number of structural paths between variables, we find that the sample is suitable for further analysis.

4. RESULTS

We have split our results section into two parts to test the constructs and the structural model. The first part was related to testing the validity of the measurement model. We performed a path analysis to investigate reflective constructs and bootstrapping to investigate the structural model. In terms of path analysis, the measurement model relations between latent and observable variables were tested by using indicator and construct reliability, and convergent and discriminant validities, while the structural model was tested by application of the bootstrapping procedure based on 5000 subsamples (Berber & Gašić, 2024).

As the first step, the authors analyzed reflective indicator loadings, internal consistency reliability, convergent validity, and discriminant validity. This type of measurement was proposed for reflective constructions in the model (Hair et al., 2019). We retained the indicators' loadings between 0.4 and 0.7 because their removal did not have an impact on the average variance extracted and composite reliability (Hair et al., 2014). Figure 1 summarizes all of the above-mentioned and shows the retained items with the allowed degree of load (see Figure 2).

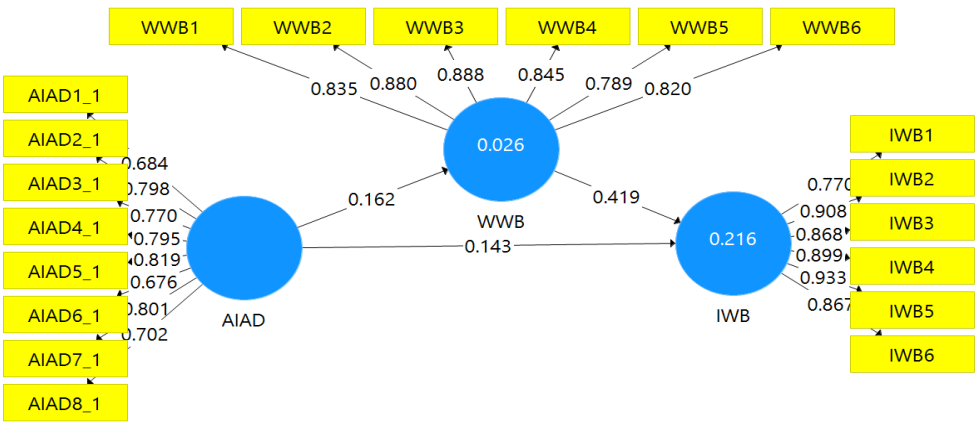


Fig. 2. Path analysis

Source: Author's calculation

Table 1 outlines the reliability test, i.e. Cronbach's Alpha, composite reliability (CR), and average variance extracted (AVE). The lowest acceptable limit of Cronbach's Alpha should be 0.6 (Dakduk et al., 2019), for composite reliability 0.7 (Tselios et al., 2011; Sabi et al., 2016), and for AVE 0.5 (Dash and Paul, 2021). Based on the data in Table 1, the convergent validity was satisfied for all reflective constructs (AIAD, WWB, and IWB).

The multicollinearity analysis indicates that all variance inflation factor (VIF) values are below 5, which means that the model is reliable and valid (see Table 1).

Table 1. Indicator reliability and construct reliability and validity

	AIAD	IWB	WWB	Cronbach's Alpha	CR	AVE	VIF
AIAD1_1	0.684						2.183
AIAD2_1	0.798						3.349
AIAD3_1	0.770						2.787
AIAD4_1	0.795			0.897	0.915	0.574	2.686
AIAD5_1	0.819						2.999
AIAD6_1	0.676						1.917
AIAD7_1	0.801						2.972
AIAD8_1	0.702						1.651
IWB1		0.770					2.133
IWB2		0.908					4.303
IWB3		0.868		0.939	0.952	0.767	2.816
IWB4		0.899					4.244
IWB5		0.933					4.628
IWB6		0.867					3.492
WWB1			0.835				3.054
WWB2			0.880				4.391
WWB3			0.888	0.919	0.937	0.712	3.917
WWB4			0.845				2.419
WWB5			0.789				1.948
WWB6			0.820				2.220

Source: Author's calculation

We examined the discriminant validity. Discriminant validity can be assessed by using the Fornell-Lacker Criterion and Heterotrait-monotrait HTMT. According to the Fornell-Larcker criterion, the root from the AVE of a latent variable must have a higher value than all correlations with other latent variables (Fornell & Larcker, 1981).

Table 2 demonstrates that the discriminant validity was satisfied.

Table 2. Discriminant Validity – Fornell-Larcker Criterion

	AIAD	IWB	WWB
AIAD	0.758		
IWB	0.211	0.876	
WWB	0.162	0.443	0.844

Source: Author's calculation

HTMT ratio values below 0.9 indicate that the defined components are sufficiently different from each other; it means that they describe different phenomena (Hair et al., 2019). The results presented in Table 3 show that the discriminant validity criterion was met.

Table 3. Discriminant Validity – Heterotrait-monotrait (HTMT)

	AIAD	**IWB**	**WWB**
AIAD			
IWB	0.201		
WWB	0.160	0.452	

Source: Author's calculation

The final step of the analysis was to analyze the relationship between the independent variable (AIAD) and the dependent variable (IWB), with the mediating variable (WWB). R2 (R-squared), as a proportion of the variance of an dependent variable that is explained by an independent variable, shows that 21.6% of the variance in *work well-being* is explained by *AI adoption* in the model. The quality of the structural model was verified using the cross-validated Redundancy Index (Stone-Geisser's Q2). The calculation was performed by the blindfolding technique in PLS. Q2 for IWB of 0.152 fall within the positive range, indicating that the structural model is of medium quality. In case of WWB, the Q2 is only 0.02, exhibiting only a marginal level of predictive relevance. Also, the structural model demonstrated an adequate fit to the data, as indicated by the Standardized Root Mean Square Residual (SRMR = 0.075), which falls below the recommended threshold of 0.08 (Shi et al., 2018).

Table 4 Mean, STDEV, T-Values, P-Values

	Original Sample (O)	**Mean (M)**	**Std. Dev. (STDEV)**	**T Statistics (|O/STDEV|)**	***p* Values**
AIAD -> IWB	0.143	0.150	0.056	2.563	0.010
AIAD -> WWB	0.162	0.176	0.052	3.133	0.002
AIAD -> WWB -> IWB	0.068	0.074	0.023	2.931	0.003

Source: Author's calculation

The results shown in Table 4 indicate a statistically significant relationship between AIAD and IWB (β=0.149; t = 2.563; p = 0.010), between AIAD and WWB (β=0.162; t = 3.133; p = 0.002), and between AIAD and IWB via mediating variable WWB (β=0.068; t = 2.931; p = 0.003).

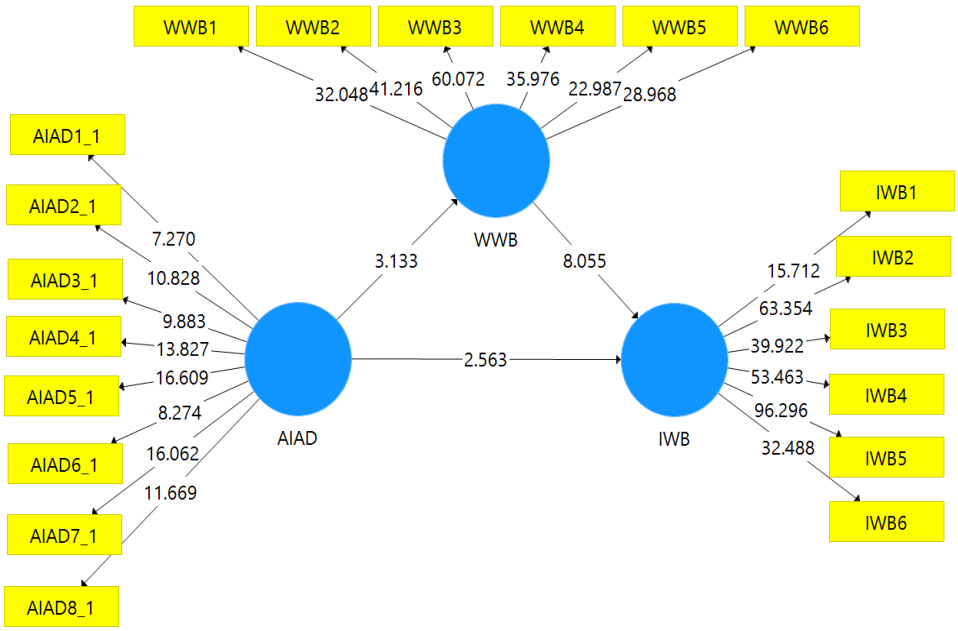


Fig.2. Bootstrapping

Source: Author's calculation

Finally, results showed that AI adoption (or use) has the potential to increase innovative work behavior of employees when they feel higher work well-being. All three of our proposed relations are statistically significant, and we confirmed all three hypotheses.

5. DISCUSSION AND CONCLUSIONS

The findings of this study showed that artificial intelligence adoption (AIAD) is positively related to employees' innovative work behavior (IWB), both directly and indirectly through work well-being (WWB). This confirms that employees who perceive AI use as a supportive, resource-enhancing tool tend to report higher well-being at work, which subsequently encourages IWB. The mediating role of WWB is partial, showing that AI adoption has the potential to increase innovative work behavior of employees when they feel higher work well-being.

The results support previous studies emphasizing the human resource management mechanisms through which technology adoption affects work outcomes (Dong et al., 2025; Zheng et al., 2015). When AI tools are designed and used to add to human capabilities, rather than replace them, they contribute to higher autonomy, competence, and employee engagement, enabling the potential to foster innovative work behavior. Also, this research, although small in scale, contributes to the growing body of literature exploring relations between AI and employees and its effects on employee-level outcomes.

From a managerial perspective, the results suggest that organizations should treat AI adoption not merely as a technological upgrade but as a people-centered change process. Managers and HR professionals should ensure that employees receive adequate training, have autonomy in using AI tools, and experience them as enablers of meaningful and efficient work. Enhancing well-being through fair workload distribution, feedback

mechanisms, and inclusive communication around AI use can amplify the positive impact on innovation. Furthermore, organizations should consider monitoring employees' perceptions of AI and well-being regularly to identify potential risks such as technostress, job insecurity, or skill mismatches that could undermine innovation efforts.

Our research has several limitations, too. First, the cross-sectional design limits causal inference, as the relationships were measured at one point in time. Future research could apply longitudinal or experimental designs to explore the temporal dynamics between AI use, work well-being, and IWB. Second, the study relied on self-reported data, which may be influenced by social desirability bias. Combining subjective measures with objective performance data would enhance validity. Finally, future research could include other moderating variables such as leadership style, digital literacy, other HRM constructs, or organizational support to better understand AI's impact on employee outcomes.

Overall, the study confirms that AI adoption can be a driver of innovative work behavior when accompanied by a positive work experience. By focusing on employees' well-being as a mediator, this research underscores the importance of balancing technological efficiency with human-centered values in the workplace.

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UNLOCKING ORGANIZATIONAL POTENTIAL: TALENT MANAGEMENT AS A DRIVER OF INNOVATION IN THE AI ERA

ABSTRACT

In the context of increasing global competition and rapid technological change, talent management has become a strategic imperative, especially for small and medium-sized enterprises. This paper first explores the importance of talent management and its relevance in a dynamic business environment shaped by digital transformation and artificial intelligence. Through desk research, it is demonstrated that effective talent strategies are becoming essential for innovation, adaptability, and long-term competitiveness. Building on these findings, the paper presents five case studies conducted in 2023 across diverse service enterprises, including banking, retail, IT, hospitality, and market research. The aim was to provide a deeper insight into the actual forms of implementation, practices, and challenges that organizations face in the process of talent management. The results indicate that while the importance of talent management is widely acknowledged, it is rarely implemented as a comprehensive, integrated system. Instead, SMEs tend to focus on isolated activities, often lacking strategic alignment. The paper concludes that in BiH there is a strong need for greater promotion of talent management as a strategic priority. To achieve meaningful and sustainable results, SMEs should move beyond fragmented efforts and adopt a comprehensive talent management model.

Keywords: *talent, talent management, talent management strategy.*
JEL: O15, J24, M12

1. INTRODUCTION

Understanding the importance of human resources as a key factor of competitiveness in the modern business environment is becoming increasingly important. In the era of digital transformation and rapid change, it is clear to company management that talented individuals are imperative for the organization's survival and growth. Talent management is emerging as a key strategy to secure this resource, become more competitive, and achieve long-term success. Talent management was first introduced in 1998 when a group of McKinsey consultants published a study called "The War for Talent," which Chambers et al. (1998, p.

46) included in McKinsey's quarterly report. This report highlighted the importance of talent in achieving organizational excellence. Since then, this field has become the focus of extensive research and interest, not only among theorists but also among human resource management practitioners.

Although this field has been extensively studied and applied in developed economies for many years, it remains relatively new and less explored in the local context. Therefore, the importance of this work lies in its contribution to expanding both theoretical and empirical knowledge about talent management in BiH. The study primarily builds on earlier work by Burić and Kljajić Dervić (2024) and Kljajić Dervić et al. (2023), which outlined the main patterns of application and challenges organizations face when developing their human resources. Previous research indicates that most organizations in BiH are familiar with, but do not fully implement, talent management, and do so without an integrated or strategic approach. Instead, activities are mainly limited to individual practices. (Burić and Kljajić Dervić, 2024, Kljajić Dervić et al., 2023) Based on these findings, this study aims to provide a deeper understanding of the actual forms of implementation, practices, and challenges organizations face in the talent management process. The primary goal of the research is to assess the level of development and methods of implementing talent management in organizations in BiH, with a particular focus on identifying factors that contribute to its effectiveness, as well as its impact on organizational success and competitiveness.

2. LITERATURE REVIEW

2.1. The Concept of Talents and Talent Management

The term ‘talent’ is very prevalent across all areas of life. From magazines, internet blogs, social media, to business newsletters, we are regularly exposed to this term, which we sometimes cannot even clearly define, especially when placed in a business context. In the book Global Talent Management, Gallardo-Gallardo (Gallardo-Gallardo, as cited in Collings et al., 2019, p. 9) notes that in 2006, an interesting review in The Economist stated that companies do not even know how to define the concept of talent, let alone manage it.

Although there are many definitions of talents, the most comprehensive one states that talents are individuals who possess sought-after and applicable knowledge, skills, and competencies, and who achieve high performance, and that if they are placed in appropriate and key positions, they can contribute to improving competitiveness and achieving overall organizational success. Accordingly, the concept of talent management has been defined as a set of all necessary activities aimed at identifying key positions within a company, recognizing the required human knowledge, competencies, and skills, then finding and appropriately utilizing them, with the goal of achieving organizational objectives, success, and competitiveness, while simultaneously providing an environment for the development and retention of talented individuals who bring these knowledge, skills, and competencies to the organization (Burić et al., 2021).

2.2. The Importance of Talent Management

The significance of talent management is demonstrated through various positive effects on a company, including gaining a competitive edge. Several review papers have linked talent

management with competitiveness. Rabbi et al. (2015) view talent management as a source of competitive advantage and propose a model that involves attracting, developing, and retaining talent, thereby directly affecting the company's competitive position. Wahyuningtyas (2014) offers an integrated talent management system model that any organization can adopt to gain a competitive edge. An entire chapter in the book by Avedon and Scholes (2010) is dedicated to the importance of integrating talent management for competitive advantage. Ordonez de Pablos (2004) concludes that human capital is a unique resource that provides the company with endless knowledge and forms the foundation for achieving sustainable competitive advantage. Abbas and Cross (2018) believe that companies capable of attracting, developing, and retaining talented employees can also secure a competitive advantage.

This relationship is also supported by the resource-based view (RBV), which argues that a firm's competitiveness depends on its ability to secure and develop valuable, rare, inimitable, and non-substitutable resources, such as human capital (Barney, 1991). Building on RBV, the dynamic capabilities (DC) perspective explains how organizations strengthen competitiveness by continually integrating, reconfiguring, and renewing their tangible and intangible resources in response to environmental change (Kruasom & Saenchaiyathon, 2015). Within this view, the ability to manage high-potential employees, referred to as dynamic talent management capabilities (DTMC), represents a crucial organizational mechanism through which firms sense emerging opportunities and transform individual talent into new business capabilities aligned with long-term strategic goals (Nalintippayawong et al., 2018; Nantharojphong et al., 2021).

Beyond its theoretical basis, the link between talent management and competitiveness has been confirmed by numerous studies. Latukha (2016) focused her research on emerging markets in Russia and verified that talent management can be considered a core of competitive capability. Alma'aitah et al. (2013) examined the same impact in Jordan's most successful companies and found that talent management significantly influences their competitiveness. Wandia (2013) conducted a case study at Symphony (K) Ltd. in Kenya and concluded that talent management in this company is a source of sustainable competitive advantage, a conclusion also supported by Moturi (2013), who researched another Kenyan firm, Data Networks Ltd. Al-Hadid (2017), based on research in Jordanian telecommunications companies, confirmed the significant impact of talent management on achieving competitiveness.

Heinen and O'Neill (2004) argue that talent management can be the best way to develop long-term competitive advantage because it stems from valuable and unique resources that are not easily imitated or transferred by competitors. Huselid et al. (2005) reach similar conclusions and suggest that organizations aiming to improve their competitive position and productivity should adopt a strategy of attracting, hiring, retaining, and developing intellectual capital. Al-Haraisa et al. (2021) conducted research in 130 insurance companies in Jordan, examining managers and their staff. The results showed a significant effect of these activities on competitive advantage. Abu-Darwish et al. (2022) also conducted research in Jordan, involving 200 private healthcare facilities, hospitals, therapeutic, and diagnostic centers, and found a statistically significant influence of talent management practices on the competitive advantage of these organizations.

3. RESEARCH METHODOLOGY

The five firms included in the case study analysis were selected from a broader sample of 101 service-sector enterprises analysed in previous research on talent management in BiH (Burić & Kljajić Dervić, 2024). The earlier quantitative study identified substantial variation in the level of talent management maturity across sub-sectors. Based on these results, one organization with the highest talent management score was chosen from each of the five major service sub-sectors: banking, retail, IT, hospitality, and market research. This ensured both sectoral diversity and theoretical relevance, as each case represented a distinct organizational context with demonstrably active or emerging talent management practices.

The study was conducted during the second quarter of 2023. Data were collected through a structured semi-structured interview protocol administered in written form to one HR- or TM-responsible manager in each of the five selected firms. Respondents received an open-ended questionnaire, had seven days to provide written narrative answers, and were subsequently contacted by phone for clarification. As interviews were written and no recordings were made, transcription was not required. All participants received an invitation outlining the purpose of the research and signed informed consent forms prior to participation. Firms were not anonymous to the researcher; however, confidentiality was ensured. The names of participating organizations and any identifiable details were omitted from all analyses and final reporting.

The main thematic areas included: the scope and implementation of talent management activities; strategy and methods for identifying, attracting, retaining, and motivating talent; challenges faced by organizations; perceptions of the impact of talent management on organizational success; and ways to measure the effectiveness of implemented initiatives. Given the qualitative nature of the research, the collected data were interpreted using descriptive and comparative methods. The focus was on identifying patterns and similarities among cases, as well as recognizing differences in approaches and results of talent management applications across different sectors.

4. RESEARCH RESULTS AND DISCUSSION

The research results are presented below, where each organization is shown separately. The responses from interviews are not displayed individually by question but are consolidated and interpreted to highlight the main characteristics of each organization's talent management approach. Each organization is described without naming it, as participation in the research was anonymous.

Company „A“ – Bank

Bank „A“ has been operating in BiH for 30 years, and 20 years ago, it was acquired by a well-known European banking group. In BiH, it has nearly 100 branches and over 1,500 employees. At Bank A, there is a talent management program, which we will refer to as the 'TM Program' for this case study. It focuses on key managerial and expert positions.

The talent management strategy focuses on filling roles with internal employees. Since the emphasis is on existing staff, their recognition relies on performance and acknowledgment

by their direct supervisor, who, in collaboration with the sector director and human resources, selects employees for the 'TM Program.' Although Bank 'A"'s goal is not to place external individuals in key positions, it still aims to attract talented personnel to other roles. External talent is drawn in through benefits such as a competitive financial package, an international work environment, collaboration within the banking group, knowledge sharing, continuous learning, and relevant training. For managerial roles, the benefits package is even more extensive.

Talent retention relies on providing opportunities for career growth. Employees in the 'TM Program' gain greater access to training and development, which, along with financial incentives like salary increases, helps motivate talent. Bank 'A' believes that key factors for attracting and keeping talent are growth opportunities, personalized career development, and a positive work environment. As a result, the bank develops programs to motivate and retain talent.

The banking sector faces talent challenges, including an unstable labor market that has recently led to high turnover and fluctuating talent levels. Bank „A“ aims to fill 80% of managerial positions from internal candidates, which is why it invests in the 'TM Program' and measures its success based on achieving this goal.

Company „B“ – Retail

Company "B" is part of a group operating in Southeast European countries and has a rich history in BiH, with 20 years of successful business on the market. Its presence extends across the country, encompassing a number of retail store branches. With its well-established retail network, company "B" supplies its customers with a diverse range of products throughout BiH. This engagement in retail brings significant benefits to the community while also providing employment for over 1,100 workers.

Talent management in this sector includes various activities aimed at discovering and developing young talents for future managerial roles. These potential successors for key positions are identified among younger colleagues who are recognized as capable of taking on more demanding roles. After recognizing these potentials, they are directed toward additional education and development programs within the Group. Educational programs, such as DRIVE Beyond Excellence, enable participants to gain insights into different business areas like finance, sales, project management, and customer relationship development. Special emphasis is placed on developing leadership skills, recognizing individual characteristics of team members, and encouraging creativity, agility, and innovative thinking.

The current talent management strategy of this company is based on ensuring that young and talented employees are in the right positions at the right time to achieve long-term success. Talent recognition is carried out through performance assessments, testing, and interviews with potential talents. Methods of attracting talents include offering attractive benefits such as education, professional and personal development, work-life balance, competitive compensation, and advancement opportunities, with a perspective of succession planning for key personnel.

Retaining talents is a challenge, as they often seek comprehensive benefit packages. Hybrid work and the possibility of working from home are becoming increasingly attractive. Motivation of talents is achieved through education, professional training, and activities like team building. From experience, talented employees value the opportunity for rapid advancement and continuous professional development. Talent management in this sector also faces challenges such as the loss of talents after completing programs, when some employees decide to move to other employers.

Company „C" – IT

Company „C" is an IT company from BiH specializing in the development of software products. It focuses on creating complex systems and IT presentations, including application and website development. Since 2010, it has been engaged in developing complete software solutions for various industries.

Talent management in this company encompasses a range of activities aimed at recognizing, developing, motivating, and retaining talents within the organization. These activities are crucial for achieving success and competitive advantage in the labor market. The way these activities are carried out can significantly impact the overall efficiency and productivity of the company.

One of the fundamental activities of talent management is regular performance evaluations. These evaluations allow for tracking employee progress and identifying their strengths and areas for improvement. Additional employee training also plays a key role in talent management. Through continuous education and development, employees are equipped to enhance their skills and competencies. Promotions and advancements are another important aspect. Through such initiatives, the company rewards talents and provides them with opportunities to advance in their careers. Regular planning of the company's needs enables timely identification of required resources and adaptation of talent management strategies.

The current talent management strategy of this company includes an internal internship program for new potential employees. This program allows for recognizing young talents and integrating them into the company. The performance of all workers is evaluated every six months, enabling continuous assessment and monitoring of employee progress. Talent recognition is based on daily performance. Employees who stand out and exceed expectations are recognized and rewarded. Top management, especially the People Operations department, is responsible for this process. Employee proactivity is also valued, as it indicates their desire for advancement and contribution to the company.

Methods of attracting talents include advertising on social media, collaboration with educational institutions, recruitment through internal channels, and socially beneficial activities. These strategies enable the company to attract qualified candidates and identify potential talents. To retain talents, the company focuses on caring for employees, creating a healthy work environment, enabling freedom of speech, regular evaluations and rewards, and respecting employees' private time. Motivating talents is achieved through providing good working conditions, attractive salaries, benefits such as transportation, food, and team-building activities. Talented employees most value that their talent is recognized and that

they are given opportunities for further development and advancement, along with appropriate rewards for their contributions.

Although talent management brings numerous benefits, the company also faces challenges such as strong competition in the labor market, adapting to individual employee needs, ensuring quality projects, and achieving success in a dynamic environment. The implementation of talent management has brought success to the company in all aspects, and the effectiveness of these initiatives is regularly reviewed and monitored in meetings.

Company „D“ – Hospitality

Company “D” holds a global hospitality franchise, ranking as the second-largest restaurant chain worldwide, serving over 10 million guests daily. Currently, two restaurants operate in BiH, having entered the market in 2022.

In the hospitality industry, a talent management strategy involves several key activities aimed at identifying, developing, motivating, and retaining talent. Regarding talent selection and recruitment, company “D" employs various channels, including advertising, social media, internal transfers, and referrals, to attract suitable candidates. This approach helps identify potential employees capable of contributing to the company's success.

Employee development is supported through internal training, additional education, participation in conferences and online courses, allowing staff to enhance their skills and continue growing. Succession planning is another vital element, as it involves identifying critical roles within the company and preparing suitable candidates for these positions to ensure business continuity and leadership development. Employee engagement and motivation are top priorities. The company actively fosters a positive work culture, assigns challenging tasks, offers competitive compensation, and recognizes achievements. Performance is regularly monitored and evaluated to ensure high productivity and support the company's overall success.

The current talent management strategy emphasizes recognizing and developing existing talents. It enables the company to discover each employee’s potential and create opportunities for growth. Talents are identified through methods such as knowledge assessments, questionnaires, evaluations, 360-degree feedback, mentoring, and interviews with key personnel. To attract talent, the company uses online advertising, referral programs, awards and recognitions, and collaborations with secondary schools. To retain employees, the focus is on career development, fair compensation, flexible work hours, days off, and providing feedback and acknowledgment of achievements. Motivation is fostered through creating an inspiring work environment, supporting professional growth, and providing transparent career advancement pathways. Experience shows that talented employees value opportunities for professional development, a positive atmosphere, and clear growth paths within the company most.

Challenges in talent management faced by this company include measuring individual performance and finding employees with specialized knowledge and skills. It has been observed that the company’s success has increased thanks to effective talent management. This strategy has led to better utilization of employee potential and improved results.

The effectiveness of talent management initiatives is assessed through key success indicators. These metrics help track progress and the efficiency of talent management efforts, ensuring they positively impact the company.

Company „E“ – Market research

Company “E” is a consulting agency involved in market research and public opinion polling, with an emphasis on integrating business activities and information technologies. The company positions itself as an expert in management, acting as a bridge between the business world and technology.

Talent management at “E” includes activities aimed at recognizing, developing, motivating, and retaining talents. This process involves regularly listening to employees’ needs and supervisors’ expectations through the "Leading/Coaching" model. In this model, employees and their supervisors collaboratively develop annual goals, vision, and mission, which are monitored and adjusted through regular conversations.

The company's current talent management strategy revolves around "Leading/Coaching" dialogues, enhancing the company's brand through a new website that highlights real work life, and implementing job/position rotations to meet employee desires and needs.

Talents are identified through various channels such as LinkedIn, Xing, recommendations, and job postings. Recognizing that a CV is not the sole indicator of potential, all candidates meeting minimum requirements are invited for interviews to increase their chances of being recognized as potential talents. Talent attraction methods include increased social media postings, open discussions about working conditions, and communication between current employees and potential recruits or referrals. Retention strategies encompass open and transparent conversations, a positive work environment, training, mentoring, job rotations, professional development opportunities, team events, flexible working hours, international assignments, and benefits like paid massages or sports sessions.

Motivation of talents is maintained through active monitoring of their work, providing constructive feedback, supporting career growth, offering diverse training opportunities, tracking individual goals, maintaining well-equipped workspaces, providing above-average salaries, annual bonuses, paid leave, and systematic health check-ups. Experience shows that factors most important to talented employees include a good onboarding process, opportunities for professional development, career progression, a strong team spirit, open communication, understanding personal circumstances, fair pay, and work-life balance.

Challenges related to talent and talent management include sourcing qualified talents who meet minimum criteria. Another significant challenge is finding individuals familiar with basic tools for work and business communication. The company observes a positive impact of talent management, which has been ingrained in the organization since inception, gradually evolving the approach to various activities. The effectiveness of talent management initiatives is assessed through low team turnover, organic growth in employee numbers, and strategic branding efforts to better showcase the benefits the company offers.

Analysis of the research results revealed that the concept of talent management in organizations in BiH is applied in various forms and stages of maturity, depending on the sector and organizational structure. The most developed forms are observed in the banking and IT sectors, where formalized talent development programs, structured performance evaluation and career planning policies, and clearly defined criteria for recognizing and promoting employees have been implemented.

These organizations achieve measurable results in terms of staff retention, increased motivation, and innovation, confirming that a systematic approach is key to successful talent management implementation. In the retail and hospitality sectors, there is a noticeable presence of development initiatives, but they are most often focused on operational levels and include internal training and youth development programs.

However, even in these sectors, awareness of the importance of talent management is growing, especially regarding employee retention and motivation. The market research sector, as a separate sector, demonstrates a more integrated and flexible approach, with management and employees jointly involved in development and performance evaluation processes, which contributes to a positive organizational culture and a lower turnover rate. A common trait among all analyzed organizations is the recognition of talent as a strategic resource in modern business. However, numerous challenges are also evident, including a shortage of qualified personnel in the labor market, limited financial resources for development programs, and a need for better alignment between individual and organizational goals.

Despite this, the findings indicate a clear trend toward integrated practices, confirming that talent management in BiH is developing toward greater institutionalization and strategic orientation. The results of this research also confirm the theoretical assumptions about the positive impact of talent management on competitiveness and organizational success, and highlight the need for continuous investment in human capital as the foundation for long-term stability and innovation of companies.

5. CONCLUSION

The research aimed to assess the level of development and the implementation methods of talent management in organizations in BiH through five case studies across various service sectors. The results indicated that, although awareness of the importance of talent management is increasing, its application remains fragmented and largely depends on a company's size, resources, and organizational culture. The banking and IT sectors exhibit the most developed and structured practices, while retail and hospitality are in the early stages of development, often limited to short-term initiatives focused on employee retention. Companies that have adopted talent management report positive outcomes, such as lower turnover, higher employee engagement, and improved overall organizational efficiency.

Based on the observed challenges, specific recommendations can be made to improve talent management practices. First, the issue of a lack of qualified personnel in the labor market can be addressed by boosting talent attraction efforts through enhancing employer branding. Additionally, establishing an integrated talent management system rather than only reacting to vacant positions, is advisable. Creating a succession system that allows for timely

preparation of future leaders and strengthening internal mechanisms for education and mentoring are also essential.

Although the research results offered valuable insights, several limitations should be acknowledged. The study included only one company from each sector, which restricts the generalizability of the findings. Additionally, data were collected solely from managers' perceptions, without incorporating employees' perspectives. The research was also conducted exclusively within BiH, where the labor market has unique structural and institutional characteristics. Future studies should include a larger number of companies within the same sectors. Furthermore, conducting quantitative analyses that connect the implementation of talent management with actual organizational metrics would offer a more comprehensive view of real business outcomes.

Ultimately, it can be concluded that in BiH, awareness of what talent management truly involves and its potential to improve business is still developing. The further development and implementation of talent management in BiH require support from the academic community, educational institutions, and the business sector to achieve greater integration of this concept into organizational culture and growth strategies.

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ADVANTAGES AND CHALLENGES OF INTEGRATING ARTIFICIAL INTELLIGENCE INTO PROJECT MANAGEMENT IN EDUCATION

ABSTRACT

The purpose of this paper is to explore the role of artificial intelligence (AI) in project management processes within higher education, with particular emphasis on university professors who continuously follow technological advancements. The research seeks to identify the potential benefits, challenges, and implications of AI integration in educational management, while also providing practical guidelines for its effective implementation. The study highlights the importance of enhancing efficiency, supporting decision-making, and adapting project management practices in education to the dynamics of modern society.
The empirical research was conducted at the University of Belgrade on a sample of 80 full-time and part-time professors. The applied methodology was a survey, based on an originally designed questionnaire consisting of two parts: socio-demographic characteristics and ten Likert-scale questions. The collected data offered valuable insights into professors' perceptions regarding the use of AI in project management and its potential to transform educational practices. The findings indicate that, although only two of the ten tested statements revealed statistically significant differences related to respondents' age, the overall results suggest a growing recognition of AI's role in improving efficiency, resource allocation, and curriculum development.
The paper also addresses ethical challenges of AI integration, including data privacy concerns and the need for adequate staff training. Both theoretical and practical contributions are emphasized: theoretically, the study broadens the understanding of AI in project management within education, while practically, it offers recommendations for institutions on how to optimize AI adoption. Ultimately, the research confirms that professors who actively monitor technological trends are better equipped to adapt teaching methods and support students in developing the skills required for the 21st century.

Keywords: *project management, education, artificial intelligence, efficiency, integration.*
JEL: I23, M15, O33

1. INTRODUCTION

In contemporary society, the integration of Artificial Intelligence (AI) into project management processes in education represents one of the key emerging paradigms that is transforming the way education is planned, implemented, and monitored. AI provides

educational institutions with the ability to leverage advanced technologies for more efficient project management, process optimization, and improved learning outcomes.

At the global level and within the broader economic perspective, AI has become a powerful tool for predicting the future of organizations and business performance. Like many other professions, project management will not remain immune to the influence of AI technologies. In the context of project management, AI is recognized as a valuable instrument that assists managers in budget monitoring, schedule control, and risk assessment, enabling more accurate forecasts based on identified patterns. The integration of AI into educational management marks a revolutionary step toward enhancing efficiency and the overall quality of educational processes. As technology continues to develop at an accelerated pace, its role across different sectors of society becomes increasingly important. The education sector, which has long relied on traditional management and teaching methods, now faces the challenge of incorporating AI to meet the rising demand for more personalized and effective learning.

Project management in education encompasses the planning, organization, leadership, and control of various activities aimed at improving educational processes and outcomes. Within this framework, AI can make a significant contribution by providing tools for data analysis, risk prediction, resource optimization, and the automation of administrative tasks. These capabilities enable institutions to more effectively plan and implement initiatives designed to improve the quality of education. Although AI integration offers numerous advantages—from the personalization of learning experiences to increased efficiency and inclusiveness—it also raises important challenges. Ethical dilemmas, data privacy concerns, and the need for additional training of teaching and administrative staff represent critical issues that must be addressed to ensure the sustainable implementation of AI in education.

2. THEORETICAL BACKGROUND

Project management (PM) entails systematic planning, organizing, leading, and controlling resources to achieve specific goals within limited time and budget (Prifti, 2022). Modern PM spans initiation, planning, implementation, and closure, with continuous control and evaluation. Artificial Intelligence (AI) - including machine learning, deep learning, and NLP - automates analytics and supports data-driven decision-making (Dacre & Kockum, 2022). Embedding AI into PM improves efficiency, risk analysis, resource allocation, and responsiveness (Dacre & Kockum, 2022). In education, the PM-AI nexus enables learning personalization and operational optimization (Prifti, 2022).

Projects move through phases (initiation, planning, implementation, closure) with ongoing control and evaluation (Jovanović, 2015). Traditional approaches (Waterfall, CPM) emphasize sequential execution and stable scope, whereas Agile/Lean promote iteration and adaptability (Jovanović et al., 2016). Agile/Scrum introduces sprints, daily stand-ups, and defined roles, enabling rapid delivery and continuous feedback (Schwaber & Sutherland, 2020; Nešković & Raković, 2012). Effective PM also covers quality, risk, change, and communication management (Fertalj, Car & Nižetić Kosović, 2016).

AI advances PM through predictive analytics (schedules, budgets), early risk signals, and resource optimization (Salleh & Aziz, 2022; Odejide & Edunjobi, 2024). PMI surveys indicate rising AI adoption across PM practices (PMI, 2023).

Machine learning and GPU acceleration enable large-scale data processing (Taboada et al., 2023), while deep learning handles unstructured inputs for scenario planning (Bi et al., 2024; Liu et al., 2024; Vijaya et al., 2024). Risks include data quality/bias, the need for human oversight, ethics/transparency, security/privacy, and workforce skills (Shamim, 2024). A human-in-the-loop model remains optimal (Nilsson et al., 2024). Educational PM must align multiple stakeholders and goals (learning outcomes, quality, efficiency).

Digitalization and AI reshape planning, resourcing, and processes, increasing adaptability and quality (Ostojić, Buha & Pećić, 2020; Baby & Wooden, 2023). AI supports personalized learning, early need detection, and administrative optimization (Igbokwe, 2023; Branković, 2017). In PM terms, AI enables faster decisions, better monitoring, and more efficient coordination (Prifti, 2022; Velović, Atlagić & Đurić, 2021).

In planning, AI mines historical/context data to propose optimal timelines, budgets, and resourcing; in monitoring, real-time alerts flag deviations (Prifti, 2022); in risk management, AI identifies patterns and recommends mitigation; in evaluation, it compares outcomes against plans and suggests improvements (Ruiz et al., 2021). Global cases include personalized curriculum pathways, campus resource optimization, and data-informed advising (Bhbosale, Pujari & Multani, 2020). In Serbia, initiatives are emerging but indicate strong potential across curriculum optimization, advising, and digital transformation.

Key benefits: efficiency (automation), cost reduction (resource allocation), better decision-making (analytics), program quality (personalization), and greater inclusiveness (Dacre & Kockum, 2022). Barriers include infrastructure and funding constraints, staff training gaps, privacy/ethics/compliance issues, and data bias (Milosavljević, Masliković & Grubišić, 2023; Vukmirović, 2023; Igbokwe, 2023; Rahiman & Kodikal, 2023). Clear policies, technical/organizational safeguards, and continuous training are essential (Francesc et al., 2019).

Institutions need standards for model fairness and transparency, data protection and oversight, and systematic professional development to ensure responsible AI use (Saputra et al., 2023; Holmes et al., 2023). AI brings advanced analytics, proactive planning, dynamic contingency plans, better team coordination, and higher productivity (Sahadevan, 2023; Odejide & Edunjobi, 2024). With proper handling of limitations (technical, ethical, skills), benefits clearly outweigh risks.

3. EMPIRICAL RESEARCH

The study included 80 full-time and part-time professors from the University of Belgrade, of whom 48 were male and 32 were female (Figure 1). The sample comprised faculties of both public and private ownership; 40% of respondents came from public faculties and 60% from private ones.

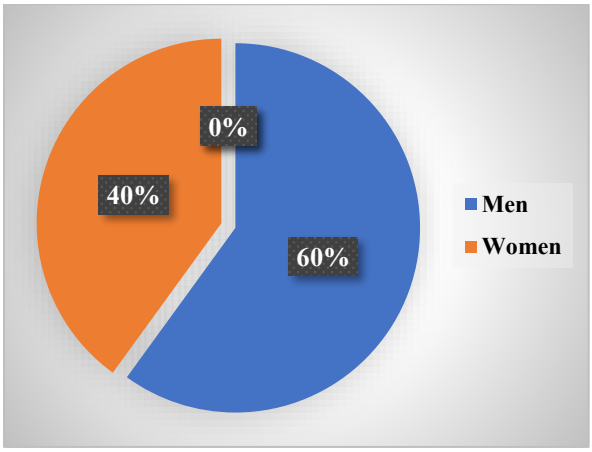


Fig. 1. Gender Structure of Respondents

The age structure of the total sample of respondents is presented in Figure 2. The largest percentage of respondents were between the ages of 40 and 50 and above (a total of 60%), while a smaller percentage were between the ages of under 30 to 40 (a total of 40%).

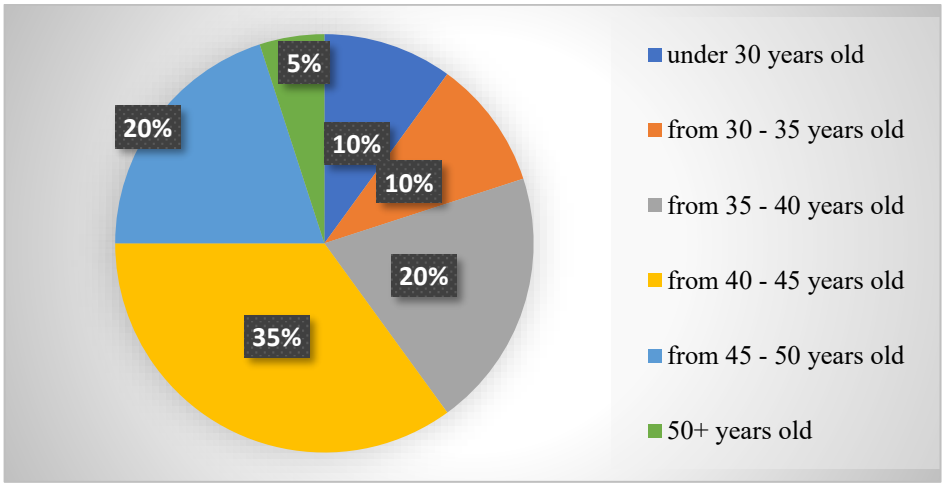


Fig. 2. Age Structure of Respondents

The majority of respondents were full-time professors at the University of Belgrade - 60%, while 40% were part-time professors teaching at various faculties of the University of Belgrade. The following faculties were included: Faculty of Security Studies, Faculty of Philology, Faculty of Organizational Sciences, Faculty of Political Science, Faculty of Economics, Faculty of Law, Faculty of Management FM, Faculty of Sports Management, MEF - Faculty of Applied Management, Economics and Finance, and the Faculty of European Business and Marketing.

In the second section of the questionnaire, 80 respondents evaluated the challenges and opportunities of integrating AI into educational management - spanning effects on processes and personalization, as well as ethics, data privacy, and training needs. The items were assessed on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly

agree"), with no reverse-scored items. Age was grouped into two cohorts: 40–50+ years (60%) and <30–40 years (40%).

Table 1. Summary of statistical significance by item

Item	Statement (short)	χ^2 (df=4, N=80)	p	Cramer V	Age effect
1	AI improves management processes	1.201	0.887	-	No difference
2	AI enhances student personalization	15.986	0.004	0.404	**Significant** (medium)
3	AI enables more efficient resource allocation	0.402	0.989	-	No difference
4	Implementing AI requires adequate staff training	3.106	0.604	-	No difference
5	AI integration raises key ethical issues	1.310	0.911	-	No difference
6	Faculty should continuously track technology	2.902	0.605	-	No difference
7	AI in management needs technical-ethical balance	10.952	0.014	0.41	**Significant** (moderate)
8	I actively follow new AI/PM technologies	8.854	0.118	-	No difference
9	My age does not affect my readiness to follow tech	6.477	0.815	-	No difference
10	Tracking tech extends professional activity	7.861	0.248	-	No difference

Note: Column labels were standardized following statistical reporting guidelines: χ^2 (df, N), p, *and* Cramer's V.
Short reading notes were added to clarify cohort grouping and thematic domains

While Table 1 provides item-level statistics (domain-level synthesis) groups items into broader analytical domains - management efficiency, personalization, ethics, training, and engagement - based on predefined conceptual criteria used during questionnaire construction. This shift from individual survey items to thematic interpretation enables a clearer understanding of how faculty perceptions of AI can guide both strategic planning and daily operations in educational institutions.

The first statement, on AI improving management processes, showed no significant age differences (χ^2=1.201, p=0.887). Professors across generations largely agreed that AI has potential to increase efficiency and support decision-making. This uniformity suggests that strategies for AI adoption should be inclusive, positioning the technology as a shared institutional standard rather than a tool tailored to specific age groups.

By contrast, the personalization of student learning revealed significant generational differences (χ^2=15.986, p=0.004; V=0.404). Older professors were more optimistic about AI's ability to enhance personalized education, while younger faculty showed greater caution and skepticism. This divergence indicates the importance of differentiated strategies: older faculty may perceive AI personalization as pedagogical support, while younger professors may question algorithmic reliability or raise concerns about data security.

Institutions should therefore complement pilot projects with transparent communication and training adapted to cohort-specific expectations.

Resource allocation (χ^2=0.402, p=0.989) and staff training (χ^2=3.106, p=0.604) both showed broad agreement across generations. While professors were cautious in fully endorsing AI's potential in resource management, they strongly agreed that systematic staff training is a prerequisite for successful implementation. These findings highlight the need for continuous professional development programs that address both technical competence and ethical awareness, ensuring confidence in using AI tools.

Ethical considerations themselves emerged as another area of consensus (χ^2=1.310, p=0.911). Respondents across age groups acknowledged the importance of privacy, fairness, and transparency. This provides fertile ground for establishing institutional AI governance frameworks with clear ethical guidelines, data protection protocols, and regular auditing practices.

Another point of divergence appeared in balancing technical capabilities with ethical dilemmas (χ^2=10.952, p=0.014; V=0.41). While some professors emphasized the efficiency benefits of AI, others prioritized fairness and responsibility. Given the centrality of these differences, the robustness of key findings was additionally examined using HC3 robust standard errors, confirming that the observed effects remained stable and consistent across specifications. This supports the recommendation that institutions adopt an "ethics-by-design" approach, combining technical innovation with explicit ethical safeguards.

The final set of statements (items 8-10) confirmed that engagement with technology is broadly shared, with no significant age differences. Professors agreed that actively following technological trends is essential for teaching innovation, and many noted that digital competence extends career longevity and relevance. This challenges the stereotype that older faculty are resistant to technology and highlights that institutional support, workload distribution, and access to training are more decisive factors than age itself.

Taken together, these results indicate that while there is broad generational consensus on most aspects of AI integration in education, personalization of student learning and balancing technical with ethical considerations remain areas of divergence. For higher education institutions, the implication is twofold: general strategies for AI adoption should be inclusive and uniform, while policies related to personalization and ethics should incorporate cohort-sensitive communication, training materials, and evaluation procedures. By doing so, institutions can achieve wider acceptance, ensure responsible use of AI, and maximize its benefits for educational management.

4. CONCLUSION

The integration of artificial intelligence into project management in education represents a crucial step toward transforming this sector, enabling more efficient use of resources, improvement of teaching quality, and adaptation to the rapid changes taking place in modern society. The findings of the conducted research suggest that professors, regardless of age, increasingly recognize the importance of technological innovations, although statistically significant differences in attitudes were recorded only in specific areas. This points to a broad

awareness of AI's potential to improve teaching practices, optimize resource allocation, and support more informed decision-making.

Nevertheless, the process of integration is not without its challenges. Issues such as data privacy, ethical dilemmas, and the necessity of adequate staff training remain central to the debate. Without systematic efforts to address these challenges, the risk of resistance or misuse of AI tools remains significant. Therefore, the success of AI adoption will depend on whether educational institutions can establish comprehensive strategies that incorporate not only the technical aspects of implementation but also organizational culture, institutional support, and continuous professional development of staff.

The research indicates that professors who follow technological trends are better positioned to adapt their teaching methods to the needs of contemporary students. This adaptation often involves the use of interactive platforms, personalized learning pathways, and innovative teaching tools that increase student engagement and learning outcomes. At the same time, some participants expressed concerns about the excessive reliance on technology and the risks associated with online learning environments, such as data protection and security. These concerns highlight the importance of balancing innovation with responsibility, ensuring that the use of AI supports rather than undermines the educational mission.

Ultimately, artificial intelligence holds great potential to modernize education by supporting decision-making, predicting future needs, and enhancing both the efficiency and inclusiveness of the educational process. The research findings reinforce the conclusion that continuous monitoring of technological development, especially in the domain of AI, is not just desirable but essential for professors who seek to remain relevant in a rapidly changing academic environment. By fostering a culture of innovation, investing in staff training, and maintaining transparency in the application of AI tools, educational institutions can ensure that technology becomes a reliable partner in improving the quality of education and preparing students for the demands of the twenty-first-century labor market.

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THE INFLUENCE OF ORGANISATIONAL CULTURE ON THE IMPLEMENTATION OF TQM IN BOSNIAN AND HERZEGOVINIAN ENTERPRISES

ABSTRACT

In today's complex, hypercompetitive, and continuously changing global business environment, all organisations must be able to strategically adapt to change to ensure sustainable survival and growth, as well as develop an innovative and competitive strategy. Today, quality has become one of the most important drivers of global competition. Quality management (TQM) is among the most popular universal strategies for the survival and growth of organisations.

The efficiency and effectiveness of quality management are conditioned by changes in environmental conditions, as well as by changes in its own factors, such as the company's organisational structure and the prevailing organisational culture. The research aims to identify the influence of organisational culture on the success of the implementation of quality management in companies in Bosnia and Herzegovina.

Starting from the perceived importance of organisational culture as a critical variable in the implementation of TQM, within this research, we have integrated numerous theories of organisational change. By reviewing relevant literature, various aspects of organisational culture and its influence on the implementation of TQM as a universal strategy were analysed. Through the research, we sampled the opinions of 117 respondents, and the data were obtained through a detailed and comprehensive questionnaire and statistically processed through the methods of descriptive analysis, factor analysis, analysis of variance and multiple regression analysis. A more complex view of the concept of quality management is analysed.

The research results confirmed the significant role of organisational culture in the successful implementation of TQM, which can serve as a basis for the development of strategies and policies in the efforts of Bosnian-Herzegovinian companies to improve quality and to increase market competitiveness.

Keywords: *organisational culture, Total Quality Management (TQM), implementation, enterprises, Bosnia and Herzegovina.*
JEL: L2, L10, M14

1. INTRODUCTION

The modern concept of approaching the problem of quality is actually a quality management system whose goal is to achieve optimal quality in a quality management system in which all functions that in any way participate in the implementation of quality management must be included. In addition, Total Quality Management - TQM implies: involvement and commitment to quality by top management and efficient coordination of all activities in its implementation; breaking down the "thick walls" that separate individual functions and their connection; clearly defining responsibility for tasks in the quality system (responsibility for achieving and improving quality extends to all employees regardless of which function or department they are in); preparing process capability studies in relation to the required quality; an efficient information system; nurturing organisational culture, education of all employees and motivation for quality.

Possessing a certificate according to the requirements of ISO 9001:2015 does not mean that a company has a successful and efficient implementation of TQM, which is why a change in organisational culture is necessary. Managing organisational culture changes at the lowest quality level, and then correcting unavoidable shortcomings in the work and the approach of employees to a culture of "best results from the first attempt", is necessary for demonstrating the successful implementation of quality management. There is a clear link between corporate culture and quality in projects, and in order to support the necessary elements of such TQM, an appropriate corporate culture is a prerequisite. This relationship is mutually reinforcing, which means that if the corporate culture is good, the quality system will be applied appropriately, and the resulting products and services will also be good.

2. LITERATURE REVIEW

2.1. Organisational culture

Organisational culture is to the organisation what personality is to a person - it creates the identity of the organisation, as personality implies the identity of a person. It is a form of experience that has accumulated in organisations and that helps its members to navigate the complex and uncertain world that surrounds them. Every decision and behaviour of individuals and groups in the organisation is a manifestation of organisational culture. *"Strategies and business policies, control systems, organisational structure, information systems, leadership styles, conflict resolution mechanisms, codes of conduct and dress, marketing strategies, communication styles, the quality and nature of interpersonal relationships - all of them can be understood as cultural artefacts, or material consequences of organisational culture*" (Janićijević, 2013, p. 3).

Organisational culture represents a set of key values shared by members of an organisation. It implies the characteristic spirit and beliefs of the organisation, e.g. norms and values that generally relate to the way people behave and interact, the nature of working relationships that need to be developed, and attitudes that need to be changed. These are deep norms, blind assumptions that must always be expressed and are often known even though they are not fully understood. Organisational culture is defined as "A system of assumptions, values, norms, and attitudes manifested through symbols, which members of an organisation have developed and adopted through shared experience and which helps them determine the

meanings of the world around them and how to behave in it." The above definition of organisational culture has several important elements; the content of organisational culture consists of assumptions, values, norms and attitudes, as well as symbols through which cognitive elements of culture are manifested. – Emergence of organisational culture: it arises from shared experience in solving problems that the organisation faces. – Effect of organisational culture: it determines the way in which members of the organisation understand the world around them and the way they behave in it (Janićijević, 2013, p. 35). Organisational culture affects almost all relevant segments of initiating, implementing organisational changes and creating modern organisations that build competitive advantage on knowledge. Organisations need leaders who are capable of leading the change process, who are one step ahead of others, who think long-term and who understand that striving to preserve the status quo is disastrous in conditions of turbulent changes in the environment. Organisations must adapt and change very quickly and easily, or they will not be able to survive in the changing and competitive environment that it is today and will be in the future. Some research shows that organisational culture is associated with success. A culture based on adaptability, employee participation in decision-making, a clear vision, and consistency can help organisations achieve sales growth, return on assets (i.e., return on total assets), profits, quality, and employee satisfaction (Williams, 2010, p. 54).

One way to change an organisation's culture to some extent is to strengthen new patterns of behaviour among managers and employees, either by introducing new or changing existing behaviour. A change in organisational culture occurs when visible features of the old culture change, such as dress codes, benefits and amenities, office layout and design, personal parking spaces, and the like. One of the most important changes in organisational culture can occur through the good selection and employment of people whose values and beliefs are in line with the desired organisational culture. For organisational culture changes to be successful, it is necessary to know the features of the existing culture – values, beliefs, attitudes, assumptions, and certain symbolic elements – such as stories, motives, rituals, and others, as well as the effects of external change tendencies that affect the organization, its economic and market position (Ubiparip, 2004, p. 88).

An organisational culture can be adequate for a certain time and set of conditions. However, times and conditions change: the impact of foreign competition, changes in legislation, changes in the economy and new technologies can have lasting consequences on the organisation's operations, if the organisational culture is inadequate and hinders its effectiveness. The role of management is to influence the change of factors that create and maintain organisational culture. In order to change organisational culture, it is first necessary to evaluate it and compare it with the desired culture. If a gap is noted between these two states, elements that need to be changed are identified. Organisational cultures differ based on certain interdependent characteristics. It is suggested that monitoring and evaluating organisational culture is carried out based on the following dimensions:

1. Individual initiative - the degree of responsibility, freedom and interdependence of individuals.
2. Risk tolerance - encouraging aggressiveness, innovation and risk-taking among employees.
3. direction - the degree to which the organisation creates clear goals and expectations related to performance.
4. Integration - coordination of units within the organisation.

5. Management support – clear communication, assistance and support provided by managers to employees.
6. Control – the number of rules and regulations and the amount of direct supervision used to predict and control employee behaviour.
7. Identity – the degree to which members identify with the organisation as a whole, rather than with a specific work group or field of professional expertise.
8. Reward system – the allocation of rewards (salary increases, promotions) based on the criterion of actual evaluation of employee performance, rather than based on age, seniority, honours, favouritism, etc.
9. Conflict tolerance – employees are encouraged to openly discuss conflicts and criticise.
10. Communication style – the degree to which communication is limited by the formal hierarchy of authority in the organisation.

It is noticeable that the definition of the determinant is characterised by the absence of a systemic approach. Also, their weight is not explicitly stated, so the researcher in specific circumstances selects the focus of action (Robbins, 2001, pp. 459-461), when analyzing the above dimensions, he/she examines the interests of the founder and those who follow him/her, i.e. how the organization responded to crises in the past and other crucial events, what it learned from these experiences and finally who is considered deviant in the culture and how the organization reacts to these people. The answers to these questions show how certain values were formed, their importance and the boundaries of the organisational culture.

2.2. Total Quality Management - TQM

According to the International Organization for Standardization (ISO, 2015), TQM is defined as: "... a way of leading an organization with the intention of involving all associates and cooperating among all groups in improving the quality achieved by the organization in: goods and services, activities and goals, customer satisfaction, long-term profitability, employee benefits and compliance with the requirements of society". Total Quality Management (TQM) is defined as an integrative philosophy that encompasses the entire organisation and is focused on continuous improvement of the quality of products and services, as well as processes, in order to fully meet or exceed customer expectations (Prajogo & McDermott, 2005; Kiella & Golhar, 1997).

TQM was created thanks to American professors W. E. Deming and J. M. Juran. TQM can be defined as the continuous satisfaction of customer requirements/needs at the lowest cost, and by educating and motivating employees to ensure quality. By its structure, TQM is a multi-conceptual discipline that integrates the new concept of quality and modern management. Total quality management as a concept represents a special management technique and is an integral part of the organisation's strategy. It also represents the most general concept of quality management that takes into account the requirements and interests of all stakeholders of an organisation (customers, employees, shareholders, suppliers, society). A large number of studies regarding the success of TQM practices pose the question: do organisations engage in TQM practices, and what factors can contribute to the success of TQM? In particular, the importance of an organisational culture that is conducive to TQM practices is often mentioned in the literature (Prajogo & McDermott, 2005; Sarros

et al., 2005; Rahman & Sohal, 2002; Brown & van der Wiele, 1996; Kim et al., 1995), with Kumar and Sankaran (2007, p. 177) describing a TQM culture as one that 'uses teams, promotes pride in work, eliminates fear, enables participative management, promotes leadership rather than supervision, and promotes a long-term orientation among organisational members'. It is therefore argued that the successful implementation of TQM depends on the prevailing organisational culture (Chapman et al., 1991), with numerous authors mentioning the "need for change in organisational culture and workforce attitudes" for TQM to be effective (Sohal & Terziovski, 2000; Samson, 1997; Dawson, 1995; Sohal et al., 1991).

Establishing TQM implies establishing organisational characteristics and employees' capabilities to accept changed behavioural patterns in companies. First of all, it is necessary to convince employees that the survival and future of the organisation are linked to the announced changes. Today's globalized and technologically advanced business climate requires that managers at all levels possess comprehensive knowledge that includes competencies for implementing TQM, both at the highest level and at the middle and lowest levels of the organisation's management.

2.3. The role of organisational culture in the implementation of total quality management

It is considered acceptable to state that organisational culture represents "a model of basic assumptions, values, and norms that a given group has developed or discovered while learning how to solve problems of external adaptation and internal integration, and that function well enough to be transferred to new members of the organisation as the correct way of thinking and feeling about these problems" (Schein, 2004). It is reflected in stated strategic orientations with clear goals and a precise policy for their achievement, which includes the concept of business organisation, dominant management style, method of employee selection and socialisation, established rituals, popular stories about key people and events, method of business evaluation, reward criteria, communication system, and so on.

A strong, positively oriented organisational culture influences employee motivation and commitment, facilitates coordination and control of the organisation's functioning, reduces conflicts, and triggers creativity. A strong organisational culture with inappropriate assumptions, values, and beliefs has a strong negative impact on business success, making it difficult to change strategy and business practices. Therefore, it is necessary to determine the desired organisational culture in order to enable the introduction of TQM and thereby improve the performance of the business system in the market.

Zeitz et al. (1997) argue that the basis of the success of a TQM program is a change in organisational culture, and that TQM tools are only a means to change. Westbrook (1993) believes that if an organisation wants to conquer TQM as a guiding principle, it begins with management efforts to create a culture that sustains such a change. Hildebrandt et al. (1991), in their research on quality culture and TQM, emphasizes that existing basic assumptions are the primary condition for successful TQM implementation, because assumptions that influence the TQM implementation process may be in conflict with the existing organisational culture. (Kekäle, 1998, p. 26) identified some of the deeply rooted assumptions that influence TQM implementation and came to the conclusion that an

organization has two options when implementing TQM: 1) choosing an approach that matches the existing organisational culture; 2) systematically managing organisational change. McNabb and Sepic (1995, p. 27) are pessimistic about the possibilities of changing culture, because organisational culture is the main driver in setting the direction and limiting organisational changes (Reger et al., 1994, p. 24) in their research on the difficulties that arise in implementing TQM, they apply cognitive theories of self-concept, to explain why planned organisational changes, including cultural ones, are resisted even by the most loyal members of the organization.

If there is compatibility, the TQM concept is integrated into the organisational culture, as a series of common norms, principles and quality principles. The basis of such a culture is a conscious commitment to quality in the organisation. An effective culture is built with respect for the principle that quality is everyone's job and that everyone is responsible for quality. The emergence, development and maintenance of culture is a process that involves all employees in various ways. This process cannot be established by itself, but is initiated by the initiatives of managers and the construction of all elements of quality management.

The culture is based on an effective quality management and assurance system and a complete commitment of management to quality. A culture that respects efficiency ensures a low level of variation in the quality of the final product of product or service, and its continuous improvement, in order to better satisfy users. A culture focused on creating new values gives the organisation a distinctiveness, a specific image, by which it is recognised in the market, and internally drives and motivates employees to give their best. The final result is the formation of an efficient and flexible organisation.

Building an adequate organisational culture is a long-term process, which must be well-designed and established. Collins (1994) believes that the TQM approach to quality is based on the culture of the organisation (31). It is generally accepted that changing the culture or at least awareness of the culture is a necessary prerequisite for excellence and quality (Lewis, 1998, p. 32). In practice, it has been confirmed that an organisation can achieve the desired results only by introducing an appropriate culture of quality, without formally adopting a TQM program (Smith et al., 2002, p. 3; Kanji & Yui, 1997, p. 33). Successful implementation of the TQM concept has the following positive effects on business: it improves financial performance (Hendricks & Singhal, 2001), increases customer satisfaction (Choi & Eboch, 1998) and product quality (Agus, 2005). However, a single component cannot lead to improvement, but rather the improvement is the result of the joint presence of all or a larger number of TQM components (Powell, 1995; Dow et al., 1999; Sun, 1999; Huarng & Chen, 2002). Unfortunately, the failure rate of TQM programs is quite high and ranges from 33-75% (Yandrich, 1994; Spector & Beer, 1994; Jackson, 1995).

However, despite the widespread recognition of the important role of organisational culture in ensuring the successful implementation of TQM, there is a gap in the empirical literature examining the connection between organisational culture and the concrete adoption of TQM practices, and the aim of this research is to examine the influence of organisational culture and its characteristics that are most conducive to the successful implementation of TQM.

3. RESEARCH METHODOLOGY

We included a detailed framework for conducting a comprehensive empirical research in the research plan. We clearly and precisely defined the methodology, determining the steps with which the validity and reliability of our research are guaranteed. The area of this research is enterprises in Bosnia and Herzegovina. We particularly valued the even representation of all activities of the target group, at all stages of the process, in order to ensure the reliability of our research results.

By approaching the problem analysis with a detailed understanding, we posed one of the key problematic questions of our research: Do current organisational cultures in enterprises affect the implementation of TQM and are changes in organisational culture necessary to be managed, with the aim of more efficient and effective implementation of TQM in enterprises in Bosnia and Herzegovina? The characteristic nature of this topic required the formation of a special research hypothesis, which is: Organisational culture significantly influences the implementation of TQM in Bosnian and Herzegovina companies.

The focus of the comprehensive research is centred on companies in Bosnia and Herzegovina, and the research sample was carefully selected in accordance with the principles of probability theory, where the sample elements were selected following a randomised procedure. When forming the research sample, the stratified sample method was applied. Taking into account the complexity within this structure, we applied a stratified random sample. Stratification was meticulously performed in accordance with the data. Three strata were identified, namely: prominent managers representing the highest level of management - directors of the company, middle management which includes managers who function as deputy directors, heads of departments in the company and the lowest management level, including other employees. The research is mainly focused on covering the first and second strata, given that managers of these two levels directly participate in the acceptance of the implementation of quality management.

Validation of the central research hypothesis required defining two variables. More precisely, organisational culture was highlighted as an independent variable, while total quality management (TQM) was set as a dependent variable. Indicators of both variables were checked using appropriate questions in the questionnaire, in order to ensure their precise response and their relevance to the research hypothesis.

The survey method, through a questionnaire formed in three segments, was used as a research tool. The first segment was created with the aim of collecting information on the basic characteristics of the respondents, while the second is actually a tool for the already selected research indicators. The third segment of the questionnaire was conceived as an open space for comments and opinions of the respondents that may be relevant to the research.

The questionnaire designed in this way obtained a large amount of primary data, the statistical processing of which yielded information that helped in creating a picture of the current situation in companies, as well as identifying advantages and disadvantages in business. Given that the range of questions included questions about the problems of introducing a quality system, an analysis of the interaction of organisational culture and

TQM was enabled. Methods of studying and analysing the organisation, with the support of statistical methods (statistical data processing with tabular and graphical presentation of the obtained data) and logical methods (analysis, synthesis, abstraction and generalisation), were used in all phases of the research.

Primary data collection was achieved in the field using survey and observation methods. Companies in Bosnia and Herzegovina were selected as the sampling location.

Univariate and multivariate analyses with different statistical interpretations were used. Descriptive analysis presented the processing of the collected data, showing the observable characteristics of the respondents and their answers to the questions asked.

Factor analysis was used to examine the connection between certain questions and research indicators, and multivariate analysis of variance (MANOVA) was used to examine how certain characteristics of the respondents are reflected in the answers given to the research indicators.

Analysis of variance (ANOVA) examined the influence of the basic characteristics of the respondents on the answers to certain questions within the indicators, and correlation analysis was used to examine the relationship between research indicators, while multiple regression analysis tested the research hypothesis.

4. ANALYSIS AND DISCUSSION OF RESEARCH RESULTS

In order to carry out the research, the sample included 117 respondents, all to obtain relevant and precise information. All of them were proposed to give answers to a series of carefully constructed questions that mainly focus on their professional habits and attitudes regarding change management, change acceptance, behaviour, and organisational culture. Before the actual data analysis, we examined the assumption of normality and the existence of atypical observations, which are often the cause of asymmetric data. We examined the normality of data distribution using various tests, such as: Kolmogorov-Smirnov test, the Shapiro-Wilk test, and the research results showed that the variable was normally distributed, i.e. the p value was greater than 0.05, confirming the null hypothesis that the data were normally distributed, as shown in the Table 1.

Table 1. Normality of data distribution - linear regression

Data distribution normality test						
	Kolmogorov-Smirnov[a]			**Shapiro-Wilk**		
	Statistics	**df - degrees of freedom**	**Statistical significance**	**Statistics**	**df - degrees of freedom**	**Statistical significance**
Unstandardized residuals	,067	117	,200*	,980	117	,055
Standardised residuals	,067	117	,200*	,980	117	,055
* This is the lower limit of true significance						
a. "Lilliefors" significance correction						

Source: Authors

The normality of standardized and unstandardized residuals is shown in the following figures:

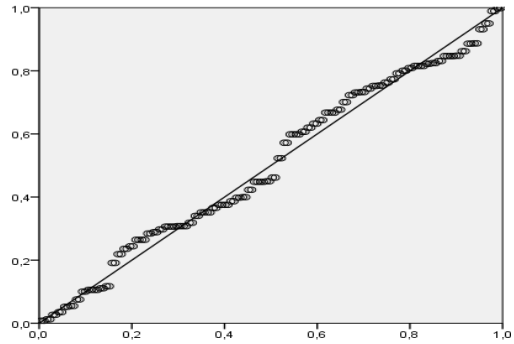


Fig 1. Normality of data distribution standardised residuals research hypothesis

Source: Authors

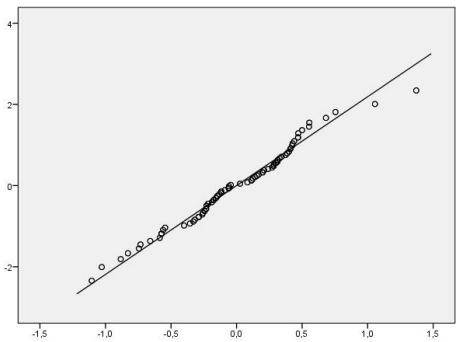


Fig 2. Normality of data distribution, unstandardized residuals research hypothesis

Source: Authors

The values of the variables shown in Table 2 are greater than 0.1, and all values are less than 10, which concludes that none of the variables causes the problem of multicollinearity:

Table 2. Multicollinearity analysis of data - research hypothesis

Coefficients							
Model	Unstandardized coefficients		Standardized coefficients		Statistical significance	Collinearity statistics	
	B	Std. error	Beta	*t*		Tolerance factor (TOL)	Variance inflation factor (VIF)
Constanta	1,305	,265		,919	,000		
Scale Organisational culture	,732	,074	,537	9,871	,000	1,000	1,000
a. Scale success (dependent variable)							

Source: Authors

In the summary of the linear regression model shown in Table 3, the value of r2 for the predictor variable of the organisational culture scale was 0.388, which means that the specified model explains 38.8% of the dependent variable of TQM (Table 2).

Table 3. Model summary - research hypothesis

Summary of the model				
Model	R	R-squared	Adjusted r^2	Standard error of estimate
	,537[a]	,388	,384	,45828
a. Scale Organisational culture – predictor (constant) b. Scale success (dependent variable)				

Source: Authors

Table 4 presents the results of the ANOVA test, which answers the question of whether at least one independent variable is in a linear relationship with the dependent variable. According to the results, the F value was not high, the p value is less than 0.05, so it is a statistically significant model, that is, the null hypothesis is accepted according to which the different groups of respondents do not differ significantly. In other words, the research hypothesis is accepted.

Table 4 ANOVA analysis of variance - research hypothesis

ANOVA						
Model		Sum of squares	df – degrees of freedom	Square of the mean df	F	Statistical significance
	Regression	20,465	1	0,465	97,445	,000[b]
	Residual	32,343	54	0,210		
	Total	52,808	155			

a. Implementation of TQM (dependent variable) la)
b. Predictors: (Constant), Scale Organisational culture – predictor (constant)

Source: Author

Table 5. Correlations – Research Hypothesis

Correlations			
		Scale Organisational Culture	Scale Success
Scale Organisational Culture	Pearson correlation coeff.	1	,537**
	Statistical significance		,000
	N - sample	117	117
Scale Success	Pearson correlation coeff.	,537**	1
	Statistical significance	,000	
	N - sample	117	117

** Correlation is significant above the 0.01 level (2-threshold)

Source: authors

We also tested the veracity of this hypothesis with the help of correlations. According to the results presented in Table 11, it is a statistically significant result (the amount of p-value was less than 0.05); therefore, it can be further interpreted as such. Furthermore, according to the results, there is a medium-strong correlation (the Pearson correlation coefficient was 0.537) between the variables, which also confirms the research hypothesis (Table 5).

Based on these analyses, the research hypothesis that the organisational culture of a company influences the implementation of TQM in Bosnia and Herzegovina was proven and confirmed.

5. DISCUSSION AND LIMITATIONS OF THE RESEARCH

The research included 117 respondents from 25 companies in Bosnia and Herzegovina with various activities: industry, construction, trade, transport, information and communications, finance, hospitality, and entertainment. Various demographic characteristics of the respondents were present - gender, age, level of education and job position in the company, which enabled a comprehensive analysis of perceptions and attitudes towards the impact of organisational culture on the implementation of TQM.

The results of the research show: that the majority of respondents in companies in Bosnia and Herzegovina recognize the importance of quality for long-term development, success and sustainability in the market, then there is awareness of the importance of continuous employee training, then the importance and need for integrating TQM in all business processes, the highest level management believes that continuous improvement and empowerment of employees results in maintaining the competitive advantage of the company.

The analysis showed several key obstacles, and the main limitation of the research was related to the sample size. Preliminary analysis of the truth of the hypotheses was planned using the SEM model, but due to the number of variables from the questionnaire, the recommended sample size was 313 respondents. Taking into account the number of collected data and respondents, the analysis of the results was done using the regression model.

The recommendation for future research is to include a significantly larger number of respondents from, then provide adequate support and resources, which would facilitate the implementation of TQM, and develop specific training programs for employees to better understand TQM practices, as well as work on overcoming employee resistance to changes and changing organisational culture itself, which would be an advantage for the implementation of TQM.

6. CONCLUSION

TQM represents a modern, innovative tool for quality assurance and quality management; it is a need and a minimum that every organisation that wants growth, development and a better future must establish, apply and constantly improve, and its establishment or implementation of total quality means major changes in the organisation, its structure, way of working, culture and behaviour of employees. Implementation involves building new attitudes and new values in the organisation, constituting an organisational culture in which the key determinant of behaviour is the quality created by everyone in the organisation, and the acceptance of the quality concept and support for implementation processes in all its phases depend on dominant values.

Culture has a significant impact on the implementation of the system by employees, management, organisational teams and coalitions, on the motivation of employees and their participation in teamwork and decision-making; the involvement of organisational members in the quality improvement process; adaptability, tolerance and acceptability. Culture can be a source of competitive advantage and superior performance because it is a resource:

valuable, rare, difficult to imitate and widespread throughout the organisation. A culture with clearly expressed values, which organisational members accept and adhere to in their everyday behaviour, creates a clear identity of that organisation, with which its existing and potential members can identify. An established common system of values and goals between the organisation and employees will help increase their competence and motivation, and thus better results. Every decision and behaviour of individuals and groups in the organisation is a manifestation of organisational culture. Resistances that come from culture reduce the chances of effectively managing implementation processes. On the other hand, a strong organisational culture sends a message to employees about what behaviour is desirable and what is undesirable and what is appreciated and valued in a particular organisation. It creates a sense of belonging among employees and encourages their identification with the organisation, from which results in their better motivation for work and commitment and thus better work performance. Creating a new culture in accordance with the requirements of the quality system represents major and essential changes, without which there is no success in the organisation's aspiration to create real value for users, to satisfy their needs and demands. In this development process, management plays a key role, i.e. one of the most important roles of the organisation's management is to consciously work on creating the desired culture that would enable maximum effectiveness of the organisation. All employees in the organisation should participate in changing the culture, changing themselves personally.

The results of this research provide significant insights into the level of awareness and obstacles that Bosnian and Herzegovinian companies face when implementing TQM practices. Effective implementation of TQM requires the existence of an adequate culture, conversely, a TQM program, such as training, employee involvement and granting of authorisations. Given the high level of awareness of the importance of quality and the identified challenges, the research recommendations would be to ensure continuous support to companies with various programs and incentives for the implementation of TQM, to increase competitiveness, survival and further growth in the market. In this way, the resources necessary for training employees in programs related to supporting the implementation of advanced quality measurement methods with a focus on key aspects of TQM can help in better understanding and applying these practices.

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AI COMPETENCIES FOR BUSINESS LEADERS: BUILDING SUSTAINABLE TRANSFORMATION SKILLS

ABSTRACT

Artificial intelligence (AI) is increasingly integrated into business operations, influencing decisions across finance services industry, supply chains, energy sector, and beyond. Despite significant investments, many organisations struggle to scale pilot projects, ensure consistent governance, and fully embed AI into core strategy. Simultaneously, heightened expectations around sustainability and environmental, social, and governance (ESG) performance demand that leaders use AI not only for efficiency but also for responsible, long-term impact. The primary objective of this research is to identify six essential competencies for executives leading AI-driven transformation: (1) AI and data literacy, (2) governance and risk management capability, (3) ethics and trust building, (4) sustainability-oriented systems thinking, (5) collaborative leadership, and (6) workforce enablement. These competencies are not merely abstract concepts. For example, finance leaders need the capacity to identify bias in lending models, supply chain executives must weigh predictive analytics against resilience, and/or energy leaders face trade-offs between efficiency and environmental responsibility. To support executives in building these capabilities, the authors propose a practical toolkit connecting each competency to governance processes such as risk registers, impact assessments, and ESG dashboards, offering actionable strategies rather than aspirational statements. The findings indicate that executives who build strength in these areas make sharper investment decisions, gain stakeholder trust, and deliver AI outcomes that align with sustainability commitments. This framework thus provides a practical pathway from small-scale experimentation to enterprise-wide responsible transformation.

Keywords: *AI governance, digital transformation, executive competencies, ethical AI, sustainability strategy.*
JEL: M10, M15, O32, M14, J24, Q56

1. INTRODUCTION

Artificial intelligence (AI) has evolved from small-scale pilots into a central part of business strategy across sectors including financial services, supply chains, energy and healthcare. For executives, the challenge is no longer whether to adopt AI, but how to integrate it responsibly and at scale so that technological progress aligns with ethical standards, social expectations and long-term organisational goals. Despite significant investment, many organisations remain stuck. They run pilots, see promise, then struggle to move beyond early stages. McKinsey's 2024 State of AI survey highlights that the major barriers are not technical but related to governance, oversight and leadership engagement (McKinsey & Company, 2024).

Regulation is also accelerating. The European Union's Artificial Intelligence Act (2024) requires organisations to conduct risk assessments, ensure explainability and implement formal governance structures (European Union, 2024). Compliance has become a strategic expectation rather than an optional commitment. At the same time, sustainability and ESG pressures are reshaping what stakeholders expect from AI adoption. Investors, regulators and employees increasingly look for transparency, fairness and responsible long-term impact (World Economic Forum, 2025).

Leadership capability has not kept pace with these demands. Many executives rely heavily on technical teams without fully understanding the risks they are approving or the broader implications for trust, compliance and sustainability. This creates an accountability gap that exposes organisations to reputational, regulatory and operational risk. As Papagiannidis et al. (2025) note, frameworks for responsible AI are emerging, but the leadership dimension remains underdeveloped.

This paper addresses that gap by proposing six executive competencies needed to govern AI responsibly: (1) AI and data literacy, (2) governance and risk capability, (3) ethics and trust building, (4) sustainability-oriented systems thinking, (5) collaborative leadership and (6) workforce enablement. To support this objective, the paper adopts a structured research design that synthesises academic literature, international policy frameworks and industry analyses, as outlined in Section 1.1.

1.1. Research Design and Methodology

This paper uses a qualitative, conceptual approach. The aim was to bring together what is already known about AI governance, leadership capability and responsible adoption, and to identify the competencies that appear across different bodies of work. We reviewed recent academic publications (2016–2025) in the areas of AI governance, ethics, digital leadership and organisational transformation, using databases such as Scopus and Google Scholar. These sources were read closely and grouped into themes to identify capability areas that appeared consistently.

Alongside academic work, we examined major policy and standards documents, including the EU Artificial Intelligence Act (2024), the NIST AI Risk Management Framework (2023), ISO/IEC 42001 (2023), the OECD AI Principles (2024) and UNESCO's

recommendations on AI ethics. These were used to understand expectations being placed on organisations and how leadership responsibilities are being defined internationally.

We also reviewed industry reports from organisations such as McKinsey, IBM, Accenture and the World Economic Forum to see how governance challenges are playing out in practice. Financial services, supply chains and the energy sector were selected as illustrative examples because they have mature AI use cases and clear documentation of risks and governance pressures. Insights from all sources were compared to form the six competencies presented in this paper.

Across all sources, recurring themes were grouped together and refined into six competencies that appeared consistently in academic, policy and industry materials.

2. FRAMEWORK FOR AI LEADERSHIP COMPETENCIES

Responsible use of AI requires leadership capabilities that reach beyond standard digital management. AI is not simply a technical tool but a socio-technical system with ethical, governance, sustainability, and cultural implications. Executives must, therefore, understand enough about AI to question assumptions, anticipate risks, and ensure technology decisions align with both organisational strategy and societal expectations. Drawing on research on competency frameworks (Blok et al., 2021), AI governance (Attard-Frost & Lyons, 2025; Batool et al., 2025), and studies on trust, collaboration, and workforce development (Lee et al., 2024; Engin, 2025; Schmutz et al., 2024; Vats et al., 2024), six competencies emerge as central to responsible executive leadership: (1) AI and data literacy, (2) governance and risk capability, (3) ethics and trust building, (4) sustainability-oriented systems thinking, (5) collaborative leadership, and (6) workforce enablement.

2.1. AI and Data Literacy

Executives do not need to be data scientists, but they must be literate enough to interpret model outputs, question assumptions, and identify risks. This involves understanding how data are collected and trained, what performance indicators mean, and where uncertainty lies. Failures in literacy can lead to significant consequences, as shown in studies of credit scoring where biased training data produced discriminatory results (Kozodoi et al., 2022; de Castro Vieira et al., 2025). Similarly, logistics firms that relied heavily on algorithms without oversight were less resilient during supply disruptions (Culot et al., 2024). AI literacy also includes the ability to explain outcomes clearly to boards, regulators, and customers, reducing perceptions of AI as a "black box" (Burrell, 2016) and strengthening trust (Lee et al., 2024).

2.2. Governance and Risk Capability

AI brings distinctive risks, from embedded bias and privacy issues to cyber vulnerabilities and systemic dependencies. These must be integrated into enterprise-level risk management, not left solely to technical teams. Standards such as ISO/IEC 42001:2023 and the NIST AI Risk Management Framework (2023) provide useful structures for embedding oversight, but leadership is essential for assigning ownership, defining escalation processes, and monitoring emerging threats (Attard-Frost & Lyons, 2025). Governance capability,

therefore, extends beyond compliance − it reflects a recognition that AI risk belongs alongside financial and operational exposure at board level.

2.3. Ethics and Trust Building

Ethics is a core requirement for sustainable AI, not an optional add-on. Public trust declines quickly when systems appear biased or opaque (Engin, 2025). Ethical governance means embedding fairness assessments, stakeholder consultations, and transparent reporting. Neglecting this can result in reputational and regulatory harm, as seen in finance and human resources (Kozodoi et al., 2022; de Castro Vieira et al., 2025). Conversely, structured evaluations such as the Assessment List for Trustworthy AI (ALTAI) (European Commission High-Level Expert Group on Artificial Intelligence, 2020) and international frameworks like UNESCO's Recommendation on the Ethics of AI (UNESCO, 2021) strengthen legitimacy. Papagiannidis et al. (2025) link transparent, ethical governance directly to resilience and stronger stakeholder relationships.

2.4. Sustainability-Oriented Systems Thinking

AI does not operate in isolation. Large-scale models consume energy and generate carbon impacts (Li et al., 2025; Wang et al., 2025). Efficiency gains in one area can create environmental or social costs in another. Executives must, therefore, connect AI adoption to broader sustainability goals. Accenture's (2025) Powering Sustainable AI warns that unchecked optimisation can undermine public trust and ESG commitments. Embedding AI indicators in ESG dashboards and lifecycle reporting helps balance innovation with accountability (OECD, 2024).

2.5. Collaborative Leadership

AI governance is inherently cross-functional, requiring coordination across data, compliance, operations, and external partners. Executives must bridge these domains, balancing commercial pressures with ethical and regulatory expectations. Evidence from healthcare shows that implementation succeeds when clinicians, IT specialists, and patients collaborate rather than when governance is imposed top-down (Lee et al., 2024). Mechanisms such as interdisciplinary review boards and advisory committees enhance transparency and legitimacy (Schmutz et al., 2024; Attard-Frost & Lyons, 2025).

2.6. Workforce Enablement

AI transforms work itself. Executives must guide this transition by prioritising upskilling, inclusion, and clear communication. As Raisch and Krakowski (2021) describe in the automation-augmentation paradox, AI should extend − not replace − human capability. The World Economic Forum (2025) notes that organisations investing in retraining achieve higher loyalty and adaptability. Workforce enablement requires structured impact assessments, retraining programs, and ongoing consultation to ensure that technological change supports both employee wellbeing and organisational resilience (OECD, 2024).

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Together, these six competencies create a practical foundation for responsible executive leadership. They complement technical standards and regulatory guidance by embedding accountability, transparency, and sustainability into daily decision-making, helping leaders build trust, ensure compliance, and align AI adoption with long-term organisational and societal goals.

3. CASE ILLUSTRATIONS ACROSS SECTORS

The six competencies outlined in Section 2 appear in different ways across industries. The following examples − from financial services, supply chains, and the energy sector − show how leadership capability determines whether AI adoption enhances legitimacy, resilience, and sustainability when scaled.

3.1. Financial Services Industry

In the financial services sector, executives must balance technological innovation with fairness, compliance, and trust. AI tools are now central to credit scoring, fraud detection, and algorithmic trading, yet the opacity of many systems (Burrell, 2016) makes oversight difficult. Evidence highlights the risks. Kozodoi et al. (2022) found that biased training data in credit scoring can perpetuate discrimination against protected groups, while de Castro Vieira et al. (2025) documented the regulatory and reputational fallout from such cases. The 2019 Apple Card controversy, where an AI-based credit system was accused of gender bias, prompted U.S. regulatory investigations and damaged public trust. Similar incidents in Europe have since led regulators to require fairness testing in financial risk audits. Sustainability expectations are also reshaping accountability. Li et al. (2025) show that investors now link AI-enabled decision-making to ESG performance, expecting leaders to demonstrate transparency and responsible governance. The World Economic Forum (2025) likewise notes that stakeholder trust has become a key competitive differentiator. These findings make it clear that AI and data literacy, governance and risk capability, and ethics and trust building are no longer optional for financial leaders.

3.2. Supply Chains

Across global supply chains, AI-driven predictive analytics support forecasting, logistics routing, and supplier risk assessment. While efficiency gains are well-documented, these benefits can collapse when resilience and fairness are overlooked. Culot et al. (2024) warn that excessive reliance on algorithms can make supply networks brittle, while Jahin et al. (2023) demonstrate that biased supplier data can distort procurement decisions. The COVID-19 pandemic illustrated this clearly. Firms that optimised inventories solely through predictive algorithms struggled to adapt when borders closed, leading to shortages and reputational damage. By contrast, organisations that combined algorithmic insights with executive-led resilience planning were able to adjust suppliers and maintain operations. Leadership competency thus becomes a decisive factor in whether AI strengthens or undermines performance. As George et al. (2021) caution, efficiency-focused adoption without fairness and sustainability safeguards can erode stakeholder confidence.

3.3. Energy Sector

AI adoption in the energy sector has accelerated rapidly, particularly in grid management and renewable integration (Lamnatou et al., 2025). Applications in optimisation, demand forecasting, and energy storage promise substantial gains, yet they also create new dependencies that can limit operational flexibility. Wang et al. (2025) recognise AI's potential to speed the energy transition but caution against algorithmic "lock-in" − a situation where reliance on specific optimisation models constrains future policy choices. Olawade et al. (2024) make a related point: if lifecycle carbon impacts are ignored during deployment, efficiency improvements may actually work against net-zero commitments. Real cases illustrate the tension. Google DeepMind's work with the UK National Grid improved data centre efficiency substantially, yet regulators questioned the transparency of proprietary algorithms and the risk of long-term dependence on a single vendor. In Germany, smart grid pilots drew public criticism for failing to address fairness in how renewable energy access was distributed across communities. These cases highlight a persistent challenge: technical performance alone does not guarantee legitimacy. Public trust matters enormously in energy governance. George et al. (2021) note that energy innovations often meet resistance when distributional fairness is neglected, regardless of efficiency gains. The U.S. Department of Energy (2024) goes further, arguing that transparency is not simply desirable but necessary for maintaining public confidence in grid modernisation. The World Economic Forum (2025) reinforces this view, concluding that inclusive governance structures are essential if AI-driven energy systems are to gain lasting social acceptance.

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These sectoral examples show that leadership competencies directly influence AI outcomes. In financial services, neglecting fairness and transparency leads to regulatory scrutiny; in supply chains, poor governance undermines resilience; and in energy, ignoring sustainability and inclusion erodes legitimacy. Responsible AI leadership is not about technical optimisation alone − it rests on judgement, ethics, and systems awareness.

4. TOOLKIT: LINKING COMPETENCIES TO GOVERNANCE PROCESSES

The six competencies outlined in Section 2 provide a foundation for responsible executive leadership in AI, but without practical integration into governance systems, they remain aspirational. Executives need mechanisms that translate competencies into daily practice − tools, processes, and artefacts that make oversight visible and reviewable. This section offers a practical toolkit showing how each competency connects to familiar organisational structures. The goal is to shift AI governance from peripheral activity to core strategic practice.

4.1. Embedding Competencies in Governance Processes

Integrating AI competencies into existing governance routines helps position oversight as mainstream organisational accountability rather than specialist technical work. Consider how this might look in practice:

- AI and data literacy develops when executives participate directly in interpretability workshops, review AI dashboards with technical teams, and ask informed questions

about model performance and limitations (Australian Institute of Company Directors & UTS Human Technology Institute, 2024; IBM Institute for Business Value, 2024). Regular engagement builds familiarity and reduces over-reliance on technical intermediaries.

- Governance and risk capability takes shape through established risk management channels. AI-related risks should appear in enterprise risk registers, escalate through board risk committees when thresholds are breached, and face scrutiny during internal and external audits (International Organization for Standardization, 2023; National Institute of Standards and Technology, 2023, 2024). This integration signals that AI risks deserve the same attention as financial or operational exposures.
- Ethics and trust building requires dedicated structures. Fairness assessments, stakeholder consultations, and independent ethics review boards help ensure that ethical considerations receive systematic attention rather than ad hoc treatment (European Commission High-Level Expert Group on Artificial Intelligence, 2020). Without formal mechanisms, ethics can easily become performative.
- Sustainability systems thinking means evaluating AI projects using lifecycle analyses, carbon modelling, and ESG reporting (OECD, 2024). This shifts the conversation from narrow efficiency metrics to broader environmental and social impacts, making trade-offs explicit.
- Collaborative leadership depends on creating spaces where different perspectives can be heard. Cross-functional review boards and interdepartmental committees provide forums for data scientists, compliance officers, operational managers, and external advisors to work through tensions between commercial objectives and ethical constraints (IBM Institute for Business Value, 2024; Attard-Frost & Lyons, 2025).
- Workforce enablement becomes concrete through workforce impact assessments, retraining programmes, and employee consultation processes built into transformation planning (Australian Institute of Company Directors & UTS Human Technology Institute, 2024). These mechanisms acknowledge that AI adoption affects people's livelihoods and identities, not just efficiency metrics.

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When competencies are woven into familiar processes, AI oversight stops being a separate exercise and becomes part of how organisations actually make decisions.

4.2. Artefacts as Anchors of Accountability

Processes matter, but so does documentation. Governance needs tangible outputs − records that boards can review, regulators can examine, and stakeholders can access. These artefacts provide evidence that oversight is happening and create accountability trails. Different competencies generate different types of documentation:

- For AI and data literacy, organisations might produce bias summaries showing how training data were assessed, interpretability reports explaining model logic, and data quality assessments documenting accuracy and completeness.
- Governance and risk capability generates compliance logs tracking regulatory obligations, risk registers documenting identified threats and mitigation strategies, audit reports recording independent reviews, and regulatory filings demonstrating adherence to legal requirements.

- Ethics and trust building creates minutes from ethics board meetings, outputs from fairness audits, and records of ALTAI self-assessments (European Commission High-Level Expert Group on Artificial Intelligence, 2020). These documents show that ethical questions have been considered systematically.
- Sustainability systems thinking produces ESG dashboards integrating AI metrics with broader environmental and social performance, lifecycle impact analyses estimating carbon footprints, and sustainability reports communicating outcomes to external audiences.
- Collaborative leadership leaves traces in decision logs recording who was consulted and why, meeting minutes capturing different perspectives, and joint risk assessments showing how technical and non-technical expertise were combined.
- Workforce enablement appears in HR impact statements describing employment effects, reskilling plans outlining training commitments, and employee survey results gauging sentiment and concerns.

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Documentation quality matters substantially. A bias summary that simply states "no bias detected" provides little assurance. A meaningful assessment specifies which datasets were examined, which fairness metrics were applied (demographic parity, equalized odds, etc.), what mitigation strategies were implemented, and what residual limitations or uncertainties remain. Similarly, meeting minutes should capture substantive disagreements and reasoning, not just attendance lists.

4.3. Mapping Competencies, Processes, Artefacts, and Roles

Clarity about who is responsible for what prevents diffusion of accountability. While organisational structures vary, certain roles typically align with specific competencies.

Table 1. *Mapping competencies to processes, artefacts, and roles*

Competency	**Governance processes**	**Artefacts**	**Executive roles**[6]
AI & data literacy	Dashboard reviews, interpretability sessions	Bias summaries, interpretability reports, data audits	CEO, CIO
Governance & risk capability	Risk registers, compliance audits, board risk updates	Risk registers, compliance logs, regulatory filings	CFO, CRO, COO
Ethics & trust building	Stakeholder consultations, ethics board reviews	Ethics reports, fairness audits, ALTAI assessments	CEO, CSO
Sustainability systems thinking	ESG tracking, lifecycle analyses	ESG dashboards, sustainability reports	CSO, COO
Collaborative leadership	Cross-functional review boards, interdepartmental committees	Meeting minutes, decision logs, joint risk records	CIO, COO
Workforce enablement	Workforce impact assessments, reskilling initiatives	Training plans, HR impact statements, employee surveys	CHRO, COO

[6] CEO = Chief Executive Officer; CIO = Chief Information Officer; CFO = Chief Financial Officer; CRO = Chief Risk Officer; COO = Chief Operating Officer; CSO = Chief Sustainability Officer; CHRO = Chief Human Resources Officer.

Table 1 provides an indicative mapping. This table is derived from the authors' synthesis of the academic literature, policy frameworks and industry reports reviewed in this study.

This mapping should be adapted to organisational context − smaller firms may consolidate roles, while larger organisations might distribute them more finely. What matters is avoiding situations where everyone assumes someone else is responsible. Explicit ownership at executive level ensures competencies translate into practice rather than remaining good intentions.

5. DISCUSSION AND IMPLICATIONS

The framework presented in this paper shows that executive competencies are central to responsible AI adoption. Technical expertise remains essential, but it cannot stand alone. Organisational legitimacy, regulatory compliance, and long-term sustainability depend on leaders who can connect technical, ethical, and social considerations. This section discusses the implications for theory, organisations, and governance.

5.1. Theoretical Implications

The framework contributes to leadership and governance scholarship by framing AI adoption as a socio-technical challenge rather than a purely technological one. Earlier studies often emphasised digital maturity and technical capability, yet these perspectives risk overlooking questions of legitimacy, fairness, and social responsibility (Brynjolfsson & McAfee, 2014; Davenport & Ronanki, 2018). By integrating ethics, trust, and sustainability alongside literacy and risk management, this model broadens the analytical focus and argues that AI governance requires both moral and technical judgment.

Suchman (1995) reminds us that legitimacy is maintained when pragmatic efficiency aligns with normative and cognitive expectations. The present framework operationalises this idea through competency-based leadership, showing how legitimacy is built through institutional practice rather than personal charisma. A second theoretical contribution lies in linking competencies to organisational artefacts and processes. Leadership research frequently highlights traits or behaviours, but without institutionalisation these qualities fade with turnover. Competencies gain durability only when embedded in mechanisms such as risk registers, fairness audits, and ESG dashboards. This approach aligns with work on accountability infrastructures, which stresses that genuine governance depends on routines, documentation, and transparency rather than individual intention (Power, 1997; Bovens, 2007).

5.2. Organisational Implications

The framework shows how executive competencies shape decision quality, stakeholder trust, and sustainability alignment. AI and data literacy enables leaders to interrogate vendor claims and avoid hype-driven investments. Governance and risk capability ensures algorithmic risks receive the same attention as financial exposures (International Organization for Standardization, 2023; National Institute of Standards and Technology, 2023, 2024). Ethics and trust competencies prevent oversight from becoming performative

through fairness audits and stakeholder consultations. Collaborative leadership integrates diverse perspectives, reducing silos (European Commission High-Level Expert Group on Artificial Intelligence, 2020; Jobin et al., 2019). Sustainability-oriented thinking ensures environmental and social trade-offs are assessed systematically, while workforce enablement aligns AI with just transition principles (Accenture, 2025; World Economic Forum, 2025). Without these competencies, sustainability reporting risks becoming disconnected from operational reality (George et al., 2021).

These are not simply personal skills but institutional capacities. Embedding them within governance structures transforms responsible AI leadership into core organisational function.

5.3. Policy and Regulatory Implications

The policy environment is evolving quickly. The EU's Artificial Intelligence Act (European Union, 2024) introduces binding rules on risk categorization, transparency, and accountability. Early scholarly analysis of the Act's development (Veale & Zuiderveen Borgesius, 2021) highlighted the importance of its risk-based approach and the challenges of balancing innovation with protection. Complementary frameworks such as NIST's AI Risk Management Framework (2023) and ISO/IEC 42001 (2023) set international benchmarks, confirming compliance has become mandatory.

Two implications follow. First, regulatory alignment matters − without interoperability across jurisdictions, organisations face fragmented compliance burdens. OECD AI Principles (2024) call for harmonized standards to support cross-border deployment. Second, regulation needs adaptability. Because AI evolves rapidly, static frameworks soon become outdated. Scholars advocate for dynamic models incorporating sandboxes, feedback loops, and multi-stakeholder dialogue (Attard-Frost & Lyons, 2025; Taeihagh, 2025). For executives, compliance must be a leadership concern, not merely a legal function.

5.4. Limitations and Directions for Future Research

This framework should be viewed as an initial conceptual step. It draws on literature, policy frameworks, and sectoral cases but lacks large-scale empirical validation. Future studies should test the competencies across industries and jurisdictions to assess practical impact. Another limitation concerns proceduralism. Power (1997) warns that governance artefacts can become "accountability theatre" signalling compliance without changing behaviour. Research should examine when competencies become genuinely institutionalized rather than symbolic.

The framework focuses on executive leadership given its strategic importance, yet effective AI governance depends on distributed capabilities throughout organisations. Studies tracing how competencies cascade through managerial and operational layers would provide fuller understanding of organisational capacity. The framework advances understanding by reframing AI leadership as socio-technical and institutional. For organisations, it shows competencies shape decision quality, legitimacy, and sustainability. For policymakers, it underscores harmonized yet adaptive regulation. For researchers, it offers conceptual grounding for empirical inquiry within evolving governance systems.

5.5. Practical Roadmap for Implementation

Building these competencies takes time. Organisations should approach development across three phases, though pace may vary by size, sector, and existing governance maturity. Initial efforts establish foundations within six months: baseline literacy through workshops, clear risk ownership for AI systems, and early fairness assessments. Organisations should map use cases, categorize risks, and establish basic documentation for board review. Integration occurs between six and eighteen months. AI risks appear in enterprise risk registers alongside other exposures. Cross-functional boards bring together technical, legal, and operational perspectives. Workforce consultation gives employees voice. Documentation becomes substantial: bias summaries, ethics board minutes, ESG dashboards tracking impacts.

Maturity arrives when practices become routine. Regular fairness audits replace one-off assessments. ESG integration becomes comprehensive. Workforce development shifts from reactive to proactive. Continuous improvement captures lessons from failures. This phase has no fixed endpoint as AI capabilities and risks keep evolving. This staged approach balances ambition with realism, acknowledging cultural change cannot be rushed while ensuring visible progress. Each phase builds on the previous, reducing risk that governance becomes disconnected from operations.

6. CONCLUSION

Executive leadership in the age of AI requires a blend of technical awareness, ethical judgement and organisational understanding. This paper outlined six competencies that can help leaders navigate these demands: AI and data literacy, governance and risk capability, ethics and trust building, sustainability-oriented systems thinking, collaborative leadership and workforce enablement. Together, they offer a way for leaders to consider the broader implications of AI rather than viewing it as a purely technical matter.

The examples from financial services, supply chains and the energy sector show how these competencies play out in real settings. Financial institutions that failed to address fairness issues have faced criticism and regulatory attention. Supply chains designed only for efficiency have proved vulnerable to disruption. Energy projects that focused narrowly on optimisation without considering distributional or environmental concerns have struggled with community acceptance. In contrast, organisations that involved their people early, communicated clearly and made space for workforce development managed AI adoption more smoothly.

A key contribution of this framework is its connection to the governance tools organisations already use. By linking leadership capabilities to risk registers, ESG dashboards, interpretability reviews and ethics processes, responsible AI becomes something that can be embedded in everyday practice rather than treated as an add-on or a compliance exercise. This also provides a clearer pathway for organisations trying to meet regulatory expectations, and a useful foundation for researchers examining how leadership shapes the direction and impact of AI initiatives.

AI governance is ultimately not just a technical exercise. It touches on questions of judgement, accountability, values and long-term organisational resilience. Leaders who take these competencies seriously will be better placed to guide AI adoption in a way that maintains trust and aligns with organisational goals. Those who overlook them risk reputational damage, loss of legitimacy and stronger regulatory intervention. Although this paper brings together insights from multiple sources, there is still more to learn about how these competencies develop in practice, how they are used in real decision-making situations and how they evolve as AI systems and sustainability expectations continue to shift. These questions offer a helpful direction for future research and practical reflection.

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ORGANIZATIONAL COMMITMENT OF EMPLOYEES IN THE METAL SECTOR

ABSTRACT

It is an increasing challenge to find loyal employees and keep them in the company due to various challenges in the labor market. The metal sector in Bosnia and Herzegovina plays one of the key roles in the development of the economy. Physical demands of the job, safety at work, lack of qualified labor are some of the challenges in this sector. It is important to determine what motivates employees in this sector to remain part of the company and not decide to change jobs.

In this research, the primary goal is to determine the commitment of employees to the company in the metal sector. Employee commitment will be observed through three basic elements: affective, continuation and normative commitment. As part of the primary research, a survey questionnaire was used as a data collection form, the research was conducted on a random sample composed of medium and large enterprises that are spatially dispersed on the territory of Bosnia and Herzegovina, and operate within the metal sector. In the analysis of the results, non-parametric statistical methods were used to examine differences and relationships between variables in the sample. The results show a moderate level of organizational commitment, with the most pronounced affective component, indicating a stronger emotional attachment of employees to the organization, with no significant differences in the level of commitment by gender.

Keywords: *employee commitment, metal sector.*
JEL: M10, M29

1. INTRODUCTION

Organizational commitment is a relatively new concept in the field of human resources and there is no single definition, or the author's position. Mowday et al. (1974) define organizational commitment as the relative strength of an individual's identification with the organization and his involvement in its work. Wiener (1982) believes that organizational commitment represents the totality of normative pressure on an individual to behave in accordance with the goals and interests of the organization. According to O'Reilly and Chatman (1986), organizational commitment implies a psychological connection that an individual feels towards the organization, which reflects his degree of acceptance of the organization.

Becker (1960) is one of the first authors who tried to clarify the comprehensive concept of organizational commitment from the perspective of the individual's relationship with the organization. He defined organizational commitment as the "side-bet" theory. According to Becker's theory, the relationship between the employee and the organization is based on a contract on the behavior of economic exchange, committed employees are committed because they have completely hidden or somewhat hidden investments, "side-bet", which they made by staying in the given organization. Mowday et al. (1982) describe exchange theory as the main explanation of the commitment process in which commitment has developed as an alternative construct for job satisfaction, and the authors argue that commitment can sometimes be a better predictor of turnover than job satisfaction. Meyer and Allen (1991), whose work is supported by Camilleri (2006), believe that the feeling of commitment among employees appears for several reasons - because they want it, because they need it, and because they think it is right. They also point out that it is a psychological state that binds the individual to the organization.

A few generations ago, many employees around the world assumed that they would spend their entire career working for one organization. The assumption was that they would trade lifelong loyalty and good work for lifelong job security. That perception changed in the 1980s and 1990s when downsizing became a more common part of working life, largely due to technological advances. Downsizing is a form of involuntary turnover, when employees are forced to leave the organization regardless of their previous level of commitment, which is a consequence of technological development. One study found that downsizing survivors actually experienced more job-related stress than downsizing survivors who continued to look for a new job (Devine et al., 2003).

Employees are the key asset of the organization, which provides the organization with the opportunity to progress and develop in order to be more productive, and when the employees of the organization have an optimal performance. Organizational commitment is a determining factor in how employees are actively involved in performing every activity of the organization. Ramdani et al. (2019) believes that organizations with significant individualistic differences in employees, including motivation to do well, will be directed towards appropriate organizational goals, which will lead to effective work productivity. A large number of employees in Bosnia and Herzegovina work precisely in the metal sector, and it is very important to determine the commitment of employees in this sector. Due to the search for better living conditions, a large number of employees decide to leave Bosnia and Herzegovina and look for work in other countries, both operational workers and managers and engineers.

2. LITERATURE REVIEW

Definitions of organizational commitment are different, but common to all of them is some form of connection between employees and the organization based on some identified values that are valuable to them. Qualified and talented employees are not the only criterion that is important for all companies today. It is much more important to retain such employees and achieve their loyalty. Dedicated employees provide the company with loyal customers, which brings the company higher profits and a better market position in the long term. Organizations must create a work environment that will stimulate the creation of the sense

of commitment needed by employees (Sánchez Cañizares & López-Guzmán Guzmán, 2010).

Meyer and Allen (1991) developed their model on the basis of previously developed models of organizational commitment, which were mostly unidimensional. Their research is considered significant because even today it represents the starting point of all serious discussions about the phenomenon of organizational commitment. These authors found that there are three components of commitment: affective, continuation, and normative commitment. The basic difference in these forms of organizational commitment refers to the reasons for potentially leaving or staying in the organization. No research on organizational commitment has been as widely accepted as that of Meyer and Allen (1991), who developed a three-dimensional model. More recent research (Sumi, 2011) is also based on the three elements of organizational commitment established by Meyer and Allen (1991), which shows that the three-dimensional concept of commitment is still the starting point in all research related to organizational commitment. According to some authors, the most relevant indicator of organizational commitment is affective commitment, which is associated with a state in which an individual is strongly associated with the organization (Kuvaas, 2006).

According to Meyer and Allen (1991), affective commitment can be defined as the desire for an employee to remain a member of an organization due to emotional attachment to that organization and involvement in it. Continuation commitment represents the desire for the employee to remain a member of the organization due to the awareness of the costs associated with leaving, that is, he stays because he has to, because he is forced to pay living expenses, due to potential current indebtedness or the fact of supporting his family. While normative commitment implies the employee's desire to remain a member of the organization due to a sense of obligation, i.e. he stays because he should, he feels obliged to return to the organization everything that has been invested in him. These three types of organizational commitment combine to create an overall sense of psychological attachment to the company. Some employees may be highly rational and cautious in nature, focusing primarily on continuation commitment when assessing their overall desire to stay. Other employees may be more emotional and intuitive in nature, relying more on "feel" than on calculated cost-benefit evaluation. The importance of the three organizational commitments may also vary over the course of a career. It has been established (Laiho et al., 2022) that an attractive employee experience provides opportunities for value creation in various areas such as process improvement, new product development, decision making, brand communication, recruitment and training, but a practical employee participation program is needed in order for business processes and work experience to influence the emotional and social needs of employees.

There is a large number of studies in which various factors influencing organizational commitment have been observed. Some of these factors are leadership style and organizational climate (Saha, 2016), then demographic and situational factors (Sommer et al., 1996), demographic and psychosocial factors (Booth-Kewley et al., 2017), organizational culture (Aranki et al., 2019), national culture (Black, 1999) and many others. Organizational commitment of employees is considered an important factor that ultimately affects organizational success, not only individual success, but also intention to leave, organizational inertia and employee engagement (Guzeller & Celiker, 2020).

3. RESEARCH METHODOLOGY

The goal of the research was to determine the extent to which employees in the metal sector are committed to the company, whether there is a difference in certain segments of commitment, and whether employee commitment differs by gender. Organizational commitment is best understood through the reasons why employees stay in or leave the organization, even when there are legitimate work benefits. Organizational commitment represents the employee's desire to remain a member of the organization (Meyer & Allen, 1997, p. 224). Affective commitment refers to the employee's emotional connection with the organization, which is reflected in friendships, a positive atmosphere, culture or job satisfaction. Continuation commitment is based on awareness of the costs of leaving the organization, such as loss of salary, benefits or advancement opportunities, while normative commitment stems from the employee's sense of moral obligation to remain in the organization out of loyalty to colleagues, superiors or the company as a whole. The question arises whether there is employee commitment in the metal sector in Bosnia and Herzegovina, and whether it differs by gender. Empirical research was carried out based on the collection of primary data through online research, where a survey questionnaire was used as a data collection form. The items of the scale were taken from an already validated measure and translated and culturally adapted for the context of the metal sector in Bosnia and Herzegovina. The respondents were employees of companies from the metal sector in Bosnia and Herzegovina. Data collection was carried out on the basis of a random sample. A sample of 128 respondents from medium and large metal processing companies, according to income classes, which represents approximately 14% of the total population of about 892 organizations, enables representativeness and reliable generalization of the results. Each employee presents his experience from the company he comes from. The survey was conducted in 2025 over a period of six months. Respondents rated the statements on a Likert scale. The statistical unit in this research was employees. The survey questionnaire was structured in the form of closed questions with an offered number of enumerations and closed questions, with an offered Likert-type intensity scale, but also in the form of open questions for the purpose of gathering additional information about phenomena. For each of the commitments, 8 statements were offered, about which the respondents declared according to the Likert scale in the range from 1 to 5 how much they agree with the statements. Through this work, the following hypotheses were tested:

H_1 There is a high commitment of employees in the metal sector.
H_2 There is a difference between individual components of employee commitment in the metal sector.
H_3 There is a difference between the commitment of employees in the metal sector by gender.

When analyzing the available domestic and foreign literature, methods of analysis and synthesis were used with the aim of identifying the characteristics, connections and cause-and-effect relationships between the elements of organizational commitment. In order to verify the accuracy of the set hypotheses, methods of proof and refutation were applied, while the method of description will serve to show the commitment of employees in the metal sector.

Analysis was performed using the Friedman, Wilcoxon and Mann–Whitney tests. After the defined research hypotheses, the results of the conducted research will be presented below. After the presentation of the research sample, answers to the research questions will be determined based on the tested research hypotheses.

4. RESEARCH RESULTS

Analyzing a sample of 128 respondents, an effort was made to establish the commitment of employees in the metal sector, as well as whether there are differences in the commitment of employees by gender. A total of 65.6% of respondents were men, and 34.4% were women. The largest number of responses came from the Central B&H region 62.5%, then from the Northwestern B&H region 15.6%, then from the Herzegovina region 10.9%, and from Northeastern B&H 9.4%, while 1.6% of respondents were from the Sarajevo macroregion. In the paper, employee commitment is presented through three components, which will be presented below.

Table 1. Reliability of the Organizational Commitment Subscales (Cronbach's α)

Type of commitment	Number of items (question)	Cronbach α	Reliability description
affective commitment	8	0,916	excellent
continuation commitment	8	0,820	very good
normative commitment	8	0,839	very good

Source: Author's calculation, SPSS

The reliability of the organizational commitment subscales was assessed using Cronbach's alpha. The affective commitment subscale, consisting of 8 items, showed excellent internal consistency with α = 0.916. The continuation commitment subscale (8 items) demonstrated very good reliability, with α = 0.820, while the normative commitment subscale (8 items) also exhibited very good reliability, with α = 0.839. Overall, these results indicate that all three subscales are sufficiently reliable for use in further statistical analyses.

First, a normality test was performed.

Table 2. Normality test for commitment components

Type of commitment	Kolmogorov-Smirnov			Shapiro-Wilk			Mean Rank
	Stat.	DF	Sig.	Stat.	DF	Sig.	
affective commitment	0.081	128	0.04	0.968	128	0.004	2.37
continuation commitment	0.087	128	0.019	0.978	128	0.034	1.79
normative commitment	0.07	128	.200*	0.982	128	0.082	1.84

Source: Author's calculation, SPSS

The distribution normality test (Shapiro–Wilk) showed that affective (p = .004) and continuation commitment (p = .034) deviated from the normal distribution, while normative commitment (p = .082) did not deviate significantly. Since two of the three variables are not

normally distributed, the non-parametric Friedman test was used for further analysis of differences between components.

Table 3. Friedman Test for commitment components

N	**128**
Chi-Square	27.817
df	2
Asymp. Sig.	0

Source: Author's calculation, SPSS

The Friedman test showed significant differences between the components of employee commitment, $\chi^2(2) = 27.82$, $p < .001$. The analysis of average ranks shows that affective commitment is the most dominant (Mean Rank = 2.37), while continuation (Mean Rank = 1.79) and normative commitment (Mean Rank = 1.84) were significantly lower. Pairwise comparisons (Wilcoxon signed-rank test) confirmed that affective commitment is significantly different from both other components, while the difference between continuation and normative commitment was not statistically significant.

Table 4. Wilcoxon signed-rank test for pairwise comparison of commitment components

	continuous - affective		**normative - affective**		**normative - continuous**
Z	-4.410	Z	-5.329	Z	-.069
Asymp. Sig. (2-tailed)	0	Asymp. Sig. (2-tailed)	0	Asymp. Sig. (2-tailed)	0.945

Source: Author's calculation, SPSS

A pairwise comparison using the Wilcoxon signed-rank test showed that affective commitment is significantly higher than continuation commitment, $Z = -4.410$, $p < .001$. The majority of respondents rated affective commitment higher, while a smaller number gave a higher rating to continuation commitment, and a very small number of respondents gave the same ratings for both components.

The Wilcoxon signed-rank test for affective and normative commitment showed that affective commitment was significantly higher than normative, $Z = -5.329$, $p < .001$. The majority of respondents rated affective commitment higher, while a smaller number gave a higher rating to normative commitment, and a very small number of respondents gave the same ratings.

The Wilcoxon signed-rank test for continuous and normative commitment showed that there was no significant difference between these components, $Z = -0.069$, $p = .945$. The number of respondents who gave a higher rating to continuation commitment was almost equal to the number of those who gave a higher rating to normative commitment, while a very small number of respondents rated both components equally.

Thus, affective commitment is the dominant component of employee commitment, while continuation and normative commitment do not differ significantly among respondents.

Therefore, we can conclude that we confirm the second hypothesis that there is a difference between individual components of employee commitment in the metal sector. In the following, we performed a normality test before determining whether there are differences in the results by gender.

Table 5. Normality test for the distribution of commitment by gender

Gender	Kolmogorov-Smirnov			Shapiro-Wilk		
	Stat.	DF	Sig.	Stat.	DF	Sig.
Male	0.088	84	0.161	0.952	84	0.003
Female	0.101	44	0.2	0.95	44	0.057

Source: Author's calculation, SPSS

The distribution of commitment is not completely normal in both groups (by gender), so we used non-parametric tests for independent samples.

Table 6. Results of non-parametric tests for the comparison of commitment by gender

Mann-Whitney U	1830
Wilcoxon W	2820
Z	-0.09
Asymp. Sig. (2-tailed)	0.928

Source: Author's calculation, SPSS

The Mann–Whitney test showed that there was no significant difference in overall commitment between men and women. The average ranks were almost the same for men and women, indicating that gender does not affect the level of employee commitment. Therefore, we can conclude that we reject the third hypothesis that there is a difference in employee commitment in the metal sector by gender.

Table 7. Employee commitment results in the metal sector

	N	Min	Max	Mean	SD
affective commitment	128	1	5	3.44531	0.945325
continuation commitment	128	1	5	3.04297	0.796529
normative commitment	128	1	5	3.04492	0.775285
Valid N (listwise)	128				

Source: Author's calculation, SPSS

On a scale from 1 to 5, respondents rated affective commitment on average with M = 3.45 (SD = 0.95), which indicates a moderate emotional attachment to the company. Continuation (M = 3.04, SD = 0.80) and normative commitment (M = 3.04, SD = 0.78) were close to the neutral value, which means that employees are not perceived to be strongly tied to the company either because of costs of leaving or because of a sense of obligation. Overall, the respondents showed a moderate level of commitment, with a more pronounced affective

component. Therefore, we can conclude that we reject the first hypothesis that there is a high commitment of employees in the metal sector.

Based on the results of the research, we can recommend that managers pay more attention to the affective commitment of employees, because this is where the potential for employee retention lies. Employees in the metal sector confirmed the importance of employees' emotional attachment to the organization and colleagues they work with. Although the companies in the metal sector are mostly large, it is very important that the employees know the goal, the purpose of the business and that they get to know each other with other employees through socializing and activities in and outside of work.

5. CONCLUSION

Based on the conducted research, it can be concluded that the main purpose of the work was achieved, that is, an answer was obtained to the question about the level of commitment of employees in the metal sector in Bosnian enterprises. The results show that the respondents show a moderate level of commitment, with the most pronounced component being affective commitment, which indicates a stronger emotional attachment of employees to the organization compared to other dimensions of commitment. This confirmed the existence of differences between individual components of commitment, with some appearing as more dominant and significant for understanding the overall commitment of employees.

These findings also have important practical implications. The strategy of human resources management in companies in the metal sector should be aimed at strengthening all dimensions of employee commitment. However, considering the already observed expressiveness of affective commitment, it is recommended to further nurture and strengthen this emotional bond, since it can represent a key comparative advantage in the process of retaining quality and competent personnel.

It is interesting that the research results did not show significant differences in the degree of commitment of employees according to gender. Contrary to the common assumption that certain sectors or activities are naturally more suited to one gender, the findings of this paper suggest that in the metal sector employee commitment is not gender-determined. Therefore, when designing motivational strategies and human resource management policies, it is not necessary to make a distinction between genders, as employees, regardless of gender, show a similar pattern of attachment and loyalty to the organization.

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CHARACTERISTICS OF STRATEGIC PARTNERSHIPS BETWEEN BUSINESSES AND CIVIL SOCIETY ORGANIZATIONS IN BOSNIA AND HERZEGOVINA

ABSTRACT

Corporate social responsibility is one of the determinants of modern business. Although there were previously extensive discussions about whether a company has or does not have social responsibility, and understanding the issue of shifting the costs of these activities to the end consumer, today it is one of the characteristics of business that is accepted as such (sine qua non) - especially in large companies.

With the development of information and communication technologies, movements that call for a certain responsibility (such as the "Woke" movement), consumerism, and the like, companies are becoming a kind of corporate citizens who have certain rights, but also obligations. At the same time, corporate social responsibility, according to the theory of interest groups, implies the creation, development, innovation, and maintenance of long-term relationships with all relevant interest groups, with an emphasis on those that are most important for certain activities. When it comes to corporate social responsibility, CSOs appear as expected interest groups because they operate within the social sphere, that is, they best understand the problems and needs of a society.

Two possible relationships with CSOs have been identified - confrontational and collaborative (cooperation). Through cooperation with CSOs, companies strive to truly understand the need for social responsibility and, accordingly, optimally use scarce resources to maximize the achievement of social and economic goals. In order to achieve the achievement of the latter goals, which are expressed in the form of business performance, it is necessary to build strategic partnerships between companies and CSOs.

The paper explores the phenomenon of strategic partnerships between companies and CSOs in Bosnia and Herzegovina. Based on a sample of 100 large Bosnian and Herzegovinian companies, the basic characteristics of these partnerships are listed.

Keywords: *strategic partnerships, corporate social responsibility, CSOs.*
JEL: M14, L31, L20, D64

1. INTRODUCTION

Corporate social responsibility (CSR) has become one of the key features of modern business, with companies increasingly recognizing their role as "corporate citizens" with rights, but also obligations towards the community. Within this concept, strategic partnerships between companies and civil society organizations (CSOs) occupy a special place, as they enable the achievement of synergy between economic and social goals. Companies strive to create long-term relationships with various stakeholders, and CSOs stand out as important partners operating in the social sphere, understanding local needs, values, and challenges. The theoretical framework of these relationships starts from Freeman's stakeholder theory, which emphasizes that the success of an organization depends on the quality of relationships with key stakeholders. In this context, strategic partnerships between the business and civil sectors can generate shared value, increase the legitimacy of the company, strengthen social capital, and contribute to solving social problems. Motives of companies for entering into partnerships are mainly reputational and strategic, while CSOs recognize in such relationships the possibility of accessing resources, greater influence, and sustainability of their programs. In Bosnia and Herzegovina, where more than 12,000 CSOs operate, the potential for the development of these partnerships is significant, but still underutilized. Although CSR principles are increasingly present in business practice, partnerships with CSOs are often reduced to philanthropic activities, without a clear strategic orientation and long-term planning. This paper aims to explore and analyze the characteristics of strategic partnerships between companies and CSOs in Bosnia and Herzegovina, and to identify the main obstacles, motives, and patterns of cooperation that characterize these relationships. The empirical research includes a sample of 100 large Bosnian and Herzegovinian companies and provides insight into the actual level of institutionalization and effectiveness of these partnerships.

2. THEORETICAL FRAMEWORK

Freeman formulated his stakeholder theory, which identifies additional interest groups and the company's obligations towards the community and the environment (Letica, 2010). Stakeholder theory is a managerial concept that facilitates understanding of organizational strategy and ethics (Jones, 1995; Mitchell et al., 1997). The basic thesis of stakeholder theory is that organizational success depends on the quality of managing relationships with key groups (interest groups or stakeholders) of the organization, which include all those who can influence the realization of the organizational mission (Freeman & Phillips, 2002). The theory is supported due to its descriptive precision, instrumental power, and normative validity. The instrumental component of this theory emphasizes that to maximize shareholder wealth over an indefinite period of time, managers must pay attention to relationships with key stakeholders. Critics of this theory emphasize that stakeholder goals

cannot be mutually aligned (Jensen, 2001) as in shareholder theory (Jensen, 2001), or that this type of "social contract" is impossible in market conditions (Mansell, 2013). Some critics emphasize that stakeholder theory does not apply to small and medium-sized enterprises (Perrini et al., 2007). Regardless of criticism, stakeholder theory is widely accepted by researchers (Freeman & Dmytriyev, 2017) in the field of management, but also in other related social sciences. When it comes to the practical application of the stakeholder theory or the concept of stakeholders, among other things, there is a wide applicability of this theory within the framework of corporate social responsibility of companies (Duckworth & Moore, 2010). In addition to the theory of corporate social performance, stakeholder theory can be used to explain the complexity of partnership relations between companies and CSOs. According to stakeholder theory, CSOs are important stakeholders for the organization, and decision-makers give them importance. For CSOs, Doh and Teegen (2003) expand the framework of Freeman's Stakeholder Theory, adding two characteristics: stakeholder groups that give and stakeholder groups that take (Cullen, 2004). CSOs are those that give when they provide resources such as prestige, legitimacy, as well as an aura of morality and moral authority. On the other hand, they take, when they expose companies to the risk that CSOs become dangerous interest groups, threatening the reputation and profits of companies (Doh & Teegen, 2003). CSOs can also have an exceptionally strong role as interest groups in foreign direct investment because they often appear as shareholders, especially in larger capital projects. CSOs represent a significant interest group of companies in corporate social responsibility. Their relationship is expressed through partnerships with companies. These partnerships can create collaborative advantages and shared value (Teegen et al., 2004; Glasbergen, 2010; Porter & Kramer, 2011) and through the collection and sharing of information, knowledge and capabilities (Austin, 2000; Waddell, 2000; Selsky & Parker, 2005), which is also stated by Drucker (2008), who believes that companies can benefit from a lot of knowledge and experience from the civil sector. The motivations for companies to enter into these relationships are mainly related to employee expectations, broader societal expectations, market trends (e.g., globalization), and increased reporting requirements. For CSOs, the motivations are as follows: inability to achieve their mission independently; responding to demands made by private sector donors; exploring new funding opportunities and innovation; greater influence by leveraging the power and reach of the private sector; CSOs becoming more "business-like" (recruiting for companies); development of new "for-profit" organizations by CSOs and competition with the private sector for development contracts. In addition, partnerships improve project efficiency, social contribution, and competitiveness of CSOs (Kim et al., 2014).

These partnerships can also have negative consequences, especially for CSOs, which can threaten their legitimacy (Pattberg, 2006; Yaziji & Doh, 2009). Therefore, CSOs must avoid partnerships with certain companies (Graf & Rothlauf, 2012). Previous research shows that managers usually decide which civil society organization to donate to or support (Bhattacharya et al., 2009), and that companies enter into partnerships with CSOs for "invisible resources" such as reputation and legitimacy, while CSOs seek to engage and provide organizational and financial resources (Graf & Rothlauf, 2012). Partnerships between companies and CSOs as part of the corporate social responsibility of companies must be viewed in the broader framework of achieving the effects of these partnerships. The authors recognize three levels of effects of these partnerships – macro, meso, and micro effects (Kolk et al., 2011). Macro effects refer to higher goals that seek to solve a certain social problem, which is the original motive for forming partnerships between companies

and CSOs. These goals may relate to poverty reduction, environmental improvement, and the like. The second level of effects refers to the meso (middle) level and includes effects on individual partners within the partnership (companies and CSOs). These effects may relate to corporate image, brand reputation, sales, and company performance, access to new markets, but also the competitive advantage of the company, which refers to the company's ability to compete with its competitors through competition for the market, human and material resources, and technology, on domestic and foreign markets. These partnerships can also be understood as the possibility of creating new value. This is precisely the foundation of Porter and Kramer's theory of strategic philanthropy, which states that social responsibility is based on two conditions: that it contributes to the common good and that it is an organic part of the "competitive context" in which a particular company operates (Letica, 2010). Porter and Kramer's theory of corporate social responsibility is extremely practical when it comes to CSOs as interest groups of companies. Thus, these authors list four ways to increase social impact: selecting the best grant recipient; signaling to other donors; improving the performance of grant recipients; and improving knowledge and good practices (Porter & Kramer, 2002). The theory of strategic philanthropy seeks to integrate social responsibility into modern business practice in a way acceptable to companies. Otherwise, the productivity of socially responsible initiatives decreases (Carroll & Shabana, 2010). At the micro level, CSOs can achieve the following effects: improving resources (e.g., financial resources), volunteers, skills, visibility, and publicity. According to Porter and Kramer, companies need to find an area of convergence, the convergence of "purely philanthropic" and "purely business" interests (Letica, 2010). According to Baron (2006), one of the goals of strategic corporate social responsibility is to redirect the activities of CSOs, activists, and public pressure from their own to other companies. As for empirical research, the results of these studies show that corporate social responsibility has a significant impact on the company. It affects product purchase intentions (Sen & Bhattacharya, 2001), the final balance sheet, and also plays an important role in reputation management and especially in managing reputational threats, increases operational efficiency, creates a positive atmosphere among employees, and ensures the sustainability of investments (Kozarević, 2020). Turban and Greening (1997) conclude that companies with developed social performance can have a significant competitive advantage. Similar conclusions are reached by Porter, who states that within the new way of thinking about competition, there is no conflict between economic and social goals, but there is long-term synergy (Tafra-Vlahović, 2009). There are around 12,000 CSOs operating in Bosnia and Herzegovina, providing services to 29% of citizens (Cero, 2014). This is a highly developed civil sector that is increasingly trusted by the citizens of Bosnia and Herzegovina, according to the report "Media Freedom in BiH in 2018". According to available research, CSOs influence the behavior of companies (Adams & Zutshi, 2004; van Huijstee & Glasbergen, 2010), consumer behavior (Becker-Olsen et al., 2006), and represent the most important interest group for socially responsible activities (Arenas et al., 2009). Companies in Bosnia and Herzegovina understand corporate social responsibility as philanthropy, donations, and well-defined business strategies within legal norms (Ćatić-Kajtazović, 2011). In this regard, philanthropic responsibility has priority over other components of social responsibility (Ćatić-Kajtazović & Šumar, 2020). Employees as stakeholders have very positive attitudes towards social responsibility (Prutina & Šehić, 2016; Delić et al., 2018). Some authors conclude that corporate social responsibility implies behavior that does not endanger the interests of the company, according to perceptions in Bosnia and Herzegovina (Babić-Hodović et al., 2008). Business and civil sector partnership implies a partnership between

companies as one of the most significant achievements of modern society (Zahirović et al., 2008) and CSOs, as forms of organization that are not based on profit (non-profit) and state influence (non-governmental). It is usually called a strategic partnership because it is the result of strategic action, primarily by companies, which strive to maximize certain performances through partnerships. These partnerships improve performances and lead to improved corporate social responsibility, but also to the engagement of resources (Glasbergen, 2010). Companies enter into these partnerships for "invisible resources" such as reputation and legitimacy, while CSOs seek to engage organizational and financial resources (Graf & Rothlauf, 2012). Cross-sector partnerships of this type can create collaborative advantages and shared value (Porter & Kramer, 2002; Teegen et al., 2004) through the collection and sharing of information, knowledge and capabilities (Austin, 2000; Waddell, 2000), as stated by Drucker (2008), who believes that companies can benefit from a lot of knowledge and experience from the civil sector. Drucker (2008) explains this by the fact that in the last few decades, the situation in the civil sector has fundamentally changed, especially when it comes to organization, leadership, and project management, which is the key to the competitiveness of CSOs. Accordingly, companies can learn something new from the civil sector. The motivations for companies to enter into these partnerships are usually related to employee expectations, broader societal expectations, market trends (e.g., globalization), and increased reporting requirements. For CSOs, the motivations are as follows (Tennyson et al., 2008): Inability to achieve their mission independently; Responding to demands made by private sector donors; Exploring new funding opportunities and innovation; Greater impact by leveraging the power and reach of the private sector; CSOs becoming more "business-like" (recruiting for businesses); Development of new "for-profit" organizations by CSOs; Competition with the private sector for development contracts. In addition, partnerships improve project efficiency, social contribution, and competitiveness of CSOs (Kim et al., 2014). These partnerships can also have negative consequences, especially for CSOs, which can threaten their legitimacy (Pattberg, 2006; Yaziji & Doh, 2009). Therefore, CSOs must avoid partnerships with certain businesses (Graf & Rothlauf, 2012).

3. METHODOLOGY

The core population, which was used in the data analysis, includes the largest companies in Bosnia and Herzegovina, according to the revenue generated. The reason for choosing this population is empirical research showing that large companies are mostly engaged in socially responsible activities. Corporate social responsibility and, consequently, partnership with CSOs, are mostly a feature of the business of large companies (Smith, 2013). Thus, the European Commission only requires large companies to report specifically on social issues (Knudsen, 2018). The sample included 100 out of a total of 122 large companies in Bosnia and Herzegovina. The survey questionnaire was sent several times to company representatives (management, marketing department, social responsibility, and public relations) of all 122 companies from the target population in Bosnia and Herzegovina. Responses were received from 100 of them. This represents a return rate of 81.96%. This indicates that the sample can be considered representative.

4. DESCRIPTIVE STATISTICAL ANALYSIS

The majority of companies do not recognize the importance of strategic partnerships with CSOs within their own mission. According to the results of the descriptive statistical analysis, it can be observed that the engagement of CSOs is not stated within the company's mission. What is important to note is that it is possible that a significant number of companies do not have a clearly expressed mission, which could be the subject of future empirical research (the existence of a mission, vision, strategic documents, etc. within the company). Therefore, a significant number of respondents, 30% of them, express a neutral position, i.e. they neither agree nor disagree regarding the recognition of partnerships as part of the company's mission. The expected recommendation, based on the above, is that the importance of strategic partnerships should be recognized within the company's mission - both with CSOs and with other representatives of the private and public sectors. Unlike the mission, company representatives state that there are still contracts with institutions, associations and communities. A total of 49% of company representatives state that there are contracts of this type. A high 32% of respondents are not sure about the above. It is possible that respondents do not have enough information regarding the existence of these contracts, which can sometimes be a job managed by the legal department within the company. Only 19% of respondents stated that such contracts do not exist. All of the above support the fact that although strategic partnerships between companies and CSOs are not recognized within the company's documents, the institutionalization of these relationships is still done through certain contracts, i.e. partnerships are formed as a contractual relationship. This practice is recommended due to the possibility of adequately defining responsibilities and obligations within partnerships. When it comes to investing resources for the purpose of strengthening partnerships, a significant number of respondents do not indicate support for this issue - 29%, while 34% are not familiar with this practice. Accordingly, there is a possibility that respondents are not satisfied with the available resources for the needs of partnerships. Moreover, the respondents who responded were employees who deal with this type of partnership through marketing and corporate social responsibility or as general management within the company. Understanding that they perform these tasks, it is possible that they are not satisfied with the distribution of resources within the company, which explains the previously mentioned answers. However, what is interesting is that these respondents probably do not only perform these tasks, but may also be assigned to other positions and strategic partnerships are not their primary tasks/functions. Only 33% of respondents state that there is someone within the company who is responsible for working with CSOs. This is a very low percentage, considering that these are large Bosnian companies.

A high 32% of respondents gave a neutral answer, which may also support the fact that, as with previous answers, there is a diversification of jobs and duties within large companies, so that respondents do not have complete information about all activities related to strategic partnerships between companies and CSOs. A significant number of respondents, 47% of them, state that there are consultations with CSOs. This is in line with the theoretical framework and probably implies an expression of the uncertainty of companies regarding social action. Companies, unlike the public and civil sectors, have no experience or knowledge regarding significant social action. Therefore, consultations with CSOs are recommended, which have much more information. CSOs, in accordance with their own mission and activities, have the necessary experience regarding work in the community. Consultations create a kind of protection for companies from social pressure and create the

prerequisites for a proactive approach to solving social problems - in accordance with the principles of corporate social responsibility. The fact that everything mostly ends with consultations, without any particular influence on decision-making, is proven by the answers to the question regarding the possibility of CSOs to influence decision-making or decision-making processes of companies. A remarkable difference in the answers was shown, so that 38% of respondents stated that such a practice exists, while 36% stated that it does not, and 26% had no knowledge about the above. A clear difference in the answers is visible, which potentially maintains completely different practices of large companies when it comes to decision-making processes. Only 13% of respondents stated that they completely agree with this practice (absolute agreement). Joint programs or projects demonstrate a commitment to partnership, so the research attempted to answer the question of whether such projects/programs exist and whether they are successful. The largest number of respondents, 33%, was not sure about the above, which further suggests the respondents' lack of knowledge about partnerships. 32% of respondents stated that there are joint programs with CSOs, while a high 49% expressed that such programs are successful. It can be concluded that there are not that many joint programs, but if there are, they are extremely successful. A relatively high number of 40% of respondents stated that there is open and clear communication between partners. This is an important prerequisite for the success of a strategic partnership between companies and CSOs. A high 36% of respondents stated a neutral answer, which can again be explained by the fact that these respondents may not be involved in the communication processes between partners (internal and external communication). When it comes to adopting processes and ways of behaving towards the partner itself, which represents a kind of adaptation in accordance with the partner's requirements, the largest number of respondents is not sure about the above (35%). The smallest number of respondents expressed agreement, which means that it is possible that companies do not adapt to the requirements of CSOs to such an extent.

Regarding the fairness of the system of responsibility sharing among partners, the answers are very different, which can be explained by the different experiences and practices of large companies. 37% of respondents are satisfied with the system of responsibility sharing, 35% gave a neutral answer, while 28% stated that they were not satisfied with the given system. According to the theoretical model, the division of responsibility should follow the different interests of partner organizations. Companies have economic motives, while CSOs have broader, social motives for action. The synthesis of these goals should enable a fair distribution of responsibility, which is best demonstrated in the implementation of individual projects, i.e. their success or failure. Very interesting answers from respondents relate to social goals, i.e. avoiding bad practices on this issue. Thus, regarding the avoidance of activities that could threaten human rights, respondents offer the most agreement answers - as much as 61%. This confirms that there is an exceptionally developed awareness of the importance of human rights and their protection. Only 14% of respondents state that some of their activities and practices could threaten human rights. The recommendation, of course, is to minimize these activities and practices, while understanding the negative marketing and other effects of the above. Threatening human rights by companies can have exceptional, negative and long-term effects on business. Therefore, it is quite expected that a very small number of respondents stated that they have such practices. Regarding a possible conflict with CSOs, which falls under the category of so-called confrontational relationships, 30% of respondents stated the possibility of the above. 37% believe that such relationships will not occur, which is the largest individual number of responses (33% stated a neutral

response). It is precisely the previously mentioned human rights violation activities that can bring a company into a confrontational relationship with a civil society organization. If such a conflict occurs, then it is important that there are adequate mechanisms for resolving them. This mechanism can exist within the institution of strategic partnership between companies and CSOs. 38% of respondents stated that there is a specific mechanism for overcoming conflicts. An identical number of respondents is not sure about the existence of a given mechanism, while the smallest number of respondents (24%) stated that this mechanism does not exist at their company, or within the institution of strategic partnership. Regarding the results of strategic partnerships, the largest number of respondents is not at all sure about the above - 40%. The rest, 39%, agree, or 21% disagree, which indicates that companies do not see the importance of strategic partnerships, or at least their results. Regarding the definition of partnership goals - as a result of cooperation between companies and CSOs - the majority of respondents, 42%, state that the goals are defined. A smaller number of respondents offer a neutral position. Otherwise, the definition of goals is very important for the implementation of projects and the long-term nature of the partnership itself. When it comes to commitment to the partnership, or the level of commitment from the partners themselves, the differences are more obvious - 36% agree that there is mutual commitment, while 40% offer a neutral position, or 24% disagree with the above. Therefore, there are still many answers that support the fact that companies believe that the level of commitment shown by CSOs is not sufficient, especially when it comes to partnerships. Regarding communication within partnerships, a significant number of respondents state that the messages between partners are clear and understandable - a high 51%. Only 20% disagree with messages as part of the partnership and communication within the above. This means that large Bosnian companies have developed communication systems and that there are no problems with (de)coding messages by partners - CSOs. Company representatives state that financial resources are key to the long-term sustainability of partnerships with CSOs.

This is in accordance with the theoretical framework that emphasizes the stated contribution of companies - CSOs, especially in Bosnia and Herzegovina, have continuous problems with funding. This reality leads companies to emerge as key donors to the activities of CSOs, thereby creating the principles of corporate social responsibility. The majority of respondents, 50%, agree with the statement that strategic partnerships contribute to the organizational development of individual partners. This agreement precisely expresses the essence and importance of these partnerships because they should serve to encourage the transformation of both partners who should learn from each other. Consequently, through the strengthening of individual organizations and their identities, partnerships also contribute to strengthening the image/brand in the public. This is confirmed by 56% of respondents who agree with the statement that partnerships are precisely in the function of strengthening the image or brand of the company. In this way, specific marketing and economic goals of the company are achieved. Finally, when it comes to monitoring the partnership, 49% of respondents state that it is carried out regularly, i.e. they agree with the given statement. According to the theoretical framework, this is recommended for the functioning of strategic partnerships. Finally, according to descriptive statistical analysis, the perception of creating new values through partnership is monitored. A significant number of respondents, 46% of them, indicate a neutral response. This can be concluded that it is still unclear how this partnership contributes to the value itself - inside and outside the company. Only 33% of respondents indicate agreement on this issue, while 21% disagree. Observed by factors, the average score for the variable of being based on corporate philanthropy is 3.48, for being

based on business strategy 3.27, and for the stakeholder approach 3.16. This is shown in Figure 1.

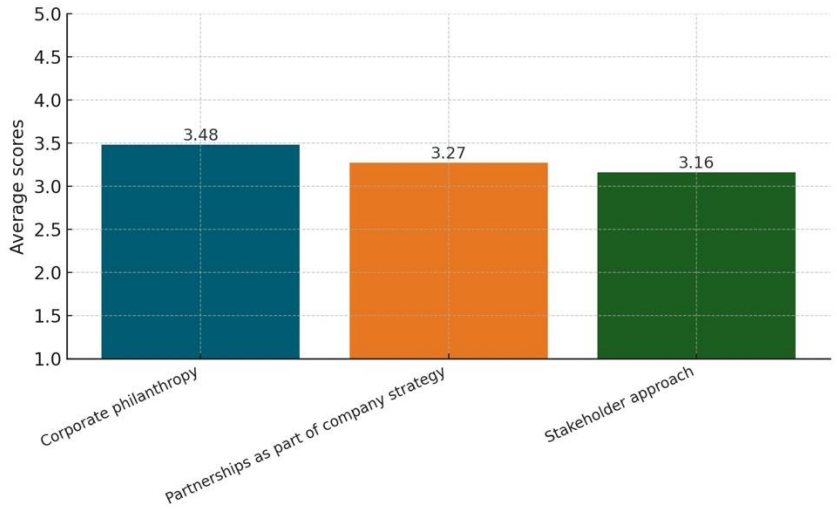


Fig 1. Average values of partnership characteristics

Questions related to corporate social responsibility of companies show that company representatives have a developed awareness of the potential harmful impacts of their business on society. The majority agree with the statement that they are aware of the negative impacts (50%). An exceptionally high number of respondents, 64%, state that they invest in the community through donations. Only 15% of respondents state that they do not do so. This confirms that there is a developed last level of corporate social responsibility, according to Carroll's pyramid of social responsibility - corporate philanthropy. 70% of respondents state that they use clear and transparent accounting standards. The high level of agreement suggests that accounting practice is extremely developed in Bosnia and Herzegovina, especially in large companies. Similarly, the practice of public disclosure of non-financial and financial reports is followed, which is expected of large companies. Respondents also state, in high numbers (66%), that there is a code of ethics for employees within the company. The existence of a code is very important in order to minimize bad work practices and improve labor standards, as well as general responsibility towards employees within a company. Based on the above, it can be concluded that in Bosnia and Herzegovina the organizational prerequisites for the development of strategic partnerships between companies and CSOs have not been developed, however, there is an extremely developed awareness of the need for the above. Companies understand that there is a need for partnerships, especially in the context of the negative impact of their business activities. Therefore, the foundation of awareness of corporate social responsibility and the necessity of strategic partnerships with CSOs is present, however, additional work is needed to develop a model that will satisfy partners and ensure long-term cooperation and action.

5. CONCLUSION

The results of the research indicate that strategic partnerships between companies and CSOs in Bosnia and Herzegovina are still not fully developed or systematically integrated into the business strategies of large companies. Although there is awareness of the importance of

social responsibility and positive attitudes towards cooperation with CSOs, in practice, ad hoc donations and philanthropic projects dominate, while real strategic partnerships are relatively rare. Most companies do not have a clearly defined mission that includes cooperation with the civil sector, nor are there specifically responsible persons or departments for the development and management of these relationships. Positive developments are visible in terms of contractual forms of cooperation, regular monitoring of partnerships, and awareness of the importance of protecting human rights. However, the research indicates a lack of systemic support, limited resources, and an unclear division of responsibilities between partners. Successful examples of partnerships show that such relationships can contribute to strengthening the image of companies, developing the organizational capacities of CSOs, and creating new social value, which confirms the theoretical postulates of "shared value". In conclusion, Bosnia and Herzegovina possesses the necessary social and institutional prerequisites for the development of successful strategic partnerships between businesses and CSOs, but it is necessary to strengthen organizational capacities, formalize cooperation, and embed CSR into long-term business strategies. Only such an approach can ensure the transformation of philanthropic practices into sustainable, mutually beneficial partnerships that contribute to the economic and social development of the country.

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INNOVATION STIMULATION MECHANISMS THROUGH INTERNAL PROCESSES AND EXTERNAL COLLABORATION

ABSTRACT

In the growing and complex modern business environment, the importance of innovation is increasingly coming to the fore, as a key driver and factor that leads to competitiveness, but also to long-term growth of companies. As part of this paper, the mechanism that leads to incentives for innovation through internal organizational processes, as well as external cooperation of companies in Bosnia and Herzegovina, is examined. The paper relies on theoretical frameworks such as resource-based approaches and the ability of companies to be open to innovation, in order to investigate how internal factors and capacities such as research and development functions, knowledge management and external cooperation contribute to innovation results. As part of the research, 304 responses were collected from companies of different sizes and from different sectors. For the statistical analysis of the collected data, regressions, t-tests and correlation were used, which were necessary to test the hypotheses set. The results show that the existence of a research and development department has a significant positive impact on innovation results, especially in small companies, while external cooperation proved to be the most beneficial for medium-sized companies. Internal mechanisms alone have not shown a significant direct effect on innovation, but are suggested to act as complementary factors within broader innovation systems. The findings highlight the existence of different innovation pathways among firms of different sizes, underscoring the need for differentiated strategies and policies. For small firms, strengthening internal R&D capacities appears to be a priority, while medium-sized firms benefit more from external networks and knowledge flows. Large firms, in contrast, require an integrated approach of complex internal and external resources.

Keywords: *Innovation stimulation mechanisms, Internal processes, External collaboration, SMEs.*

JEL: O31, O32, L26

1. INTRODUCTION

Innovations today represent one of the key factors and drivers of competitiveness and long-term development of companies, regardless of the size of the company or the sector from which they come. In an era marked by accelerated technological progress, but also by growing consumer demands, there is a growing need for constant adaptation and improvement of products, services and processes. In this context, understanding the processes and methods that lead to the stimulation of innovation within the company, but also through cooperation with external partners, becomes necessary for the formation of business strategies. It is particularly important to investigate how internal processes and resources, together with external sources of knowledge and networks of cooperation, can contribute to a greater innovative ability of the company.

Although there is a large amount of research today related to the field of innovation research, in practice there is often an insufficient connection between theoretical models and the actual situation on the market. This problem is particularly visible in developing economies, such as Bosnia and Herzegovina, where companies operate in an environment characterized by limited financial and human resources, various institutional barriers and changing market conditions. For this reason, it is necessary to take a closer look at how different forms of innovation stimulation, starting from internal knowledge management, then employee training and creating an innovation culture, to networking with various partners, academic institutions and research centers, affect innovative activities.

Previous research has mainly focused on individual dimensions of innovation, ignoring the interdependence of internal capacities, external resources, and the different needs of companies according to their size. In the case of Bosnia and Herzegovina, the research gap is further accentuated by the lack of empirical work based on primary data. This paper seeks to address this very gap and offer a systematic analysis of the combined effects of internal and external factors of innovation. The results obtained from this paper aim to offer practical and useful recommendations to managers and policymakers, all with the aim of improving the existing way in which support for the emergence of innovations is provided.

Based on this, the research problem and objectives of the paper are defined. The research problem is defined as follows:

- Lack of empirical data on the effects of internal and external mechanisms of innovation stimulation on firm performance in Bosnia and Herzegovina
- Lack of clear insight into which mechanisms have the greatest impact depending on firm size
- Limited connection of theoretical frameworks with local market conditions and practice

The specific objectives of the research are defined as follows:

- Identify key internal and external mechanisms of innovation stimulation
- Examine the connection of these mechanisms with innovative outcomes through statistical analysis
- Analyze differences in the effectiveness of mechanisms by firm size

- Formulate recommendations for improving innovation policy and practice in the private sector

2. REVIEW OF PREVIOUS RESEARCH

The ability of firms to innovate has long been the subject of research through various theoretical frameworks. The resource base of the firm argues that competitive advantage arises from valuable, rare internal resources and capabilities of the firm (Barney, 1991, p. 99-120). According to this theory, innovation occurs when a firm can effectively use its internal resources, such as knowledge, technology, and human capital, in a unique way, creating new products and processes that competitors cannot easily copy (Cohen & Levinthal, 1990, p.128-152).

In parallel, dynamic capabilities build on this model and focus on the capacity of the firm to continuously adapt and transform its resources in a constantly changing environment (Teece, Pisano, & Shuen, 1997, p. 509-533). Dynamic capabilities, such as the ability to spot opportunities, learn quickly, and adapt internal competencies, are crucial for the continued innovation of a firm. It is these capabilities that explain why some companies succeed in innovating under the pressure of change, e.g. The ability to rapidly recombine knowledge and processes allows a firm to stay one step ahead of its competition through innovation (Eisenhardt & Martin, 2000, 1105-1121).

The concept of open innovation considers that companies should not rely only on internal ideas and resources, but should systematically include external actors in their innovation process (Chesbrough, 2003). In his work, Chesbrough showed that companies can achieve greater innovation performance if they combine internal R&D activities with external ones. Open innovation actually implies a two-way flow of knowledge: "inside", through the exploitation of external ideas within the company, and "outside" through the commercialization of internal ideas with the help of external partners (West & Bogers, 2014, p. 814-831). This paradigm is particularly important for small and medium-sized enterprises that often do not have all the necessary resources internally (van de Vrande et al., 2009, p. 423-437).

Human resource management practices also strongly influence a company's innovativeness. HRM practices such as continuous training, employee skill development, teamwork, participatory decision-making, and rewarding creative ideas create an environment conducive to innovation (Laursen & Foss, 2003, p 243-263). High-quality human capital and a learning culture within a company often drive innovation from the bottom up, where employees themselves suggest improvements to products or processes.

An equally important factor is knowledge management and learning within the company, since companies that actively collect, share and apply knowledge are better at ultimately innovating. Setting up internal "knowledge banks", databases with best practices, and encouraging informal knowledge exchange, through mentoring and brainstorming, lead to strengthening the innovation capacity of the company. Darroch (2005) finds in his work that effective knowledge management is directly related to a higher number of patents and new products filed. Companies that have an established culture of organizational learning, where mistakes are used as lessons for progress, create fertile ground and a basis for creativity

(Skerlavaj, Song, & Lee, 2010). Especially in the context of the countries of the Western Balkans, it has been observed that many SMEs have limited internal resources primarily through the lack of a formal R&D department, which can reduce their innovation performance and requires a focus on strengthening internal capacities (Fedajev, Panić, & Živković, 2024, p. 447-475).

In addition to internal factors, companies can significantly stimulate innovation through cooperation with external partners and inclusion in wider knowledge networks. One of the most prominent forms of external cooperation is cooperation with universities and research institutes. Universities should be sources of the latest knowledge and a place where it is possible to access talent selection. In this context, connecting industry with academia brings a double benefit as companies gain access to new knowledge and technologies, while researchers can commercialize their ideas (Perkmann et al., 2013, p. 423-442).

Successful examples include technology clusters and joint R&D centres where universities and companies work on projects, from pharmaceutical consortia to IT start-up incubators in cooperation with technical faculties. The Western Balkans are also moving towards this model, although the intensity of this type of cooperation is still lower than in the rest of Europe, initiatives such as technology parks in Slovenia or university-business cooperation in Serbia show the potential for enhancing regional innovation through closer links between science and business (Fedajev et al., 2024, p. 447-475).

It is important to emphasize that internal and external mechanisms act complementary. Contemporary literature speaks of ambidexterity in innovation in the sense that successful companies are able to simultaneously use internal resources and explore external opportunities for innovation. For example, research conducted in small and medium-sized enterprises in China (Zeng, Xie, & Tam, 2010, p. 181-194) showed that the combination of strong internal, technical competencies and intensive external cooperation in networks brings the best innovation performance. Companies that had only internal focus, or only external dependence, lagged behind those that balanced both dimensions, which is consistent with the concept of absorptive capacity, which indicates that for external cooperation to yield results, the firm must have sufficient knowledge and processes internally to absorb new information (Cohen & Levinthal, 1990, p. 128-152).

3. METHODOLOGY

This research is based on a quantitative approach, with a focus on empirically testing the relationship between internal processes, external cooperation mechanisms and innovative results of enterprises in Bosnia and Herzegovina. The main goal of the research is to gain insights that would explain how different forms of internal activities, such as human resource development, formalization of innovation procedures and knowledge management, and external activities, such as cooperation with various partners from industry and academia, contribute to the emergence of innovations.

The research was conducted using a survey questionnaire that was prepared to cover all essential and significant dimensions of internal and external stimulation of innovations. The questions were prepared in accordance with the standards of similar research, and the measurement scale was a five-point Likert scale, where 1 indicated complete disagreement

or minimal presence of the factor, and 5 complete agreement or maximum presence. The sample included micro, small, medium and large enterprises from different industries, which also enabled a separate analysis according to the size of the enterprise, with the aim of identifying possible structural differences.

The data were collected using a purposive sampling method to ensure representativeness of the companies by size and the sectors they come from. After collection, they were first processed using descriptive statistics to obtain a clear picture of the basic distributions of responses. Inferential analyses, including Pearson correlation and multiple regression, were then conducted to determine the strength and direction of the relationship between the observed variables. In addition, tests were conducted separately by company size. Python was used for statistical processing, while visual displays of the results were created in Excel. The statistical significance threshold was set at $p < 0.05$, with additional marking of results that move towards the significance limit to avoid exaggerating the effects.

3.1. Research questions or hypotheses

This research assumes that innovations arise from a combination of internal processes, such as human capital development, organizational culture and knowledge management, and external forms of cooperation with partners, suppliers, clients and research institutions. In addition, it is expected that the size of the company can significantly affect the intensity and efficiency of these mechanisms.
The formulated research questions and hypotheses are designed to enable testing of these relationships and provide empirical evidence relevant to theory and practice. In accordance with the above, the following research questions were formulated:

- Which internal mechanisms contribute most to the stimulation of innovation in companies in Bosnia and Herzegovina?
- Which external cooperation and partnerships have the greatest impact on innovative results?
- Are there significant differences in the effects of innovation stimulation mechanisms depending on the size of the company?

In addition to the defined research questions, the following hypotheses were also defined:

- **H1 -** There is a statistically significant relationship between internal processes and innovative results of the company.
- **H2 -** External collaboration with partners positively affects innovation outcomes.
- **H3 -** The effects of internal and external innovation stimulation mechanisms vary depending on the size of the company.

4. RESULTS AND ANALISYS

For the purpose of testing the hypotheses, different statistical methods were used, depending on the type of variables and the hypothesis being tested. Hypothesis 1 was tested using regression analysis, which assessed the impact of selected independent variables, such as internal processes and mechanisms) on innovative results. Hypothesis 2 was analyzed using the independent samples t-test, by comparing the mean values between groups with a high

and low level of involvement in external cooperation. Hypothesis 3 was tested using Pearson correlation, with the aim of examining the relationship between the intensity of cooperation and innovation results. The analyses were first conducted on the total sample, and then separately by company size (micro, small, medium, large), in order to identify possible differences between different companies.

The results obtained indicate certain differences in significance between hypotheses and groups. In the total sample, only hypothesis H1 was confirmed, while H2 and H3 did not show statistical significance. However, a more detailed analysis by company size shows additional connections. For small companies, H1 was confirmed, while for medium-sized companies, significance is evident for H2, which indicates that in these companies external cooperation mechanisms may play a greater role than in other categories. In the case of micro and large companies, none of the hypotheses was confirmed, which may suggest that in these companies other factors, not included in the models, have a stronger impact on innovation results. Therefore, the results indicate the heterogeneity of innovation mechanisms, depending on the size of the company, which is an important finding of the research.

Table 1. presents a summary of the statistical analyses conducted, grouped by hypotheses, applied methods and sample size distribution. For each hypothesis, the appropriate statistical technique was used. The "Model/Effect" column shows the main effects and the obtained coefficients, while the "Statistic(s)" column shows key indicators such as p-values, t-values, correlation coefficients, which allow for the assessment of statistical significance. It is important to emphasize that the results vary depending on the observed group of companies.

Table 1. Summary of statistical testing

Hypothesis	Method	Group	N	Model/Effect	Statistic(s)	Significant?
H1	OLS	All	304	R^2=0.018	β(Q5)=0.127, p=0.0210; β(Q6)=-0.021, p=0.7710; β(IM)=0.003, p=0.9589	Yes
H1	OLS	Small	88	R^2=0.076	β(Q5)=0.223, p=0.0436; β(Q6)=0.136, p=0.2902; β(IM)=-0.091, p=0.3812	Yes
H2	t-test	Medium	51	Means: high=4.09, low=3.67	t=2.113, p=0.0421	Yes

Source: Author's creation based on primary research

Hypothesis 1 was based on the assumption that the existence and strength of a research and development department in a company positively affects the level of innovation. To test this hypothesis, regression analysis was used, where the key independent variables were indicators of the connection with the research and development functions, as well as the innovation mechanisms index. The results on the total sample of 304 companies showed that there is a statistically significant relationship between the existence of a research and development department and the innovation index (β=0.127, p=0.021), indicating that organizations that have an established research and development function achieve higher innovation performance compared to those that do not.

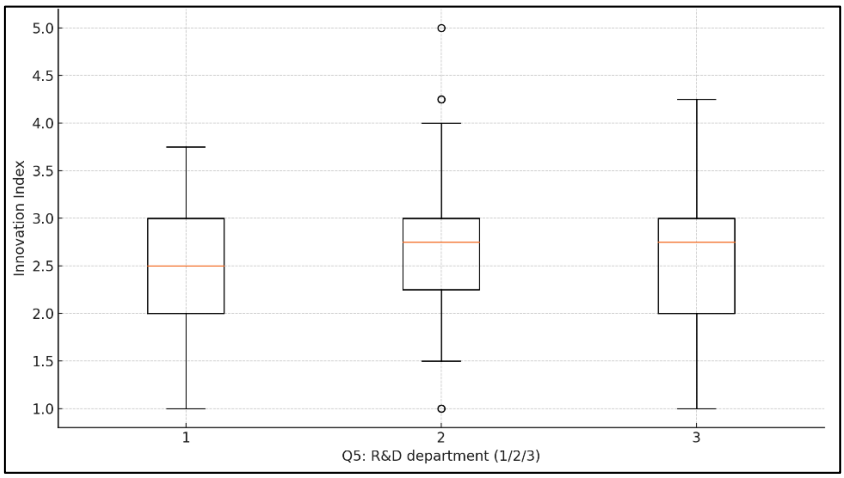


Fig. 1. Innovation by R&D Department (All Companies)
Source: Author's creation based on primary research

The visualization shown in Figure 1. further confirms these results. The graph shows the distribution of the innovation index according to different categories of R&D departments, so that 1 is defined as the lack of a formal department, 2 as partial or limited capacity of the R&D department, and 3 as a developed and active department. It can be seen that companies with developed R&D departments have a higher median of the innovation index and a wider range of values, which indicates that this group of companies generates a greater number of innovations, but also greater variability in the success of innovations.

When the results are analyzed by company size, additional clarifications and insights are obtained. Namely, a significant positive effect of the R&D department was confirmed only in small companies (β=0.223, p=0.044), while in micro, medium and large companies the effect was not statistically significant. This finding can be interpreted as meaning that small companies benefit the most from introducing R&D departments, as this allows them to manage innovation more systematically compared to the ad-hoc solutions typical of micro-firms. In large and medium-sized companies, it is possible that the complexity of the structure and the different sources that lead to the emergence of innovations reduce the relative importance of the R&D department itself.

The second hypothesis was based on the assumption that a higher degree of reliance on external sources of knowledge and cooperation has a positive effect on the innovative performance of a company. To test this assumption, an independent samples t-test was used, comparing companies with high and low intensity of external cooperation. When observed on the total sample, the results did not show a statistically significant difference (t=0.910, p=0.364), indicating that, in general, reliance on external sources alone does not guarantee a higher innovation index. In other words, companies that cooperate intensively with external actors are not necessarily more innovative than those that rely more on internal resources.

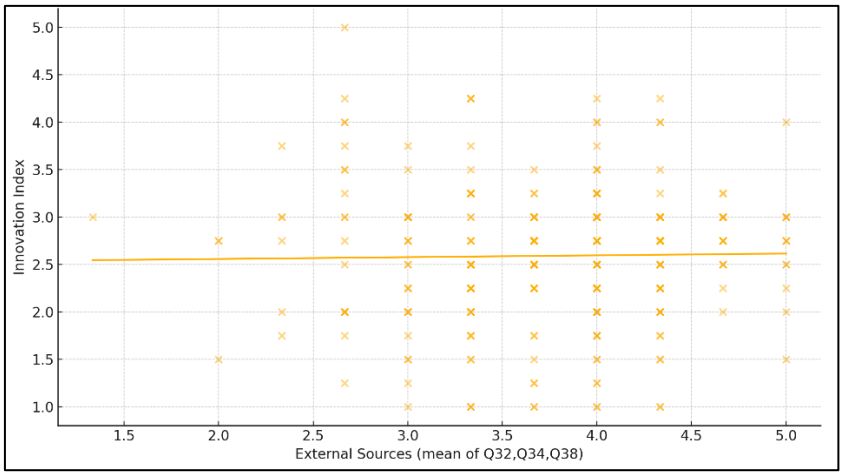


Fig. 2. External Sources vs Innovation (All Companies)
Source: Author's creation based on primary research

Figure 2 shows the relationship between external sources and innovation. Although a certain dispersion of the data can be visually observed, the trend line remains almost horizontal, confirming that there is no clear linear relationship between these two dimensions. When the results are analyzed by company size, heterogeneity is additionally observed. In medium-sized enterprises, a statistically significant difference between the groups was found ($t=2.113$, $p=0.042$), indicating that it is in this category that external sources play a key role in strengthening innovation. In contrast, in micro, small and large firms the effect was not significant. This finding can be interpreted as the fact that medium-sized enterprises, although they have certain internal resources, still have insufficiently developed own capacities for research and development, and rely more on external partners to compensate for these shortcomings.

The third hypothesis was aimed at examining the relationship between the intensity of use of internal mechanisms, such as various training programs, employee incentives, or formalized procedures, and the innovation performance of the company. It was expected that a stronger orientation to internal processes would positively correlate with a higher innovation index. For this analysis, the Pearson correlation coefficient was used, which showed a value of $r=-0.011$ with $p=0.849$ on the total sample of 304 companies. It can be seen that these results clearly indicate that no statistically significant linear relationship was found between these variables, which means that a more intensive use of internal mechanisms, at least in this sample, is not directly related to higher innovation results.

Figure 3 shows the relationship between the average intensity of internal mechanisms and the innovation index. The dotted distribution indicates a relatively even and scattered sample, without a clear trend. The regression line is almost horizontal, which further confirms the absence of a linear relationship. In practice, this means that firms that invest more in formal internal procedures do not necessarily innovate more. However, a deeper analysis by company size shows different results. Although none of the groups (micro, small, medium, large) showed a statistically significant correlation, in some cases a trend of weak positive or negative relationships can be observed, which may mean that the effects of internal mechanisms also depend on other factors such as managerial approach,

organizational culture or the ability to connect knowledge acquired within the company with external sources. In other words, internal mechanisms alone are not sufficient to stimulate innovation, but in combination with other factors they can have a direct impact.

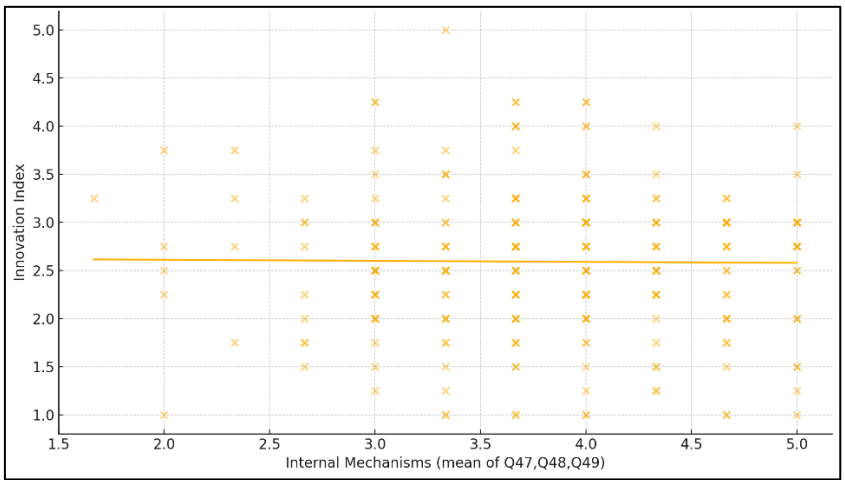


Fig. 3. Internal Mechanisms vs Innovation (All Companies)
Source: Author's creation based on primary research

5. DISCUSSION

The results of the research showed that there is no universal way to stimulate innovation through various mechanisms within the company, but that it also depends on the context, as well as the characteristics of the companies themselves. The empirical analysis confirmed that the existence of a research and development department has a positive and statistically significant impact on innovation when looking at the entire sample, while on the other hand, external sources and internal mechanisms showed much weaker results. These results are largely in line with theoretical assumptions about the dynamic capabilities of companies, which emphasize the importance of organizational resources and capacities in the process of knowledge accumulation (Cohen & Levinthal, 1990; Teece, 2020). The results obtained clearly show that this dimension is the most important for the companies in the sample, but that its effect is not the same for all categories and sizes of companies.

When it comes to small companies, their R&D capacities have proven to be particularly important, as they allow limited resources to be directed at a targeted level of innovative activities. These conclusions are in line with research showing that small companies often do not have the luxury of relying on a wide range of innovative activities, so that even their modest investment in R&D can significantly increase their competitiveness (Mališić et al., 2025). On the other hand, in medium-sized and large companies, the effect of the existence and activities of a R&D department was not statistically significant. There are works available in the literature indicating that in large companies, innovations increasingly occur through networks and various collaborations, and not exclusively within internal R&D departments (Gooderham et al., 2022).

The second dimension of the research concerned external collaboration, which is often presented in the literature as a key factor for the emergence of innovations within a company (Chesbrough, 2003; Xie et al., 2023). Although the theoretical arguments in the literature are quite strong, the empirical results of this research showed that external sources do not have a universally positive effect on innovation, at least not in the total, analyzed sample. The results of the T-test showed that there are no significant differences in innovation activities between companies with high and low intensity of collaboration, which indicates that the mere fact of collaboration is not enough if the company does not have the capacity to absorb and use externally available knowledge. This conclusion is in line with the theory of absorptive capacities (Cohen & Levinthal, 1990), which emphasizes that the value of external knowledge is conditioned by the company's internal capabilities to apply that knowledge. In other words, these companies have sufficient resources to cooperate with partners, but they do not yet have developed internal mechanisms like large companies, so external actors are crucial for the emergence of innovations. These results fit with empirical studies, which show that medium-sized companies benefit the most from participating in various networks and clusters (Orlić et al., 2019; Rexhepi & Jusufi, 2023).

In this paper, the third hypothesis dealt with internal mechanisms such as training, employee incentives and various formalized procedures. Although the literature often emphasizes the importance of these factors for the emergence and application of innovations (Sarfraz, 2023; Bawa et al., 2023), the results obtained did not show a statistically significant relationship between the intensity of use of internal mechanisms and innovation results. At first glance, this may seem like a contradiction, however, a possible explanation lies in the fact that internal mechanisms do not guarantee innovation by themselves, but their value depends on the connection with other elements in the overall innovation process. In other words, internal mechanisms act more as “support” than as the main drivers of innovation. This result supports theories of the complementarity of innovation mechanisms, according to which the effect of individual factors is not sufficient, but real value is achieved only through their integration.

Micro and small enterprises dominate the structure of the economies in the Western Balkans, while medium and large enterprises make up a smaller but strategically more significant part. The results clearly show that policies and management strategies cannot be unique, but must be adapted to both the size and capacities of the enterprises. For micro enterprises, the key challenge is the lack of resources, so their innovation activity is often driven by improvisation and individual attempts. For small enterprises, investment in research and development plays a crucial role because it introduces systematicity into the innovation processes. Medium-sized enterprises benefit most from external cooperation, while for large enterprises, innovation depends on the mutual coordination of complex internal and external resources. These findings are compatible with the literature that emphasizes that innovation paths differ depending on the context, and that it is necessary to develop different approaches (Stoeber, 2025; Castillo, 2023).

6. CONCLUSION

The results of the conducted research clearly show that innovations in companies do not arise from a single universal mechanism, but from a combination of different factors whose effects differ depending on the context. The analyses confirmed that the existence and

development of research and development departments have a significant positive impact on innovative activities of companies, especially in smaller ones, while in medium-sized companies the external sources of knowledge and cooperation that these companies have are of the greatest importance. In contrast, internal mechanisms such as training and formalized procedures did not show a direct connection with innovative activities, which indicates that they are not sufficient in themselves to lead to the emergence of new innovations.

These findings confirm theoretical assumptions from the literature that indicate the importance of dynamic capabilities and the interconnection of different sources that lead to the emergence of innovations. It is particularly emphasized that companies, depending on their size and capacity, develop different strategies for which they lead to the stimulation of innovations. Small companies rely on research and development as a key resource, medium-sized companies look for external partners, while micro and large companies show less pronounced and clear patterns in how innovations arise. Such results suggest that universal innovation stimulation policies do not have the same effectiveness on all enterprises, but that support measures must be differentiated and adapted to the specific needs of enterprises.

As part of this research, it is important to emphasize that there are certain limitations that must be taken into account when interpreting the results obtained. First of all, the analysis is based on subjective assessments of the respondents, especially in terms of the perception of innovation and the intensity of cooperation. Second, the research is based on a cross-sectional design, which is why it is not possible to determine causal relationships between the observed variables. Third, the analysis is limited to the area of Bosnia and Herzegovina, which means that the results cannot be generalized to other countries. Finally, the research conducted includes only a certain number of internal and external mechanisms, while other potentially important factors were not the subject of this research, which also leaves room for new research in the future.

In terms of practical implications, the results obtained offer clear guidelines for managers and decision-makers. For small enterprises, the most important thing is the development of basic research capacities, which implies investment in human resources and formalization of the product development process. Medium-sized enterprises should intensify cooperation with academic institutions, suppliers and key customers, in order to benefit from external sources of knowledge. Large companies, as they often face greater organizational complexity, often require an integrated approach, which can combine internal and external resources. For decision-makers, the results indicate the need for differentiated support for innovation according to company size, instead of unified programs, since they often tend to ignore the specificities of the economy in Bosnia and Herzegovina.

In future research, it would be useful to include qualitative methods, such as interviews or case studies, in order to understand in an even deeper way the processes identified through statistical research. Also, expanding the model to additional variables, such as digital transformation, could contribute to a more complete understanding of the causes of innovation, as well as comparative studies between Western Balkan countries.

Overall, the contribution of this research is reflected in the empirical evidence that innovations are not the result of individual factors, but above all a complex and differentiated system. The key is to identify different ways of behaving according to the size of the

enterprise, which offers practical guidelines to managers and policymakers on how to target innovation within enterprises. In this way, the work not only confirms the theoretical frameworks from the literature, but also provides very concrete recommendations that are more than significant for the context of developing countries and European integration.

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APLICATION OF ETHICAL PRINCIPLES TO EMPLOYEE SALARIES - EXAMPLE OF SERBIA AND BiH

ABSTRACT

Salaries of employees are one of the ethically most sensitive issues in human resource management, precisely because salaries can meet a whole spectrum of human needs. The basic ethical principles in salary distribution are fairness and equality. The application of these principles is facilitated by objective criteria. The work shows that regular salary payments are an ethical principle that is more important than the amount itself, or the distribution of salaries, relying on Adams' theory of equity, which postulates that salaries should be equivalent to the effort, knowledge, skills, and results achieved, but also fair in relation to other employees. The application of these principles of equivalence and fairness can only be ensured by clear criteria and procedures known in advance as the "rules of the game," which determine the expectations of the employees.
The aim of the research is to answer the research question of whether and to what extent the prevailing practices of determining salaries in Serbia and Bosnia and Herzegovina can be assessed as ethical based on the application of ethical arguments, through the analysis of these practices from a business ethics perspective.
The research was conducted on a sample of 325 respondents, of which 208 are from Serbia and the remaining 117 are from Bosnia and Herzegovina. A survey method was used to collect primary data. The SPSS statistical program was used to process the obtained results. Basic methods of descriptive statistical analysis, causality tests, factor analysis, and other multivariate analysis techniques were used to test the main hypothesis. The results of the research confirmed the initial assumptions that employee salaries are determined based on an established system that is known to all employees, but also that there is a low level of application of ethical principles in the distribution of salaries.

Keywords: *business ethics, ethical principles, salaries, HRM, management.*
JEL: M14, M20, M54

1. INTRODUCTION

Earnings and rewarding employees is a human resource management process that undoubtedly carries the greatest ethical challenges. The main argument for this claim lies in the fact that it is a crucial existential issue for employees and, at the same time, a factor of immediate costs for employers. In this process, the conflicting interests of these two parties are most pronounced, and "swinging the pendulum" to either side can cause ethical, as well as numerous other, problems. Ethical analyses of human resource management emphasize that employees cannot be treated merely as a resource, but as stakeholders whose interests and rights must be taken into account in managerial decisions (Winstanley & Woodall, 2000; Greenwood, 2002).

Highlighting earnings as a matter of particular ethical significance, Lay (1996, p. 225) points out the importance of "fair pay" and emphasizes that earnings are fair if they are paid in an amount specified by a contract and if the contractually determined amount of the salary is set according to the expected criterion. Earnings should essentially be equivalent to the effort, abilities, knowledge, and time that the employee invests in the work and the organization. Fair pay depends on a number of external and internal factors, and the role of perception should not be overlooked either. The perception of fairness determines employee behavior in terms of their level of engagement and decisions about potentially leaving the organization, as indicated by Adams' equity theory (Adams, 1965). According to this theory, employees compare the ratio of their own outcomes and inputs with that of relevant others, and perceived underpayment creates tension which they seek to reduce (Adams, 1963). Later research distinguished distributive justice, which concerns the fairness of the amounts received, from procedural justice, which concerns the fairness of the procedures by which these amounts are determined (Greenberg, 1987). Procedures are perceived as fair when they are applied consistently, free of bias, and based on accurate information (Leventhal, 1980). Meta-analytic evidence confirms that both forms of justice are related to job satisfaction, organizational commitment, and withdrawal behavior (Colquitt et al., 2001), while satisfaction with pay level is associated with lower turnover intentions (Williams et al., 2006). It does not take many arguments to establish that not paying salaries to employees represents an obvious form of exploitation and immorality on the part of employers.

From the beginning of the development of industrial relations worldwide, wages have represented an inviolable right of the employee and an obligation of the employer. In disturbed relations between labor and capital, as well as in an imbalanced power structure favoring employers, in a state of general unemployment reaching up to 30% and the loss of several hundred thousand jobs, the phenomenon of unpaid work emerges. The same applies to avoiding the payment of contributions for pension and health insurance, leaving many unable to access health insurance and pension benefits. Research on transition economies shows that late payment of wages is more likely in state-owned firms and in firms with declining performance, and that it is reinforced where overdue wages are prevalent in the wider environment (Earle & Sabirianova, 2002).

2. RESEARCH METODOLOGY

The sample included a total of 325 respondents, of which 208 were from Serbia and the remaining 117 from Bosnia and Herzegovina (BiH). Among the respondents, 46% were female and 54% male. In the Serbian subsample, men (52%) and women (48%) were almost equally represented, while in BiH the share of male respondents (59%) was relatively higher than that of female respondents.

For data processing, the statistical program SPSS was used. Basic methods of descriptive statistical analysis, causality tests (Chi-square test, test of variable independence, ANOVA, MANOVA, etc.), factor analysis, and other multivariate analysis techniques were applied.

The results of the empirical research are presented based on a survey involving 325 respondents - 208 from Serbia and 117 from Bosnia and Herzegovina. The sample was proportionally stratified in the sense that the subsamples from BiH and Serbia were roughly

proportional to the population sizes of the two countries. In addition to primary data collected through the survey, secondary data sources were also used whenever possible. These secondary data primarily relate to relevant publications in the media. The use of secondary data aimed, on the one hand, to provide a more complete picture of the studied phenomenon, and on the other hand, to serve as control data for certain aspects of the research.

3. RESEARCH RESULTS

Negotiating salaries with each individual carries the great risk that compensation will depend on the bargaining abilities of either party. Determining salaries based solely on educational level and organizational position carries the risk of unfairness, as neither education nor position guarantees that employees will achieve the expected results. Research on pay raise decisions shows that distributive justice primarily affects satisfaction with pay, whereas procedural justice more strongly affects organizational commitment and trust in the supervisor (Folger & Konovsky, 1989).

Table 1. How are employees' salaries determined in the respondent's organization

		0	No of negative responsenes	No of positive responsenes	% responses 0	% negative	% positive	Mean	St dev	N
Employee salaries are negotiated individually with each employee	Serbia	33	105	70	16	50	34	-.33	1.551	208
	BIH	13	57	47	11	49	40	-.19	1.537	117
	Total	46	162	117	14	50	36	-.28	1.545	325
Employee salaries are determined according to an establisher system known to all employees	Serbia	29	51	128	14	25	62	.57	1.395	208
	BIH	13	25	79	11	21	68	.73	1.430	117
	Total	42	76	207	13	23	64	.62	1.408	325
Employee salaries depend only on educational level and organizational position	Serbia	28	51	129	13	25	62	.49	1.300	208
	BIH	17	24	76	15	21	65	.55	1.283	117
	Total	45	75	205	14	23	63	.51	1.292	325
Managers salaries are fixed according to the contract, while other employees salaries are determined by	Serbia	45	94	68	22	45	33	-.28	1.438	208
	BIH	27	44	46	23	38	39	.00	1.402	117
	Total	72	138	114	22	43	35	-.18	1.430	325

internal regulations										
Employees salaries are paid irregularly and with delays	Srbija	14	178	16	7	86	8	-1.49	1.068	208
	BIH	16	86	15	14	74	13	-1.17	1.308	117
	Total	30	264	31	9	81	10	-1.37	1.168	325

Source: Author's research

Negotiating pay with managers makes sense only if clear and measurable goals are established. However, in practice, this often leads to favoritism toward managerial structures, who make decisions about their own compensation, thus calling objectivity into question.

Table 1 and the derived charts (Fig. 1) show that the largest percentage (64% of the total sample) agreed with the statement that employee salaries are determined according to an established system known to all employees. The agreement rate among respondents is higher in Bosnia and Herzegovina (68%) than in Serbia (62%).



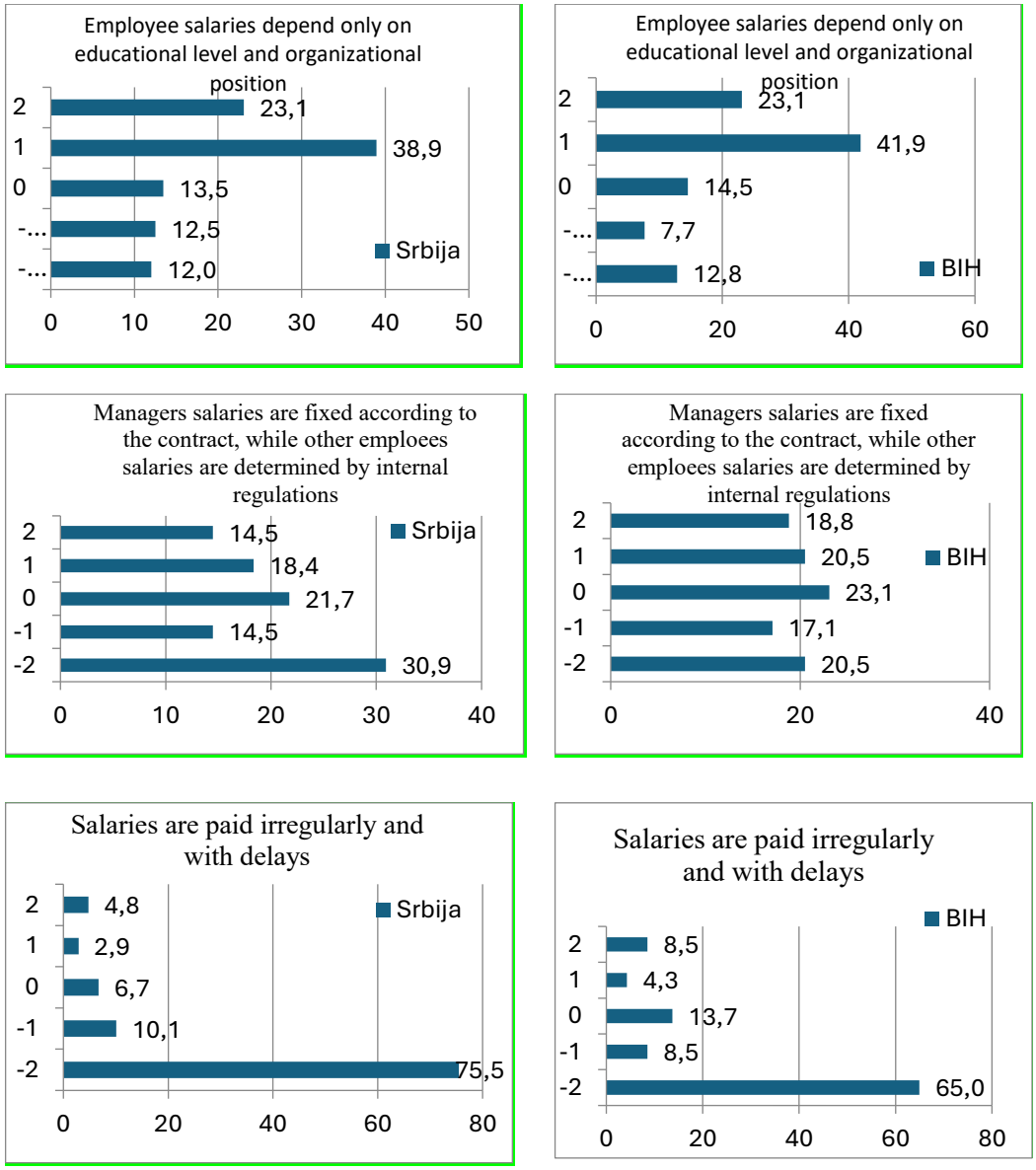


Fig 1. Panel of selected responses

Source: Author's research

The remaining percentage of negative and undecided responses to this statement (36%) seriously indicates that about one-third of organizations in these countries do not implement salary systems based on job requirements and work performance, which opens significant opportunities for unfair salary distribution, favoritism, and other forms of inequality. Perceived underpayment can also have hidden costs for employers, as employee theft was found to increase after pay cuts, particularly when they were not adequately explained (Greenberg, 1990).

A similar percentage (63%) agreed with the statement that salaries depend on educational level and organizational position, which suggests that respondents associate these criteria with a salary system based on pre-established standards.

This assumption is also supported by the researchers' experience. Of the total number of respondents in both countries, 36% agreed with the statement that employee salaries are determined through individual negotiation with each employee, with a higher percentage of positive responses among respondents from Bosnia and Herzegovina (40%). At the same time, these responses show a high standard deviation (1.545 for the total sample). Such practices leave significant room for unequal treatment and unfairness in salary determination. One-third of respondents (35% of the total sample) confirmed that managers' salaries are determined as fixed according to the contract, while the salaries of other employees are determined according to internal regulations. Irregular payment of salaries was reported by 10% of the respondents, with slightly higher rates in BiH (13%) than in Serbia (8%). When considering organizational characteristics, the significance of ownership structure, business performance, trade union presence, and the method of using HR services in salary-related matters becomes apparent. By examining the mean values of responses, we can see that the highest agreement with the statement that employee salaries are determined according to an established system known to all employees comes from respondents in private companies with mixed domestic and foreign capital, companies with foreign capital, organizations using HR services from external agencies, and those where a single professional performs the HR function. The view that salaries depend only on educational level and organizational position was most strongly confirmed by respondents from state-owned enterprises.

Table 2: Models od salary determination according to the characteristics of the organizations employing respondents

	Employee salaries are determined through individual agreements	Employee salaries are determined based on an established system known to all employees	Employee salaries depend only on educational level and position in the organization	Managers salaries are determined by fixed contract, while other employees salaries are regulated by internal rules	Employee salaries are paid irregularly and with delays
Up to 49 employees	-.04	.56	.39	-.32	-1.26
Between 50 and 250 employees	-.35	.52	.23	-.23	-1.47
Over 250 employees	-.34	.58	.60	-.04	-1.37
Private company / domestic capital	.08	.19	.13	-.52	-1.24
Private company with mixed domestic and foreign capital	-.13	.90	.45	.35	-1.23
Private company with foreign capital	-.18	.84	.33	-.10	-1.70
State ownend company	-.81	.47	.95	-.24	-1.14
The organization achived profit in the previous period	-.23	.58	.42	-.21	-1.39
The organizational recorded losses in the previous period	.11	.43	.06	.11	-1.11
The organization uses external HR agency	.00	.95	.42	.84	-1.00
The organization has its own Hr department	-.34	.66	.57	-.20	-1.49
HR activities in the organization are performed by a single professional	-.69	.95	.43	-.24	-1.33
HR activities in the organization are performed exclusively by the owner or director	.15	.14	.20	-.41	-1.21

Source: Author's research

Among the five offered ratings regarding the method of salary distribution, the most ethically and professionally acceptable is that employee salaries are determined according to an established system known to all employees (second column), as this model meets the requirements of fairness (objectively determined and known criteria) and equality (applies to all employees). Most respondents from all types of organizations selected this option as an assessment of the practice in their organization, although it should be noted that some respondents may have given socially desirable answers (Podsakoff et al., 2003), and the statement was not entirely clear in terms of practical application.

The highest number of positive responses came from respondents in organizations that use external HR services, organizations where a single professional performs HR functions, and private companies with mixed domestic and foreign capital. The lowest number of positive responses came from respondents in organizations where the owner or director performs HR functions and in private companies with domestic capital.

4. CONCLUSION

This research indicates that educational level as a primary criterion in salary distribution is highly pronounced in companies in Bosnia and Herzegovina and Serbia. Although it is a relatively objective criterion, it cannot satisfy the principles of fairness, as it is not linked to employee performance. It only partially ensures the principle of equality from an output perspective, while neglecting other criteria (knowledge, skills, results) and being overly formalized, though it is the simplest to apply. According to our respondents, this criterion is most frequently used in state-owned enterprises and least in organizations that have incurred losses and in private companies with domestic capital. Negotiating salaries individually with each employee carries risks of inequality and unfairness because it allows for favoritism, subjectivity, and the influence of bargaining skills rather than actual employee potential. Recently, this practice has been quite widespread in Bosnia and Herzegovina and Serbia. According to the results of this research, this type of salary distribution is most common in private companies with domestic capital, in organizations where HR functions are performed by the owner or director, and in small enterprises, and least common in state organizations, large enterprises, and companies where HR functions are performed by a single professional. The observation that managers' salaries are fixed according to the contract, while the salaries of other employees are determined according to internal regulations, was confirmed by the majority of respondents in organizations that use external HR services and in private companies with mixed domestic and foreign capital, but denied by respondents from private companies with domestic capital and organizations where HR functions are performed by the owner or director. Although irregular salary payments are a common practice in organizations during transitional processes, respondents in this research did not report this phenomenon to a significant extent. Employee compensation and reward systems are a human resource management process that undoubtedly carries the greatest ethical challenges. The main argument for this claim lies in the fact that it is a key existential issue for employees and, at the same time, an immediate cost factor for employers. In this process, the conflicting interests of both parties are most evident, and any "swing of the pendulum" to either side can cause ethical as well as numerous other problems, Highlighting compensation as a matter of special ethical importance for the organization and management, Lay (1996, p. 225) emphasizes the significance of "fair pay" and states that compensation is fair if it is paid in the amount established by the contract and if the amount specified in the contract is determined according to the expected criteria.

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ARTIFICIAL INTELLIGENCE IN PUBLIC ADMINISTRATION

ABSTRACT

Artificial Intelligence (AI) is transforming public governance worldwide, enabling states to provide services faster, more efficiently, and more transparently. In Serbia, AI has the potential to reshape public administration, strengthen democratic accountability, and support sustainable development. Yet, it also poses ethical, legal, and institutional challenges that must be addressed with foresight and responsibility. This paper explores how Serbia can integrate AI into its governance system in an ethical, effective, and citizen-centered manner. Through comparative analysis, theoretical synthesis, and policy recommendations, the paper outlines a roadmap for aligning Serbia's public administration with European and global standards of AI governance.

Keywords: *Artificial Intelligence, Public Administration, Ethics, Republic of Serbia, Digital Transformation.*
JEL: H83, O33, O38, D73

1. INTRODUCTION

The 21st century marks a profound shift in governance, as Artificial Intelligence (AI) transforms decision-making, data management, and public service delivery. AI is not only a technological tool but a governance reform catalyst, requiring foresight, ethics, and institutional readiness. Systematic reviews show that AI applications in the public sector range from process automation and virtual agents to predictive analytics and knowledge management, but also that research on their implications for public governance is still largely exploratory and conceptual (Wirtz et al., 2019; Zuiderwijk et al., 2021).

Countries like Estonia, Denmark, and Singapore show that AI can reduce bureaucracy, enhance transparency, and strengthen public trust. Serbia's digitalization progress is notable, yet institutional fragmentation and slow adaptation remain key barriers. Effective AI integration thus means redefining governance, not just adopting technology. Digital transformation in government is therefore understood as a holistic effort to revise core processes and services, which goes beyond the traditional digitization of existing procedures (Mergel et al., 2019).

When responsibly managed, AI enables evidence-based decisions and inclusive services; when misused, it risks inequality and mistrust. Algorithms can systematically introduce bias and reinforce historical discrimination, while their growing autonomy makes them harder for the public to scrutinize (Janssen & Kuk, 2016). Serbia's framework must therefore rest on ethics, transparency, and inclusiveness, aligned with the EU Artificial Intelligence Act (European Parliament & Council, 2024) and OECD AI Principles (OECD, 2024). A review

of 84 AI ethics guidelines found that transparency, justice and fairness, non-maleficence, responsibility, and privacy are the most widely shared principles, although their interpretation and implementation differ considerably (Jobin et al., 2019).

Ultimately, AI should augment human judgment, advancing a human-centric model that promotes accountability, fairness, and the public good. Whether a task favors human discretion or the use of AI depends largely on its complexity and uncertainty, as well as on the organizational and legal context (Bullock, 2019).

2. METHODOLOGY

This research employs a qualitative, interdisciplinary approach combining policy analysis, comparative evaluation, and conceptual reflection. AI in governance is treated as a multidimensional phenomenon - technological, legal, ethical, and sociopolitical.

The analysis draws from Serbia's Strategy for the Development of Artificial Intelligence (Government of Serbia, 2020), the UN E-Government Survey (United Nations, 2024), and the OECD Digital Government Policy Framework (OECD, 2020) to assess national readiness and international alignment.
A comparative benchmark with Slovenia, Croatia, and Montenegro identifies regional lessons - from Slovenia's coordinated governance and Croatia's EU-funded initiatives to Montenegro's pilot-based experimentation.

Theoretical insights from Drucker (1999), Floridi (2019), and Dignum (2019) inform the ethical and philosophical grounding of AI governance, emphasizing innovation with accountability. Finally, stakeholder mapping and institutional diagnostics reveal Serbia's administrative capacity and coordination gaps, connecting conceptual frameworks with governance practice.

3. STRATEGIC CONTEXT: AI AS A CATALYST FOR PUBLIC SECTOR REFORM

Reform Artificial Intelligence (AI) transforms governance, shifting it from reactive to predictive administration. In Serbia, AI can drive modernization and institutional renewal. The AI Strategy for Serbia (Government of Serbia, 2020) outlines five goals: research, infrastructure, education, ethics, and cooperation. Yet, implementation is fragmented. A central coordination body is needed to unify standards and oversight. Evidence from public healthcare shows that policy makers, managers, and technology providers frame the challenges of AI differently and sometimes in contradictory ways, which makes such coordination essential (Sun & Medaglia, 2019).

Table 1. Key Strategic Sectors for AI Application in Serbian Governance

Sector	Example Use Case	Expected Impact
Health	AI-based diagnostic triage	Reduced waiting times; improved outcomes
Agriculture	Predictive yield & weather analytics	Higher efficiency, food security
Education	Adaptive learning systems	Personalized education; skill tracking
Justice	Legal text analysis; case prediction	Faster case processing; fairer decisions
Social Welfare	Predictive social risk mapping	Better targeting; inclusion policies

Regulatory modernization must follow - updating administrative law, procurement, and data protection. The EU Artificial Intelligence Act (European Parliament & Council, 2024) offers a balanced model of transparency, proportionality, and oversight. Priority sectors - health, agriculture, education, justice, and welfare - can gain from targeted AI use, improving efficiency and inclusion. Finally, building a National Data Platform aligned with the EU Data Governance Act (European Parliament & Council, 2022) would ensure secure data exchange and strengthen trust and transparency in public institutions.

4. INSTITUTIONAL READINESS AND HUMAN CAPACITY

Institutional readiness for AI adoption depends not on infrastructure alone, but on the competence, motivation, and integrity of civil servants. Serbia must build a professional class of digitally literate administrators capable of understanding the ethical implications of automation. Training must evolve beyond technical workshops to include interdisciplinary programs combining law, ethics, and technology. Introducing AI governance modules into the Civil Service Academy and partnering with universities can ensure long-term knowledge continuity. A systematic review of AI adoption in public administration identifies technological, organizational, and environmental factors, together with absorptive capacity, as key determinants of adoption (Madan & Ashok, 2023).

Furthermore, Serbia needs a civil service innovation fund to reward projects that improve efficiency through AI. Incentivizing innovation reduces bureaucratic resistance and attracts younger professionals into the public sector. Institutional transformation also depends on leadership. Ministers and mayors must model openness to experimentation and establish "regulatory sandboxes" - controlled environments for testing AI systems before national rollout.

Ultimately, the concept of an AI-ready civil service is not utopian. It reflects a workforce where humans and machines collaborate transparently, with clear accountability chains and ongoing ethical training.

5. DOMAINS OF AI APPLICATION IN SERBIA'S PUBLIC ADMINISTRATION

AI's practical potential in governance is extensive. In Serbia, key opportunities include:

- Administrative Automation – Automating document handling, permits, and registries can reduce delays and costs by up to 70%, as seen in Estonia.

- Predictive Policy Analysis – AI can forecast health trends, identify vulnerable groups, and optimize infrastructure maintenance, supporting proactive governance.
- Citizen Interaction – Chatbots and NLP tools improve service access and transparency by analyzing public feedback and detecting irregularities, provided systems remain explainable and unbiased.
- Education and Capacity Building – AI enables personalized training and continuous learning for civil servants, aligning public administration with technological change.

To harness these benefits, Serbia must adopt a unified digital and ethical framework that integrates all applications under consistent governance standards.

6. COMPARATIVE BENCHMARKING: REGIONAL AND INSTITUTIONAL INSIGHTS

Benchmarking is a diagnostic tool that reveals real reform needs behind Serbia's EGDI score of 0.70, which hides major gaps between ministries and municipalities. Many local systems remain fragmented and underfunded. Key lessons from the region:

- Slovenia – long-term investment in interoperability and shared standards.
- Croatia – EU-funded digital projects and strong private partnerships.
- Montenegro – small scale, but agile pilot initiatives.

Serbia's advantage lies in its ICT expertise; the goal is to turn it into shared public infrastructure and open data systems. Priority actions are the following:

- Conduct sectoral audits and map legal/technical gaps.
- Run interoperability tests between key systems.
- Launch peer exchanges with Slovenia and Croatia on AI governance and training.

A central monitoring unit should publish regular performance dashboards to sustain transparency and reform momentum.

7. LESSONS FROM AI IN RURAL AND LOCAL DEVELOPMENT

AI delivers the most value where information gaps and logistical barriers are greatest - particularly in rural areas. Pilot projects in agriculture, telemedicine, and local administration have demonstrated that targeted AI solutions can enhance efficiency and service delivery. Yet technology alone is insufficient; success depends on local data, community participation, and digital infrastructure.

In Serbia, bridging the digital divide requires pairing AI pilots with investments in broadband, local data literacy, and partnerships with civic organizations. Co-design and local ownership are critical. Solutions must reflect real user needs and local conditions - for instance, agricultural models should be validated against farmers' field practices and terminology.

Avoiding “project parachutes” ensures that systems remain functional beyond external funding. Each pilot must produce measurable outcomes - improved yields, reduced travel times, or faster administrative processing - to justify scaling. Municipalities should be selected for diversity (urban-adjacent, remote, high-emigration) to yield transferable lessons. Finally, evaluation must be systematic: assess technical performance, service quality, equity impact, cost-effectiveness, and political feasibility. Publishing results transparently builds citizen trust and provides an evidence base for national replication.

8. IMPLEMENTATION ROADMAP - DETAILED PHASES AND OPERATIONAL TASKS

A roadmap is useful only if it ties time, budget, organizational responsibility, and measurable indicators together. Below, each phase is expanded into concrete tasks and expected outputs which will be laid out in the next table number 2.

Throughout these phases, assign clear points of responsibility (Council = policy leadership; Ministry of Finance = budgeting; Office for IT = technical delivery; municipalities = local implementation; universities = evaluation). This allocation prevents diffusion of responsibility and ensures measurable accountability.

Table 2. AI Implementation Roadmap - Overview of Phases

Phase	Duration	Core Objectives	Key Outputs
1. Foundations	0–12 months	Establish governance & data infrastructure	National AI Council, dataset inventory
2. Pilots & Capacity	12–24 months	Test models, train workforce	Pilot reports, certification modules
3. Scaling	24–48 months	National rollout of successful pilots	Shared digital services, APIs
4. Institutionalization	48–72 months	Embed AI law & oversight	Legal frameworks, algorithm registry
5. Continuous Improvement	72+ months	Monitor & evolve	Annual reports, updated strategy

9. GOVERNANCE, ETHICS AND ACCOUNTABILITY - OPERATIONALIZING PRINCIPLES

Ethical AI governance, including principles of human rights, democracy, and the rule of law, must translate principles into concrete tools (Council of Europe, 2024). Algorithmic Impact Assessments (AIA) should classify systems by risk and ensure proportional oversight - from simple checklists for low-risk tools to full bias audits and legal review for sensitive applications. Each AIA must produce a public summary to guarantee transparency. Such instruments respond to the broader accountability deficit of algorithmic systems, whose opacity limits the ability of public bodies to explain and justify their decisions (Busuioc, 2021).

A public algorithm registry and standardized explainability reports should disclose system purposes, data sources, and decision logic, enabling citizens and oversight bodies to verify outcomes. Technical safeguards such as audit logs and version tracking ensure traceability and accountability.

Human-in-the-loop procedures must remain mandatory for high-impact systems, securing legal responsibility and appeals channels. Human oversight, however, is not a sufficient safeguard in itself, since experimental evidence from the Netherlands shows that public officials tend to adhere selectively to algorithmic advice when it is aligned with group stereotypes (Alon-Barkat & Busuioc, 2023). Finally, participatory governance through advisory councils, academia, and civil society enhances legitimacy and public trust, ensuring that AI in governance serves citizens, not systems.

10. RISK MANAGEMENT - IDENTIFICATION, MITIGATION, AND RESILIENCE

Effective AI risk management requires clear categories and proportional safeguards across four key areas:

- Algorithmic Fairness - uses diverse datasets, fairness testing, and independent audits. Systems with social impact must undergo demographic reviews and allow model rollback if bias appears.
- Data Security - applies strict access control, encryption, and certified data environments. Third parties must meet security standards and include breach-notification clauses.
- Vendor Dependence - avoids lock-in through open interfaces, data portability, and regular audits. Prefer open-source or interoperable systems for public transparency.
- Organizational Risks - ensures independent oversight, whistleblower protection, and scenario planning. Transparent and legally grounded governance builds trust and resilience in AI use.

11. DISCUSSION AND CONCLUSION - INTEGRATIVE REFLECTION AND STRATEGIC IMPERATIVES

AI can deliver immense public value - but only through capable institutions, transparent governance, and clear safeguards. Serbia's strategies provide a solid policy base, yet the key challenge lies in execution: turning frameworks into measurable outcomes through reforms in procurement, data governance, and civil service capacity.

Strategic progress should combine quick wins and structural investment. Local pilots that cut waiting times or simplify permits build public trust, while shared data platforms and standardized APIs strengthen long-term efficiency. These parallel efforts create both political momentum and institutional resilience.

Effective leadership is essential. A strong National AI Council with real authority and cross-sector expertise can coordinate ministries and ensure ethical alignment. Public algorithm registries, mandatory AIAs, and independent audits reinforce accountability and sustain public confidence.

In sum, Serbia's modernization through AI must be incremental but irreversible - guided by ethics, transparency, and human oversight. The goal is not faster bureaucracy, but a smarter, fairer, and more responsive state that earns citizens' trust in the digital era.

Suggestion for Future Research:

Future studies should examine empirical results from AI pilot projects in local governments across the Western Balkans, with emphasis on cost–benefit outcomes, administrative simplification, and citizen trust. Comparative datasets would support the development of regionally tailored AI governance models.

Open Question:

How can public administrations in Southeastern Europe ensure long-term institutional resilience while integrating AI systems that evolve faster than existing regulatory and organizational capacities?

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HOW ENTREPRENEURIAL ORIENTATION CONTRIBUTES TO BUSINESS PERFORMANCE: EVIDENCE FROM SOUTHEAST EUROPE

ABSTRACT

The aim of this paper is to examine the role of entrepreneurial orientation as a multidimensional strategic capability and its effect on firm performance in Bosnia and Herzegovina. Grounded in a theoretical framework that conceptualizes entrepreneurial orientation as a dynamic construct composed of five dimensions - innovativeness, proactiveness, risk-taking, autonomy, and competitive aggressiveness, the research explores relationships between these dimensions and both financial and non-financial performance outcomes. Empirical data were collected using a structured and validated questionnaire administered to managers and owners of 73 enterprises of different sizes across various sectors. Data were analyzed using descriptive statistics, reliability tests, and multiple regression techniques using the SPSS software package.

Findings show that the overall entrepreneurial orientation positively and significantly influences firm performance. At the dimension level, autonomy and competitive aggressiveness emerged as particularly important predictors: autonomy is most strongly associated with non-financial outcomes such as customer loyalty, reputation, and process flexibility, while competitive aggressiveness is most closely linked to improvements in financial indicators. Innovativeness, proactiveness, and risk-taking also contribute positively to performance, albeit with more modest incremental effects.

The paper contributes theoretically by clarifying the relative role of entrepreneurial orientation dimensions in a transitional economy context and offers practical implications for managers and policymakers, particularly regarding leadership development, organizational design, and policies that foster an entrepreneurial climate to strengthen firm competitiveness.

Keywords: *entrepreneurial orientation, business performance, innovativeness, autonomy, competitive aggressiveness.*
JEL: L25, L26, M12, O3

1. INTRODUCTION

Modern business environment in Bosnia and Herzegovina (BiH) stands as a significant challenge for enterprises of various sizes, particularly for micro, small, and medium-sized enterprises (MSMEs) that face complex operating conditions. These enterprises, which form the backbone of BiH economy, are exposed to many limitations that slow their growth and make achieving a competitive advantage and improving business performance more difficult. Among the most common challenges are limited access to financial resources, complex regulatory framework, economic system instability, and high market volatility, which poses a threat to the stability and long-term sustainability of enterprises (Smajlović et al., 2019). Therefore, MSMEs strive to build their competitive position and sustainable business operations by relying on internal potentials, primarily human resources and decision-makers, whose managerial and entrepreneurial competencies, especially their entrepreneurial orientation (EO), represent important factors for successful business performance.

Entrepreneurial orientation is defined through proactiveness, innovativeness, and risk-taking willingness, which enables enterprises to respond more quickly and efficiently to changes in the market environment (Covin & Slevin, 1991). According to Lumpkin and Dess (1996), EO consists of proactiveness, innovativeness, risk-taking, autonomy, and competitive aggressiveness. Proactiveness is reflected in identifying new business opportunities and timely responding to them before competitors; innovativeness involves creating new products, services, and business models; and risk-taking refers to the willingness to invest in projects with uncertain outcomes, but with the potential for significant benefits (Calantone et al., 2002; Lumpkin & Dess, 2001). Autonomy represents the authority and freedom granted to an individual or team in an enterprise to implement business concepts and visions (Lumpkin & Dess, 1996), while competitive aggressiveness refers to the continuous assessment of competitors through environmental analysis in order to identify and exploit business opportunities (Hughes & Morgan, 2007). All these dimensions, as integral elements of EO, enable enterprises to adapt their business strategies to changing market conditions and achieve a comparative advantage (Hult et al., 2004).

Scholars such as Hurley and Hult (1998) emphasized that enterprises' success in turbulent surroundings depends on their ability to promptly recognize changes in the external environment and respond to them through entrepreneurial initiatives. In such circumstances, EO gives a framework for increasing enterprise resilience, adapting business models, and optimizing resources to achieve long-term sustainability (Miller, 1983; Miller & Friesen, 1983).

Given their limited resources, MSMEs in BiH often find themselves in situations where they must react quickly to market changes so as to keep their positions. The lack of formal support and financial instruments for strengthening their innovation capacities further restricts their adaptability. At the same time, according to Hult et al. (2004), EO enables them to take a proactive position, thereby increasing the likelihood of maintaining stability under unpredictable conditions. In this context, this research is focused on analyzing the impact of EO on key indicators of business performance, with the aim of comprehensively examining the factors that contribute to the business success of MSMEs in BiH. The central research

question refers to the enquiry of the influence between EO and business performance of MSMEs in BiH.

In this regard, the aim of this research is to analyze the impact of EO on financial and non-financial performance indicators of MSMEs. The dimensions of EO that will be examined in this study include innovativeness, proactiveness, risk-taking, autonomy, and competitive aggressiveness. The research seeks to provide findings that reflect the contribution of managers' EO to the financial and non-financial performance of enterprises.

The article is structured as follows. After the introductory section, which presents the research context and the importance of EO for business performance, section two provides a review of previous studies, discusses the theoretical framework and develops the research hypotheses. The third section presents the research methodology, offering a detailed description of data collection, research design, measurement instruments, and statistical methods used in the analysis. The fourth section brings the research results, including the findings of descriptive statistics and multiple regression analyses that examine the effects of EO on financial and non-financial business performance. Section five focuses on the discussion of the findings and their interpretation in relation to previous research and the specifics of the business environment. The sixth section provides the conclusion, summarizing the key contributions of the research, outlining its limitations, and giving recommendations for future research as well as practical implications for managers and policymakers.

2. LITERATURE REVIEW AND DEVELOPMENT OF HYPOTHESES

EO takes a rather prominent place in the literature on management and entrepreneurship, since it is seen as a key determining factor of an enterprise's competitive advantage and long-term success. Research conducted over the past decades indicated that EO is a multidimensional phenomenon that covers a range of interrelated elements, such as innovativeness, proactiveness, risk-taking, autonomy in decision-making, and competitive aggressiveness. Together, these dimensions' shape behavior patterns of organizations that determine their ability to identify and exploit new market opportunities. In modern enterprises, EO represents an essential business style, as enterprises are increasingly giving their employees more freedom to encourage development of innovative ideas while simultaneously raising enterprise performance to a higher level (Kolaković, 2006).

According to Šlogar et al. (2023), the most commonly used definition of EO is based on Miller's work from 1983, further developed by Covin and Slevin (1989), and expanded by Lumpkin and Dess (1996). According to Miller (1983), there are three basic dimensions that serve as the pillars of EO - innovativeness, risk-taking, and proactiveness, to which other authors later added autonomy and competitive aggressiveness.

Innovativeness refers to innovative activities of each enterprise or of an individual, if we consider the entrepreneur, and includes the development of new as well as the improvement of existing products and services, as well as new production methods and procedures.

Risk-taking implies the extent to which managers are willing to activate resources in every venture they undertake, even when they are not certain if they will succeed or fail. Risk-

taking is largely associated with an enterprise's search for entrepreneurial opportunities, which are simultaneously linked to enterprise's success (Smajlović et al., 2024; Turulja & Smajlović, 2021).

Proactiveness involves searching for opportunities, looking ahead in business depending on circumstances, and actively identifying possibilities for introducing new products and services before competitors, thereby influencing an increase in future demand (Lumpkin & Dess, 2001). According to Hughes and Morgan (2007), proactiveness actually represents a series of activities that include recognizing and evaluating new opportunities, as well as recognizing and monitoring market trends, which enhances enterprise's competitiveness. Through proactiveness, future opportunities are anticipated, in terms of products and technologies, as well as markets and consumer demand (Clark et al., 2025).

Autonomy is an independent action of an individual or a team aimed at realizing a business model (Lumpkin & Dess, 2001). Casillas and Moreno (2010) state that autonomy is one of the foundations of innovative and entrepreneurial behavior.

Competitive aggressiveness refers to undertaking strategic actions and specific competitive moves initiated by the enterprise for the purpose of improving its competitive position (Ferrier, 2001). In a hostile environment, where resources are limited and competition is intense, enterprises with stronger competitive aggressiveness achieve better results (Messersmith & Wales, 2013).

A significant number of studies on EO point to a positive relationship between enterprise performance and EO (Wiklund & Shepherd, 2005). The seminal papers by Covin and Slevin (1989, 1991), Lumpkin and Dess (1996, 2001), and Wiklund and Shepherd (2005) point to a positive relationship between EO and business performance, which they empirically confirm across different samples. Rauch et al. (2009) whose meta-analytic study encompasses more than 50 empirical studies, further indicate that EO has a consistently positive effect on enterprise performance.

However, the global economic crisis and accelerated technological trends created a diverse context for studying the effects of EO on business performance. The authors emphasize that the implications for both financial and non-financial enterprise performance may vary depending on different stages of enterprise growth, moderating variables, as well as the methods used to measure performance (Pérez-Luño et al., 2011; Wiklund & Shepherd, 2005, 2011). For example, Kusa et al. (2022) demonstrate that there is no single recipe for success; rather, different configurations of dimensions of EO lead to positive outcomes, depending on the context and combination of factors.

Bernoster et al. (2020) focus their research on emotions and affects, emphasizing that entrepreneurial decisions are not solely rational choices, but also emotionally colored reactions that significantly influence decision-making and risk-taking. Gupta and Gupta (2015) in a longitudinal study conducted between 1999-2008 on a sample of large German enterprises, found that EO has a strong initial impact on performance, which gradually decreases over time. In small enterprises, the results indicate that EO complements market orientation by enhancing a culture that directly influences the quality and quantity of innovations within the enterprises (Baker & Sinkula, 2009).

Given that developing and transitional countries in Southeastern Europe are characterized by operating in turbulent environments, Luu and Ngo (2019) state the need for a deeper examination of the effects of EO on performance outcomes, as also indicated by studies from authors such as (Morić Milovanović et al., 2021; Veselinović et al., 2021; Wiklund & Shepherd, 2005). Certain studies were conducted regarding the relationship and impact of EO on the performance of small and medium-sized enterprises (SMEs) across various industries, which point to inconsistent findings.

Observing EO as a construct composed of the dimensions of innovativeness, proactiveness, risk-taking, autonomy, and competitive aggressiveness in a sample of 105 manufacturing SMEs from Croatia, Morić Milovanović (2012) shows that only innovativeness has a positive impact on both financial and non-financial performance, while the other dimensions did not prove to have a significant effect on business success. Risk-taking showed a significantly negative impact on the overall business performance and financial performance (Morić Milovanović, 2012). Observing EO through innovativeness, proactiveness, and risk-taking, Petković and Sorak (2019) indicate that EO has no impact on the financial performance of small enterprises in BiH. Morić Milovanović (2022) in a study examining direct and nonlinear relationships between EO, observed as a uni-dimensional and multi-dimensional construct composed of innovativeness, proactiveness, and risk-taking, and performance in a sample of 109 SMEs in Montenegro, finds that EO affects performance, and that out of five dimensions of EO, only innovativeness and proactiveness have a direct positive impact. The results of the study further indicate that EO has a nonlinear, inverted U-shaped relationship with the performance of small firms. Morić Milovanović et al. (2021) reveal that the configurational model provides a statistically better explanation of the variation in EO and the performance of small firms, with strategic networking and environmental dynamism considered as moderators, compared to contingent and universal models.

On the other hand, there are studies that support the positive impact of EO on enterprise performance. Morić Milovanović et al. (2016), using structural equation modeling on a sample of 252 SMEs in Croatia, confirms the positive effect of the multidimensional construct of EO and strategic networking on financial and non-financial performance. Business activities of managers in small firms were found to reflect a greater tendency toward innovation, a more proactive approach to market opportunities, carefully calculated risk-taking, assertive autonomous behavior, and an aggressive stance toward competitors (Morić Milovanović et al., 2016).

Šlogar et al. (2023) investigated the existence of nonlinearity between EO and financial performance among SMEs in the countries of Southeastern Europe. Using a sample of 963 SMEs operating in Slovenia, Croatia, BiH, Serbia, Montenegro, and North Macedonia, and applying the hierarchical linear regression analysis, the authors confirmed there is a positive direct relationship between EO and financial performance, including positive effects on sales growth and the profit-to-sales ratio. On the other hand, the results did not confirm the existence of nonlinear effects of EO on financial performance, sales growth, or the profit-to-sales ratio. Research in BiH is limited to only several studies conducted on SME samples. The results of the study by Palalić and Bušatlić (2015) conducted on a sample of 178 fast-growing enterprises (gazelles) and slower-growing enterprises (mice) among SMEs in BiH

showed a small to moderate correlation between the dimensions of EO and performance (sales growth and number of employees) for both gazelles and mice. Also, any change in sales growth and the number of employees may be associated with variability in innovativeness, risk-taking, and the age of the enterprise (Palalić & Bušatlić, 2015).

Based on the previous discussion, it is possible to postulate the following research hypotheses:

H1: Entrepreneurial orientation has a significant impact on the non-financial performance of micro, small, and medium-sized enterprises.
H2: Entrepreneurial orientation has a significant impact on the financial performance of micro, small, and medium-sized enterprises.

3. RESEARCH METHODOLOGY

The data used in this study were collected directly from the respondents through a structured questionnaire, designed to measure the dimensions of EO and assess the business performance of MSMEs in BiH. The respondents were owners, co-owners, or managers of the enterprises, as precisely they possess the most relevant information regarding the strategies, management practices, and business outcomes of their organizations.

The variables were differentiated into independent and dependent, with the operationalization of the independent variable based on the theoretical framework and models of EO developed by Miller (1983), Covin and Slevin (1991) and Lumpkin and Dess (1996, 2001), and the instrument was further adapted to the specific characteristics of the business environment in BiH. The dependent variable was defined through financial and non-financial indicators of business performance.

The questionnaire consisted of eight interrelated sections – the dimensions of EO: innovativeness, proactiveness, risk-taking, autonomy, and competitive aggressiveness. Each dimension was operationalized through five statements, and the respondents rated their level of agreement on a five-point Likert scale (1 – strongly disagree, 5 – strongly agree). The questionnaire also included two sections dedicated to assessing business performance – financial and non-financial performance. Financial indicators included total revenue trends, profitability, market share, and profit achieved relative to the previous business year and compared to competitors. Non-financial indicators included customer loyalty, number of new customers, quality and innovativeness of products or services, enterprise image and reputation, as well as the ability to attract and retain high-quality personnel.

The Cronbach's alpha coefficient is a measure of the internal consistency of a set of statements and can range from 0 to 1. Based on the results presented in the previous table and the reference values reported in the literature, it can be concluded that the reliability analysis of the measurement scales for the dimensions of EO, innovativeness, proactiveness, risk-taking, autonomy, competitive aggressiveness, and the dependent variables of performance, observed through non-financial and financial performance, range from 0.793 to 0.902. This indicates good reliability and internal consistency for this sample.

Table 1. The reliability analysis of measurement scales – Cronbach's alpha coefficient

Scales	Subscales	Cronbach's alpha coefficient	Standardized Cronbach's alpha coefficient	No. of statements
Entrepreneurial orientation	Innovativeness	0.812	0.814	5
	Proactiveness	0.884	0.885	5
	Risk-taking	0.894	0.893	5
	Autonomy	0.793	0.809	5
	Competitive aggressiveness	0.820	0.833	5
Business performance	Non-financial performance	0.857	0.860	8
	Financial performance	0.902	0.902	9

Source: Authors

Descriptive statistics and multiple regression analysis were used as the statistical methods to test the proposed hypotheses, and the SPSS software package was used for data analysis.

4. RESEARCH RESULTS

The empirical research was conducted on a sample of 73 enterprises from BiH, selected using a purposive (targeted) sampling method. During the selection process, criteria such as formal registration, active business operations, and representation of different enterprise sizes were considered, which allowed for the formation of a representative sample. The collected data were first analyzed to examine the socio-economic characteristics of the enterprises included in the research sample.

In terms of territory, the sample structure shows that the majority of the analyzed enterprises are located in the Federation of BiH (61.6%), followed by Republic of Srpska (31.5%) and Brčko District (6.9%). The distribution of enterprises by size indicates that micro (32.9%) and small enterprises (34.2%) dominate, while medium-sized (17.8%) and large enterprises (15.1%) constitute a smaller but significant segment.

Regarding the sectors of business activity to which the enterprises in the research sample belong, the largest share consists of enterprises from the trade sector (31.5%) and the manufacturing industry (15.06%). Significantly lower representation is observed in enterprises from professional, scientific, and technical activities, as well as transportation and storage activities (5.48% each), followed by activities in the production and supply of electricity, gas, steam, and air conditioning, construction, administrative and support service activities, education, healthcare and social protection, and other service activities (4.10% each). These indicators suggest that the research primarily covered sectors with high competition and dynamic market conditions.

Multiple regression analysis was used in this study to test the first research hypothesis, which states: *"Entrepreneurial orientation has a significant impact on the non-financial performance of micro, small, and medium-sized enterprises."*

To quantify the relationship between the dimensions of EO and the non-financial performance of enterprises, the key parameters of the multiple regression analysis model are presented below.

Table 2. Model of multiple regression analysis for the dependent variable non-financial performance

Model	Linear correlation coefficient	Coefficient of determination	Adjusted coefficient of determination	Standard error	Sig. of F change
1	0.708a	0.501	0.464	3.41941	0.000

a. Independent variable: innovativeness, proactiveness, risk-taking, autonomy, competitive aggressiveness

b. Dependent variable: non-financial performance

Source: Authors

The results show that the coefficient of multiple linear correlation is 0.708, which points to a moderate linear relationship between the observed variables. The coefficient of determination ($R^2 = 0.501$) indicates that the selected model explains 50.1% of the total variability of non-financial business performance. The adjusted coefficient of determination is 0.464, which confirms that the model is stable and representative even when considering the sample size (n = 73) and the number of included independent variables. These values point to a significant, but not complete, explanation of variability, which is expected in socio-economic research where outcome variables are influenced by a larger number of interrelated factors.

To additionally confirm the validity of the regression model, the analysis of variance (ANOVA) was applied, which allows for testing the overall statistical significance of the model.

Table 3. ANOVAa – analysis of variance of the multiple regression model

Model	Sum of squares	Degrees of freedom	Mean squares	F ratio	p-value
Explained by the model	785.982	5	157.196	13.444	0.000b
Unexplained by the model	783.388	67	11.692		
Total	1,569.370	72			

a. Dependent variable: non-financial performance

b. Independent variable: innovativeness, proactiveness, risk-taking, autonomy, competitive aggressiveness

Source: Authors

The analysis of variance (ANOVA) further confirms the statistical validity of the model. The obtained results indicate that the null hypothesis, stating that the population coefficient of determination is equal to zero, can be rejected at a high level of statistical significance ($p = 0.000 < 0.05$). The value of the F-ratio ($F(5.67) = 13.444$) shows that the independent variables, taken as a whole, significantly contribute to explaining the dependent variable.

In the final stage of testing the first working hypothesis, a detailed analysis of the standardized beta coefficients was carried out in order to determine the relative contribution of each dimension of EO to non-financial business performance.

Table 4. Results of the multiple regression analysis – evaluation of the independent variable

Model	**Unstandardized coefficient**		**Standardized coefficient**	**t**	**Sig.**	**VIF**
	B	St. error	Beta			
(Constant)	16.277	2.360		6.898	0.000	
Innovativeness	0.132	0.171	0.110	0.768	0.445	2.733
Proactiveness	0.193	0.187	0.172	1.034	0.305	3.733
Risk-taking	-0.140	0.122	-0.146	-1.150	0.254	2.173
Autonomy	0.552	0.129	0.489	4.278	0.000	1.754
Competitive aggressiveness	0.195	0.190	0.162	1.027	0.308	3.333

a. Dependent variable: non-financial performance

Source: Authors

A detailed analysis of the standardized beta coefficients reveals the relative contributions of individual dimensions of EO to explaining non-financial performance. The strongest positive and statistically significant effect is registered for autonomy ($\beta = 0.489$, $p = 0.000$), confirming the importance of granting decision-making freedom and flexibility to employees and managers. This result is in line with research that emphasize that high autonomy fosters innovative behavior, faster decision-making, and greater adaptability to market changes. The dimensions of proactiveness ($\beta = 0.172$) and competitive aggressiveness ($\beta = 0.162$) show positive but statistically insignificant effects ($p > 0.10$), which may indicate their overlap with the effects of other variables or suggest that their importance is expressed more strongly through long-term rather than short-term performance indicators. The dimensions of innovativeness ($\beta = 0.110$) and risk-taking ($\beta = –0.146$) exhibit low and statistically insignificant coefficients.

The second working hypothesis of this research, which states, "*Entrepreneurial orientation has a significant impact on the financial performance of micro, small, and medium-sized enterprises*," was tested using multiple regression analysis. Below is a summarized overview of the key indicators of the multiple regression model.

Table 5. Multiple regression model for the dependent variable financial performance

Model	Linear correlation coefficient	Coefficient of determination	Adjusted coefficient of determination	Standard error of the estimate	Sig. of F change
2	0.528a	0.279	0.225	5.22388	0.000

a. Independent variable: innovativeness, proactiveness, risk-taking, autonomy, competitive aggressiveness

b. Dependent variable: financial performance

Source: Authors

The analysis showed that the multiple linear correlation coefficient (R) is 0.528, which indicates a moderate positive linear relationship between overall EO and the financial performance of the enterprise. The obtained coefficient of determination (R^2) of 0.279 indicates that 27.9% of the total variability in financial performance may be explained by the combined effect of the given dimensions of EO. The adjusted coefficient of determination (0.225) suggests that the model is stable and that the inclusion of additional predictors would not significantly increase its explanatory power.

To further verify the validity of the model, an ANOVA analysis was conducted. The results of the ANOVA test are presented below.

Table 6. ANOVA – analysis of variance of the multiple regression model

Model	Sum of squares	Degrees of freedom	Mean squares	F ratio	p-value
Explained by the model	708.135	5	141.627	5.190	0.000b
Unexplained by the model	1,828.358	67	27.289		
Total	2,536.493	72			

a. Dependent variable: financial performance

b. Independent variable: innovativeness, proactiveness, risk-taking, autonomy, competitive aggressiveness

Source: Authors

The results of the ANOVA analysis confirm the statistical validity of the evaluated multiple regression model. The obtained F-ratio ($F = 5.190$) with the corresponding degrees of freedom ($df1 = 5$; $df2 = 67$) shows high statistical significance ($p = 0.000$), which allows for the rejection of the null hypothesis of no linear relationship between the observed predictors and the dependent variable - financial performance.

The total sum of squares is 2,536.493, of which the model explains 708.135 units of variability, or 27.9% of the total variation ($R^2 = 0.279$), while the remaining 72.1% depends on factors not included in this model. The mean square for the model (141.627) substantially

exceeds the mean square of the residuals (27.289), which further confirms the strength of the model in explaining the dependent variable.

To identify individual contributions of each dimension of EO to financial performance, the standardized beta coefficients were analyzed. These coefficients allow for a direct comparison of the importance of predictors, regardless of differences in measurement scales and value ranges.

Table 7. Results of the multiple regression analysis – evaluation of the independent variable

Model	Unstandardized coefficient		Standardized coefficient	t	Sig.	VIF
	B	St. error	Beta			
(Constant)	19.197	3.605		5.325	0.000	
Innovativeness	-0.326	0.262	-0.213	-1.244	0.218	2.733
Proactiveness	0.193	0.285	0.134	0.670	0.505	3.733
Risk-taking	0.081	0.186	0.066	0.432	0.667	2.173
Autonomy	0.348	0.197	0.242	1.764	0.082	1.754
Competitive aggressiveness	0.537	0.290	0.351	1.855	0.068	3.333

a. Dependent variable: financial performance

Source: Authors

The results show that competitive aggressiveness has the highest standardized coefficient ($\beta = 0.351$), which indicates that this dimension is the strongest individual predictor of financial performance in the observed sample. Autonomy is the second most important predictor ($\beta = 0.242$), which confirms that an enterprise's ability to make fast and independent decisions positively affects business outcomes, especially in rapidly changing environments. The other dimensions, innovativeness ($\beta = –0.213$), proactiveness ($\beta = 0.134$), and risk-taking ($\beta = 0.066$), are not statistically significant at conventional significance levels ($p > 0.10$).

Based on the conducted statistical procedures and the obtained coefficient values, the empirical findings support the second working hypothesis. The hypothesis is accepted as valid within the context of the analyzed sample and the applied model, which leads to the well-supported conclusion that EO, viewed through its five dimensions, represents a significant predictor of financial performance in the MSME sector in BiH.

5. RESULTS AND DISCUSSION

The theoretical framework which served as the basis for the construction of the instrument in this study - the five-dimension model explicitly predicts that each dimension may manifest differently depending on the organizational and market context. In this study, autonomy shows a strong and significant contribution to non-financial outcomes, while competitive aggressiveness, and to a lesser extent autonomy, are more pronounced for financial

outcomes. In particular, the prominent effect of autonomy on non-financial outcomes (customer satisfaction and loyalty, quality, reputation, internal efficiency) is in line with findings from previous research, where autonomy is defined as the authority and freedom of teams and individuals to implement concepts and visions. The results obtained in this study are consistent with the conclusions made by Lumpkin and Dess (1996) and Morić Milovanović et al. (2016) who specify the role of autonomy as a dimension of EO in enhancing the business performance of enterprises.

At the same time, the finding that competitive aggressiveness (alongside autonomy) has the strongest impact on financial outcomes is in line with studies linking this construct to intensive competitor monitoring and proactive market positioning, which more quickly translate into revenues, profitability, and market share (Morić Milovanović et al., 2016).

Regarding innovativeness, proactiveness, and risk-taking, the coefficients show positive but statistically insignificant values (with risk-taking exhibiting a negative but insignificant coefficient). This pattern is not inconsistent with the existing literature: previous studies indicate that the intensity and statistical prominence of these dimensions vary with economic cycles, competitive intensity, performance measures (short-term versus long-term), and the timing of innovation diffusion. For example, the longitudinal study by Gupta and Gupta (2015) finds a strong initial effect of EO on performance that gradually diminishes, which leads to the conclusion that innovativeness and proactiveness, while theoretically important, may be statistically more modest in shorter-term or context-specific samples - such as the MSME sample in BiH examined in this study.

6. CONCLUSION

The empirical findings of the research confirm that EO has a statistically significant positive effect on both the financial and non-financial performance of MSMEs in BiH. Two dimensions of EO particularly stand out, competitive aggressiveness and autonomy, with a significant direct impact on financial results. Competitive aggressiveness, defined as a firm's ability to act intensely and decisively in order to outperform competitors, proved to be a critical factor in market conditions characterized by strong competition and limited resources. Autonomy, on the other hand, refers to the freedom of managers and employees to make decisions and initiate business activities without excessive hierarchical control, which proved to be especially important for a firm's agility and responsiveness in changing conditions.

These results suggest that, in the BiH context, strategies focused on strengthening market positioning and making independent decisions have a more direct impact on profitability and growth, while innovativeness and proactiveness may generate indirect or long-term effects, which is in line with the results by Rauch et al. (2009) who emphasize that the time dimension may be crucial in measuring the contribution of certain dimensions of EO.

The comparison with the results of international research shows that the findings of this study share similarities with numerous studies in the fields of strategic management and entrepreneurship, but they also reveal specific patterns associated with the transitional context of BiH. For example, while in developed economies innovativeness often plays a dominant role in explaining performance, in this research its immediate impact appears

limited, which may be a consequence of structural constraints such as limited access to capital, less developed markets for innovation, and slower adoption of new technologies. Similarly, proactiveness, although statistically positively related to performance, is not equally important as in contexts with more stable institutional environment.

The limitations of this research are reflected in the sample size which, although representative for basic statistical analysis, may be insufficient for more complex models. Reliance on self-reported data may result in subjective perceptions and a potential overestimation of actual performance.

Despite the described limitations, the results of this research have significant theoretical, methodological, and practical implications. Theoretically, they confirm the relevance of the dimensions of EO as factors of performance in the context of MSMEs in transitional economies. Methodologically, the research demonstrates the applicability of a quantitative approach in examining strategic constructs under limited research conditions, while practically, it provides managers and policymakers with clear guidelines on which dimensions of EO should be given priority in order to improve financial and non-financial performance of their enterprises.

Based on these findings, it is recommended that MSME managers in BiH actively develop competitive aggressiveness through strategies such as monitoring competitors, agile adjustment of pricing and marketing policies, and intensive positioning in the market. At the same time, autonomy of employees and managers should be strengthened through the decentralization of decision-making, the encouragement of intrapreneurship, and the reduction of bureaucratic procedures that slow down decision-making.

Future studies should use longitudinal methods to measure the changes in dimensions of EO and their effect on performance. It is also advisable to include additional variables, such as the industry in which an enterprise operates and enterprise's life-cycle stage.

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HALAL COMPETENCIES AND THEIR ROLE IN IMPROVING ORGANIZATIONAL EFFICIENCY IN THE HALAL INDUSTRY

ABSTRACT

The halal industry, as a value-based business system, has become one of the most dynamic segments of the global economy, with increasing significance for Southeast Europe. This paper provides a theoretical foundation and empirically tests an originally conceived framework for halal competencies based on KSAH approach. The authors develop it as an integration of employees' knowledge, skills, attitudes, and habits, operationalize it within halal context into composite measures, and examine its impact on organizational efficiency through process management, internal halal audit, nonconformity management, and customer satisfaction. The research was conducted on a sample of 225 respondents from 79 halal-certified companies in Bosnia and Herzegovina, Croatia, and Serbia.

Empirical analysis shows that the reliability of the scales is high, intercorrelations among competency dimensions are pronounced, while associations with efficiency outcomes are low but stable. All four regression models are globally significant with determination coefficients. Partial effects are differentiated: skills reliably predict internal halal audit, while habits significantly contribute to customer satisfaction. For process management and nonconformity management, no significant individual predictors stand out, although the effects are in the expected direction.

The contribution of the paper is twofold: first, in the original conceptualization and measurement validation of the KSAH framework adapted to the halal context, and second, in the empirical explanation of the mechanisms that translate competencies into measurable domains of efficiency, offering clear guidelines for workforce development and integration with quality management systems.

Keywords: *halal competencies, KSAH, organizational efficiency, halal industry.*
JEL: M12, M14, L21, L66

1. INTRODUCTION

Over the past decades, the halal industry has evolved into a globally relevant segment of the real economy, where value-based principles intersect with modern quality management systems and operational practices. Within this framework, human resources and their competencies represent a key mechanism for translating normative requirements into measurable outcomes of efficiency, integrity, and market confidence. Despite its rapid development, there is still insufficient empirical evidence on the extent to which specific employee competencies contribute to the organizational efficiency of halal-oriented organizations, particularly in the context of Southeast Europe.

The aim of this paper is to provide a theoretical foundation and operationalize the concept of halal competencies through the KSAH approach and empirically examines their predictive effect on four dimensions of organizational efficiency. Halal competencies are modeled through knowledge, skills, attitudes, and habits, while efficiency is assessed through process management, internal halal audit, nonconformity management, and customer satisfaction. The initial hypotheses assume a positive impact of competencies on each efficiency dimension, with the expectation that technical competencies will more strongly predict audit-related outcomes, whereas value-driven behavioral competencies will influence outcomes in the domain of customer experience.

The empirical research was conducted on a sample of certified companies in Bosnia and Herzegovina, Croatia, and Serbia using a standardized questionnaire and composite scales. After verifying reliability and basic assumptions, descriptive and correlation analyses were applied, followed by multiple linear regression for each dependent variable separately.

The structure of the paper includes a review of relevant literature and the conceptual framework, methodology, results with interpretation in relation to the stated hypotheses, and concluding remarks with implications, limitations, and directions for future research.

2. PREVIOUS RESEARCH

2.1. Halal Context

In contemporary discourse, business practices based on Islamic values are increasingly conceptualized as holistic management model encompassing Islamic banking and finance, as well as the halal products and services industry. The literature uses a range of terms to denote this domain, including *Islamic economy* (Dinar Standard, 2019, p. 7), *halal industry* (International Trade Centre, 2015, p. xi), and *halal ecosystem* (Noordin et al., 2014, pp. 91–92).

More recent notions introduce *halal economy* or *halalonomics* (Hodžić, 2022, p. 38), and the *Halal Lifestyle Market*, which, alongside Islamic finance, encompasses six sectors of the real economy: halal food, modest fashion, media and recreation, Muslim-friendly travel, halal pharmaceuticals, and halal cosmetics (Dinar Standard, 2024, p. 64). In this study, the term *halal context* is adopted to denote business functions and practices aligned with halal principles and standards (Sakić, 2025, p. 4).

The regulatory framework for halal is rooted in Islamic or Shariah provisions, while its operationalization in business is codified through halal standards. A distinctive feature of this business model relates to the food supply chain, which requires compliance "from farm to consumer."

Halal certification operates as a complementary mechanism to quality management systems, emphasizing process orientation, adherence to legal and religious requirements, hygiene, safety, and transparency (Othman et al., 2019, p. 44). Successful implementation of halal standards requires qualified and competent personnel with expertise in Shariah principles, halal standards, and technical competencies (Hashim & Shariff, 2016, p. 36). The expansion of the halal sector increases demand for educated and specialized personnel who understand both technical and ethical aspects of halal production (Fadzillah, 2022).

The global halal industry has experienced significant growth in recent decades, albeit with varying degrees and intensity across different regions. According to Dinar Standard (2025), the Islamic economy addresses the needs of faith-inspired ethical consumption for approximately 2 billion Muslim consumers worldwide. The value of the global market at the end of 2024 exceeded USD 2.43 trillion (Dinar Standard, 2025, p. 8). This paper focuses on three Southeast European countries – Bosnia and Herzegovina, Croatia, and Serbia – where, at the time of writing, 248 halal-certified companies employing more than 16,000 people were documented (Sakić, 2025, p. 4).

Existing research has predominantly explored consumer perceptions, religiosity, and motivational factors related to halal (Ahmad et al., 2013, p. 249; Memon et al., 2019, p. 1821), while human resource management and competency development has remained underexplored (Rafiki & Abdul Wahab, 2016, p. 139; Razalli et al., 2016, p. 158), despite the strategic importance of human capital for halal integrity.

At the same time, standards such as OIC/SMIIC 18:2021 – Halal Quality Management System (sections 5.1.1, 7.2.1, 7.3.2) and BAS 1049:2023 – Halal Food: Requirements and Measures (section 11.2) emphasize the critical role of employee competencies, awareness, and continuous development in achieving halal quality objectives (Institute for Standardization of Bosnia and Herzegovina [BAS], 2023; Standards and Metrology Institute for Islamic Countries [SMIIC], 2021).

2.2. Halal competencies

Within the halal context, the human factor is the custodian of values and a fundamental component in the successful establishment of the Halal Assurance System (HAS), while employee competencies and motivation are critical determinants of performance and sustainability in halal processes (Baharuddin & Ismail, 2018, p. 456; Jamaludin et al., 2015, p. 3). Building employee capabilities that combine knowledge, skills, and attitudes is critical for resilience and for maintaining the integrity of halal supply chains (Rejeb et al., 2021, p. 110; Voak et al., 2023, p. 15).

In existing academic literature, the human factor in the halal context has not been sufficiently explored, nor has a unified definition of halal competencies been established. Progress in recognizing the importance of human resources has been achieved through the adoption of

the SMIIC 18:2021 standard, which sets guidelines for applying Islamic ethical values in organizations seeking to confirm the compliance of their products or services with halal standards (Standards and Metrology Institute for Islamic Countries [SMIIC], 2021, Section 1).

Operationally, a HAS requires the appointment of personnel responsible for internal audits (Alić, 2010, pp. 99–101; Othman et al., 2019, p. 47), which is in line with the requirements of sections 5.1.1, 7.2.1, and 7.2.2 of SMIIC 18:2021 and section 11.2 of BAS 1049:2023. Organizations are obliged to educate employees to acquire the necessary knowledge of halal standards, thereby ensuring the effective implementation of internal audits (Alić & Hadžić, 2022, pp. 188–189).

Implementing proper halal training is the key to avoiding operational errors to intensify employee halal competency (Karim et al., 2021, as cited in Harwati et al., 2024, p. 2349). Human resource management must, therefore, align with regulatory requirements and Islamic ethical principles – particularly in high-risk processes such as slaughtering - possess the necessary qualifications, technical skills, and training to maintain workplace safety and prevent accidents (Hashim & Shariff, 2016, p. 37).

The identification and development of halal competencies require a holistic model that integrates spiritual, moral, intellectual, and emotional growth. Education plays a dual role: transmitting knowledge and fostering awareness of halal integrity (Dz & Nurhayati, 2019, pp. 171, 173). Human resource development plays a pivotal role in the halal industry, as structured training and competency building are essential for ensuring consistency, credibility, and alignment with organizational and ethical standards (Idris et al., 2025, pp. 28–29).

From a theoretical perspective, halal competencies can be interpreted through established HRM models that define competencies as knowledge, skills, and abilities (KSA), or as knowledge, skills, abilities, and other characteristics (KSAO) (Society for Human Resource Management [SHRM], 2022, p. 5).

A more comprehensive approach is offered by the Peak Performance Center, which classifies competencies into four dimensions: knowledge, skills, attitudes, and habits (KSAH/KASH). In this model, knowledge refers to condition of being aware of facts and concepts; skills denote the ability to perform tasks or activities measured in time and precision; attitudes encompass feelings, beliefs and values of something; and habits represent aspects of behavior that are performed repeatedly and consistently without effort of conscious thought (The Peak Performance Center, 2025).

Based on HRM theories and the specific requirements of the halal industry as a value-driven business system, this study adopts the KSAH/KASH framework for identifying halal competencies, as it incorporates value-based and behavioral dimensions. The elements of this model are summarized in Table 1.

Table 1. Halal competency elements in KSAH/KASH approach

Competency	Content
Knowledge	• Familiarity with halal standards, processes, and procedures • Understanding of Islamic teachings on halal • Awareness of hygiene and health safety requirements
Skills	• Ability to apply halal requirements and HrCCP • Ability to manage halal documentation • Ability to plan and conduct internal audits • Ability to manage nonconformity and risks
Attitudes	• Acting in accordance with Islamic ethical principles • Responsibility for the integrity of halal processes • Sensitivity to the needs of halal customers • Awareness of the importance of personal contribution to halal integrity
Habits	• Actively improving personal knowledge and skills • Effective communication and collaboration • Contribution to the implementation and improvement of halal procedures • Ability to adapt to dynamic work conditions

In the halal competency model, **knowledge** refers to understanding of the fundamental religious principles contained in SMIIC 18:2021, as well as technical and procedural requirements such as traceability and cross-contamination prevention prescribed by BAS 1049:2023. Bidin et al. (2021, p. 2560) underscores that halal knowledge is "fundamental for an organization to understand the key aspects of Halal, its principles, and the technicalities of the Halal certification process". **Skills** focus on the operationalization of standard requirements, the application of the HrCCP system, internal auditing, nonconformity management, documentation, and process monitoring. **Attitudes** are related to organizational values outlined in SMIIC 18:2021 (e.g., trustworthiness, responsibility) and the need to preserve consumer confidence. **Habits** refer to long-term behavioral patterns that support professional excellence, continuous learning, adaptability to change, teamwork, and contributions to procedural improvement.

Summarizing these insights, *halal competencies* can be defined as *an integrated set of cognitive, functional, ethical, and behavioral attributes that enable individuals and organizations to consistently manage production and service delivery processes in accordance with halal principles.*

2.3. Organizational Efficiency in Applying Halal Requirements

Halal standards are not merely technical guidelines for production and certification, but they also shape the overall management approach. Aligning processes with the requirements of the BAS 1049:2023 standard is a prerequisite for obtaining certification for a halal product or service, while integrating the principles of the SMIIC 18:2021 standard directs the organization toward establishing a functional halal quality management system.

The halal requirements in BAS 1049:2023 relate to compliance regarding the origin of ingredients (Section 5), processing (Section 6), and technical conditions (Sections 7 and 8), as well as provisions on hygiene, sanitation, and food safety (Section 9). Requirements for

operational planning and control, traceability, internal control, and documentation are detailed in BAS 1049 (Sections 11 and 12) and SMIIC 18 (Sections 8.1, 8.5.2, and 9.2). These requirements encompass all business processes within the organization, including leadership, hygiene maintenance, equipment and machinery upkeep, quality control, and more (Jašić et al., 2022, p. 78). As Khan et al. (2023, p. 10) emphasize, implementing halal standards requires consistent alignment between production activities and norms based on Islamic values. Proper implementation relies on a strong halal commitment, which is essential for risk prevention and recovery, including strengthening communication, mitigating risks and re-routing operations (Tieman, 2017, as cited in Harwati et al., 2024, p. 2349). Halal supply chain management needs strategic coordination and collaboration among the stakeholders to ensure halal integrity for the end consumers (Khan et al., 2018, p. 7).

Organizational efficiency in the halal context can be viewed through four dimensions: process management, internal halal audit, nonconformity management, and customer satisfaction. Each plays a specific role in preserving halal integrity and enhancing organizational performance.

Process Management (PM) involves clearly defined processes, secured resources for their execution, control, and continuous improvement of activities that directly or indirectly affect the halal quality of products and services. The SMIIC 18:2021 standard (Sections 8.1–8.6) and BAS 1049:2023 (Sections 5–11) identify key processes, including traceability, hygiene control, supplier validation, and physical segregation of halal and haram materials. Introducing process management into the halal system contributes to resource optimization, reduces the risk of nonconformity, and preserves halal integrity.

Internal Halal Audit (IHA) is a systematic and documented evaluation of compliance with halal standard requirements. Its purpose is to ensure that all processes, documentation, and operations function in accordance with halal requirements. An effective internal audit provides continuous monitoring of haram critical control points (HrCCP), acts preventively against potential nonconformity, and is a key mechanism for maintaining the integrity of the halal system. According to SMIIC 18:2021 (Section 9.2) and BAS 1049:2023 (Section 11.4), the internal halal audit must be planned, documented, and implemented.

Nonconformity Management (NCM) enables timely detection, documentation, and corrective action in cases of deviation from halal norms. An efficient nonconformity management system minimizes the risk of recurring errors and contributes to the continuous improvement of the quality management system. Provisions on managing nonconformity, corrective, and preventive measures are outlined in BAS 1049:2023 (Sections 11.5 and 11.7) and in SMIIC 18:2021 (Sections 8.7, 9.3.2, and 10.2). Corrective measures serve to identify and eliminate deviations, document corrective activities, and enhance the reliability of the halal system.

Customer Satisfaction (CS) is the ultimate indicator of organizational efficiency. In the halal context, customers value not only the technical correctness of the product but also the ethical, religious, and cultural aspects symbolized by halal. As Bidin et al. (2021, p. 2560) note, identifying the behaviour patterns and trends that influence consumer purchasing decisions, as well as ensuring their satisfaction are among major factors in determining

organizational performance. The SMIIC 18:2021 standard (Sections 8.2–8.6, 9.2.2, and 10.1) and BAS 1049:2023 (Section 11.2) emphasize obligations to monitor customer satisfaction through formalized mechanisms, feedback analysis, and loyalty measurement.

Integrating these dimensions into a unified organizational efficiency management system enables consistent implementation of halal standards, preservation of halal integrity, risk minimization, and fulfilment of user and regulatory expectations. Effective process management, internal audits, nonconformity management, and orientation towards customer satisfaction are the foundations for successful halal standard implementation and long-term business sustainability.

3. RESEARCH METHODOLOGY

The empirical research examines the impact of employees' halal competencies (KSAH) on organizational efficiency in the halal industry. The unit of analysis is halal-certified organizations, while the unit of observation comprises managers and professionals involved in planning, implementation, and monitoring of halal processes. Data were collected using a structured standardized questionnaire based on a 5-point Likert scale, with voluntary and anonymous participation; after data screening and cleaning, N = 225 valid responses were analyzed. The independent construct, KSAH, was modeled as a higher-order construct with four first-order dimensions (knowledge, skills, attitudes, habits), while the dependent construct, organizational efficiency, was defined through process management, internal halal audit, nonconformity management, and customer satisfaction. Control variables (size, age, industry) were incorporated in the model, where data were available, to mitigate estimation bias.

The methodological procedure included descriptive statistics and reliability assessment (Cronbach's alpha), followed by exploratory factor analysis using the principal component method with oblimin rotation, along with assumption checks (KMO, Bartlett) and factor retention criteria (eigenvalue > 1, scree plot); composite scales were formed as averages of clearly saturated items. Normality was tested using the Kolmogorov–Smirnov test and graphical diagnostics; in case of deviations, Spearman correlations were reported alongside Pearson correlations. Linear regression assumptions were verified through residual analysis (linearity, homoscedasticity) and multicollinearity checks (VIF, tolerance), and robust standard errors were applied in the presence of heteroscedasticity. Hypotheses were tested using multiple linear regression in blocks (1: controls; 2: KSAH dimensions), with reporting of B and β coefficients, p-values, R^2/adjusted R^2, and F-test; the significance level was set at $\alpha = 0.05$. Missing data were treated using the listwise procedure; analyses were conducted in IBM SPSS Statistics; ethical requirements were ensured through informed consent, confidentiality, and anonymity.

4. RESULTS AND DISCUSSION

The study covered three countries: Bosnia and Herzegovina, Serbia, and Croatia. The population consists of 248 halal-certified companies: 115 from Bosnia and Herzegovina, 40 from Serbia, and 93 from Croatia. The sample included 79 companies with a total of 225 respondents: 168 from Bosnia and Herzegovina, 33 from Serbia, and 24 from Croatia. The

coverage of the population by the sample is 31.85% overall, with country-specific coverage as follows: Bosnia and Herzegovina 46.09%, Serbia 30.00%, and Croatia 15.05%

The distribution by industry is predominantly within the food and beverage processing sector. The most represented sector includes the processing and preservation of meat and meat products (NACE 10.1 and subcategories), bakery products (10.7), dairy products (10.51), oils and fats (10.4), and other food products (10.8). To a lesser extent, retail trade in meat (47.22), hospitality (55.1; 56.10), and certain non-food activities linked to the halal supply chain (e.g., plastic packaging 22.22) are represented. This sample structure reflects the operational reality of the halal sector in the three countries, with a focus on core food industries where most standards, controls, and audit practices are conducted.

Reliability assessment results confirm high internal consistency across all scales: for halal competency dimensions, Cronbach's α is 0.878 (knowledge), 0.903 (skills), 0.931 (attitudes), and 0.929 (habits), while in the organizational efficiency domain values are 0.908 (process management), 0.950 (internal halal audit), 0.944 (nonconformity management), and 0.947 (customer satisfaction). The overall instrument records α = 0.964, with practically identical standardized item alphas. This profile (α ≈ 0.88–0.95 across subscales) implies low measurement error and consistent content sampling, with the most reliable dimensions being "attitudes" and "habits" within competencies and "internal control" and "nonconformity management" within efficiency. Given the short to moderately long scales (3–5 items), item averages represent adequate composites of latent constructs and allow reliable correlation and regression analyses with reduced likelihood of biased estimates due to measurement error.

Descriptive findings indicate a pronounced central tendency toward higher values (M = 4.32–4.66; medians near the upper end of the scale; mode = 5), suggesting slight negative asymmetry and potential "ceiling" effects in several dimensions. Within halal competencies, the highest-ranked dimension is attitudes (M = 4.55; SD = 0.698), followed by knowledge (4.52; 0.689) and skills (4.45; 0.710), while habits show the lowest mean (4.36; 0.743) and greater dispersion, indicating uneven operationalization of behavioral routines across organizations. In the domain of organizational efficiency, the highest means are observed for nonconformity management (4.66; 0.644) and process management (4.59; 0.652), while internal halal audit records 4.62 (SD = 0.714). Customer satisfaction is rated lowest (M = 4.32) with the greatest variability (SD = 0.901), suggesting more heterogeneous practices in measuring and managing customer experience. This profile – high means with low to moderate dispersion, except for customer satisfaction – provides a stable basis for testing relationships, noting that coefficient interpretation should consider potential scale compression at the upper end.

Subsequently, a correlation analysis was conducted to examine the relationships between halal competency dimensions and organizational efficiency dimensions. The results presented in Table 2 show consistently positive and statistically significant associations at the 0.01 level. Correlations between competency and efficiency dimensions are low, ranging from r ≈ 0.25–0.37, indicating that higher competency intensity is accompanied by a moderate increase in process and outcome efficiency. At the same time, organizational efficiency dimensions are strongly complementary: process management strongly correlates with internal halal audit (r = 0.892) and nonconformity management (r = 0.900), while links with customer satisfaction remain moderate (r ≈ 0.62–0.66). Competency dimensions are

highly interrelated (e.g., knowledge–skills r = 0.874; skills–habits r = 0.864; attitudes–habits r = 0.808), confirming the coherence of the KSAH construct.

Table 2. Results of the correlation analysis

	Knowledge	Skills	Attitudes	Habits	Process management	Internal halal audit	Nonconformity management	Customer satisfaction
Knowledge	1	0,874**	0,857**	0,800**	0,318**	0,301**	0,316**	0,255**
Skills		1	0,770**	0,864**	0,352**	0,370**	0,365**	0,337**
Attitudes			1	0,808**	0,279**	0,268**	0,276**	0,253**
Habits				1	0,348**	0,350**	0,357**	0,357**
Process management					1	0,892**	0,900**	0,631**
Internal halal audit						1	0,889**	0,662**
Nonconformity management							1	0,622**
Customer satisfaction								1

**. significant correlation at a risk level of 0.01 (two-tailed).

Source: Authors

Using regression models, we estimated the predictive effect of halal competencies (knowledge, skills, attitudes, habits) on each dimension of organizational efficiency separately. For clarity, we begin with a summary of the main adequacy indicators, then report the ANOVA test for overall significance, and finally the coefficients of individual predictors.

Table 3. Summary of regression models (R, R^2, adjusted R^2, SE of estimate)

Model summary[b]				
Model	R	Coefficient of determination	Adjusted coefficient of determination	Standard error of the estimate
1	0,365[a]	0,133	0,117	3,063
2	0,381[a]	0,145	0,129	2,665
3	0,378[a]	0,143	0,127	1,806
4	0,377[a]	0,142	0,127	2,527

a. Predictors: (const.), knowledge, skills, attitudes, habits

b. Dependent variable: process management, internal halal audit, nonconformity management, customer satisfaction

Source: Authors

All four regression models reach statistical significance at the overall level (ANOVA, $p < 0.001$), with consistently modest yet stable effect sizes: $R^2 \approx 0.133$ for process management (Model 1), 0.145 for internal halal audit (Model 2), 0.143 for nonconformity management

(Model 3), and 0.142 for customer satisfaction (Model 4), while adjusted R^2 ranges from 0.117 to 0.129. This explanatory profile is methodologically expected for organizational outcomes with multiple determinants and indicates that the competency set contributes to outcome variance in a measurable but moderate way, consistent with the assumption of relevant out-of-model factors (e.g., resources, technology, market conditions).

Table 4. ANOVA – Test of overall model significance (F, Sig.)

ANOVA						
	Model	**Sum of squares**	**df**	**Mean of squares**	**F**	**Sig.**
1	Regression component	317,280	4	79,320	8,454	0,000[b]
	Residual component	2.064,080	220	9,382		
	Total	2.381,360	224			
2	Regression component	264,985	4	66,246	9,324	0,000[b]
	Residual component	1.563,077	220	7,105		
	Total	1.828,062	224			
3	Regression component	119,324	4	29,831	9,145	0,000[b]
	Residual component	717,672	220	3,262		
	Total	836,996	224			
4	Regression component	232,881	4	58,220	9,117	0,000[b]
	Residual component	1.404,835	220	6,386		
	Total	1.637,716	224			

Source: Authors

At the global level, all regression models reach statistical significance (ANOVA, $p < 0.001$), indicating that the combination of predictors – knowledge, skills, attitudes, and habits – collectively provides a reliable explanatory power for each observed dimension of efficiency (see Table 3). This validates the model specification and methodologically justifies the transition to assessing partial effects through standardized β-coefficients, where we identify which competency dimensions contribute independently and with statistically confirmed significance to explaining the outcome variables.

At the level of partial effects, a differentiated pattern across outcomes is observed. Internal halal audit is predicted with statistical reliability exclusively by skills ($\beta = 0.340$, $p = 0.033$), whereas knowledge, attitudes, and habits do not reach the significance threshold once predictors are mutually controlled. Customer satisfaction exhibits a different structure: a significant contribution stems from habits ($\beta = 0.317$, $p = 0.024$), while the remaining dimensions are non-significant. In the domains of process management and nonconformity management, no individual predictor attains statistical confirmation; nevertheless, the coefficients for skills and habits retain the expected positive sign, and the occasional negative signs on knowledge and attitudes are not supported by significance and are therefore not interpretively meaningful.

Table 5. Regression coefficients by models (B, SE, β, t, p)

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. error	Beta		
1	(Constant)	15,662	1,420		11,030	0,000
	Knowledge	0,079	0,191	0,067	0,416	0,678
	Skills	0,207	0,183	0,180	1,135	0,258
	Attitudes	-0,099	0,157	-0,085	-0,628	0,530
	Habits	0,182	0,123	0,207	1,479	0,141
2	(Constant)	12,176	1,236		9,853	0,000
	Knowledge	-0,077	0,166	-0,074	-0,465	0,642
	Skills	0,342	0,159	0,340	2,151	**0,033**
	Attitudes	-0,070	0,137	-0,068	-0,508	0,612
	Habits	0,132	0,107	0,171	1,232	0,219
3	(Constant)	9,651	0,837		11,526	0,000
	Knowledge	0,015	0,112	0,022	0,137	0,891
	Skills	0,160	0,108	0,236	1,490	0,138
	Attitudes	-0,067	0,093	-0,097	-0,721	0,472
	Habits	0,111	0,072	0,214	1,537	0,126
4	(Constant)	7,575	1,172		6,466	0,000
	Knowledge	-0,193	0,157	-0,197	-1,227	0,221
	Skills	0,251	0,151	0,264	1,670	0,096
	Attitudes	-0,037	0,130	-0,038	-0,283	0,778
	Habits	0,231	0,101	0,317	2,276	**0,024**

Source: Authors

The implications for the hypotheses are as follows: H2 is empirically confirmed through the effect of skills on internal halal audit, and H4 is confirmed through the effect of habits on customer satisfaction. H1 and H3 are not confirmed at the level of individual predictors (although the models are globally significant), suggesting that process efficiency and nonconformity management are likely dependent on a broader set of organizational determinants beyond competencies alone, or on combined effects of dimensions that do not manifest as a dominant single predictor. Operationally, the results suggest that investments in the operationalization of skills (planning, documentation, and conducting audits) and in formalized work habits (discipline in applying standards, collaboration, continuous learning) are most likely to generate measurable gains in audit practices and in customer perceptions.

Our findings on the differentiated effects of competency dimensions align with theory and prior empirical insights: the statistically confirmed role of skills in predicting internal halal audit corresponds with the requirements of SMIIC 18:2021 and BAS 1049:2023, which emphasize competencies, planning and documentation of audits, and the operational practices of the Halal Assurance System (Alić, 2010; Alić & Hadžić, 2022; SMIIC, 2021), thereby confirming that operational capability constitutes the functional core of Halal quality (Hashim & Shariff, 2016; Jašić et al., 2022). Meanwhile, the modest partial effects of knowledge and attitudes indicate that declarative familiarity with norms is insufficient without operationalization and practiced execution in real processes (Othman et al., 2019; Tieman, 2017, as cited in Harwati et al., 2024). At the same time, the significant influence of habits on customer satisfaction is consistent with the KSAH/KASH approach, which underscores value-behavioral components as the foundation of sustained excellence and

trust, wherein consistent application of standards, clear and consistent communication, and continuous learning generate recognizable market quality and loyalty within the Halal value chain (Bidin et al., 2021; Dz & Nurhayati, 2019; Khan et al., 2018; SHRM, 2022; The Peak Performance Center, 2025). Taken as a whole, the moderate coefficients of determination are methodologically expected for complex organizational outcomes and are consistent with literature that interprets efficiency in the Halal context as the result of a synergy among quality management systems, logistics solutions, and managerial practices, accompanied by continuous workforce development and institutional support for education (Dinar Standard, 2019, 2024, 2025; Fadzillah, 2022; Harwati et al., 2024; Idris et al., 2025; Khan et al., 2018, 2023; Othman et al., 2019; Rejeb et al., 2021).

5. CONCLUSION AND RECOMMENDATIONS

This study theoretically confirms that the Halal context constitutes a sustainable and competitive management framework that integrates Shariah norms with contemporary principles of quality and process management, while the KSAH approach provides a coherent model for the operationalization of competencies within value-based systems. The normative foundation of SMIIC 18:2021 and BAS 1049:2023 is consistently translated into organizational practices through four efficiency dimensions. The empirical part of the study builds on this framework and demonstrates that the link between competencies and efficiency is statistically confirmed at the model level, although partial contributions vary across outcomes. Skills most reliably predict internal halal audit, habits are associated with customer satisfaction, whereas process management and nonconformity management remain multidetermined areas where competencies intersect with other organizational and market factors. *This closes the theoretical–empirical loop: standards guide competencies, and competencies, indirectly and with varying intensity, shape efficiency.*

The findings highlight two drivers of change. The first is structured strengthening of skills through targeted training, audit planning, and consistent documentation, thereby improving internal halal audit and reducing operational risk. The second is systematic cultivation of work habits that enhance repeatability and transparency of execution, which translates into customer perceptions and loyalty. In practice, this means integrating the KSAH logic into human resource policies, linking learning objectives with process and audit metrics, and ensuring that competency development is measured through objective indicators of process performance and user experience. Such an approach aligns the value identity of Halal with measurable operational excellence.

The limitations of the study relate to its cross-sectional design and reliance on self-assessments, which may constrain causal interpretation and introduce socially desirable responses. The sample covers the core of the Halal industry in three countries but does not equally represent all sectors and company sizes. The explained variance is moderate, implying the existence of relevant factors outside the model, including leadership style, quality culture, technological maturity, and supply chain complexity.

For future research, longitudinal and multilevel modeling is recommended to capture the dynamics of competency effects on outcomes over time and across levels. Objective indicators of processes, audit findings, and customer satisfaction should be incorporated, while testing mediating and moderating relationships between competencies and efficiency.

Expanding the comparative scope to encompass diverse industry sectors and market contexts is essential. Experimental evaluation of training and habits-development initiatives would yield substantial added value, reinforced by systematic measurement of outcomes through operational and market performance indicators.

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ECONOMIC THEORY AND POLICY

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THE ROLE OF PUBLIC DEBT IN THE TRANSITION TOWARD A REGENERATIVE ECONOMY OF SOUTHEAST EUROPEAN COUNTRIES

ABSTRACT

For decades, decision-makers at national, regional, and global levels have been adopting policies aimed at addressing environmental pollution. At the same time, the human population, global economy, and worldwide energy consumption continue to grow. Increasing investment in renewable energy sources has become imperative. In this context, the concept of a regenerative economy emerges, requiring investments in renewables, research, and innovation. The assumption is that countries with lower public debt have more fiscal space to invest in renewable energy, research, and development, while those with high public debt face limited opportunities for such endeavors.

The main objective of this paper is to classify Southeast European (SEE) countries according to the level of development of their regenerative economies and to determine whether public borrowing serves as a catalyst for accelerating the transition toward a regenerative economy—or rather poses an obstacle to that path. The analysis will be conducted using indicators such as: Public Debt (% of Gross Domestic Product - GDP thereafter), Renewable Energy Share (%), CO_2 Emissions (tons per capita), R&D Expenditure (% of GDP), and Sustainable Development Goal 15 (SDG15), covering the period from 2010 to 2023.

The main findings suggest that SEE countries differ significantly in terms of their regenerative economy development, and that public debt plays a substantial role in shaping their transition. These insights offer valuable guidance for policymakers in designing strategies to enhance national and regional competitiveness, attract foreign direct investment, and guide investors—especially since countries with higher R&D investment offer more favorable conditions for green investments and innovation development. Moreover, this cluster analysis can contribute to strengthening regional cooperation in SEE because it facilitates the identification of leader countries and countries that need additional support and knowledge transfer.

Keywords: *Public debt, regenerative economy, transition, Southeast Europe.*
JEL: O40, F64

1. INTRODUCTION

The world is facing numerous challenges. The human population, the world economy, climate change and global energy use are reaching enormous proportions. Environmental pollution has become a global problem for humanity, and its solution requires global engagement. These findings have strengthened the demands of the democratic public in different parts of the world to heed warnings and make efforts on a global scale to establish a balance between the pace of development and uncontrolled degradation of the natural environment. This degradation has reached such a level that it seriously threatens humanity's continued survival, because the environment has become the main and insurmountable limitation of life and work on this planet.

As a result of the increasingly frequent public demands for increased environmental care, numerous discussions, conferences and confrontations on the nature of environmental problems have arisen. The world has had to face the fact that it is very difficult to have an ecologically stable society and an expansive economic structure. The problem of environmental preservation is one of the crucial global issues today. Over time, greater investments will be needed in technology that reduces environmental degradation or in resource management technology. The use and investment in renewable energy sources are becoming imperative. In this context, the regenerative economy comes to the fore, which implies investments in renewable sources, research and innovation.

Regenerative economics is a relatively new branch of economics that involves a holistic approach to development challenges, analyzing them from an economic, ecological, and broader social perspective. The primary focus of regenerative economics is on improving resources and economic systems, as well as on their renewal. It incorporates the principles of responsibility, inclusion, protection of land, water, air quality, etc. The development of a regenerative economy requires adequate financial resources, or investments, and this paper considers the role and importance of public debt as one of the instruments for financing its development. Public debt is a very important financial instrument that countries often use to finance economic growth and development. It can be defined as "accumulated surplus of spending over revenues that were realized in the previous period" (Rosen & Gayer, 2010, p. 458).

The amount of public debt and the way it is used are very important for each country. Questions about the size and use of public debt are often asked, but there is no single answer. Public debt can, if used wisely, be seen as an instrument for investing in future prosperity. The link between public debt and a regenerative economy is largely unexplored in academic circles. Countries that use public debt to invest in the restoration of natural and social systems, such as investments in green infrastructure, energy transition, circular economy, see public debt as an instrument or tool for increasing prosperity. However, on the other hand, excessive or inefficient borrowing can threaten the financial stability of the country, leaving little room for investment in renewable energy sources, research and development.

In recent decades, the countries of Southeast Europe have undergone significant economic reforms. Through these reforms, economic progress has been achieved (although very unevenly across countries), primarily visible in the improvement of the business environment, the attraction of foreign direct investment, and the strengthening of

competitiveness. Although the reforms have led to certain economic progress, this region still faces numerous challenges, above all pronounced unemployment (in 2024, unemployment was highest in Montenegro (14.1%), North Macedonia (13.4%), Bosnia and Herzegovina (10.7%), and Albania (10.5%) (World Bank, 2025)), migration issues (some, one could say most, Southeast European countries have a negative net migration balance, particularly Bosnia and Herzegovina, Albania, and Serbia (Eurostat, 2025)), corruption, and political instability (Western Balkans Stability Monitor (2024) shows that certain Southeast European countries are still facing political tensions, with Bosnia and Herzegovina and Kosovo being the most sensitive, while Albania and Montenegro are relatively more stable).

In addition, policies in the Western Balkans concerning entrepreneurship development and strengthening the resilience of the private sector "lag behind those in OECD and EU member states" (OECD, 2025). Furthermore, there are numerous problems related to infrastructure development, the energy sector, and the development of renewable energy sources.

Moreover, development challenges include the implementation of development strategies as well as the continuation of structural reforms with the aim of paving the way for inclusive and sustainable economic growth. The assumption is that countries with lower public debt have more room for investment in renewable energy sources, research and development, while countries with high public debt have fewer opportunities for such endeavors.

The main goal of this paper is to classify the countries of Southeastern Europe according to the level of development of the regenerative economy, and to determine whether debt is an instrument for accelerating the transition to a regenerative economy in Southeastern Europe or whether it represents an obstacle on that path?

2. THEORETICAL BACKGROUND AND PREVIOUS RESEARCH

The turn of economic science towards regenerative economics provides answers to climate challenges, pollution problems, and the promotion of social well-being. Therefore, regenerative economies are aimed at establishing "sustainable social, economic, and cultural capacity through the creation of the resources, diversity, resilience, and integrity of interconnected networks at all levels of global society" (Jain, 2021, p. 1).

Regenerative economics combines the best aspects of the green economy, circular economy, and bioeconomy into a single whole. "It adds active ecosystem restoration to the green economy, situates the circular economy within a broader regeneration strategy, and grounds the bioeconomy in regenerative processes that ensure the long-term health of biological resources" (Čegar et al, 2024, p. 2). Regenerative economics involves the renewal and re-emphasis on the growth of social, economic and environmental systems. It is based on a holistic approach that balances different systems and allows them to progress simultaneously.

This implies a transition from conventional (through green, sustainable and restorative) to a regenerative economy (Figure 1).

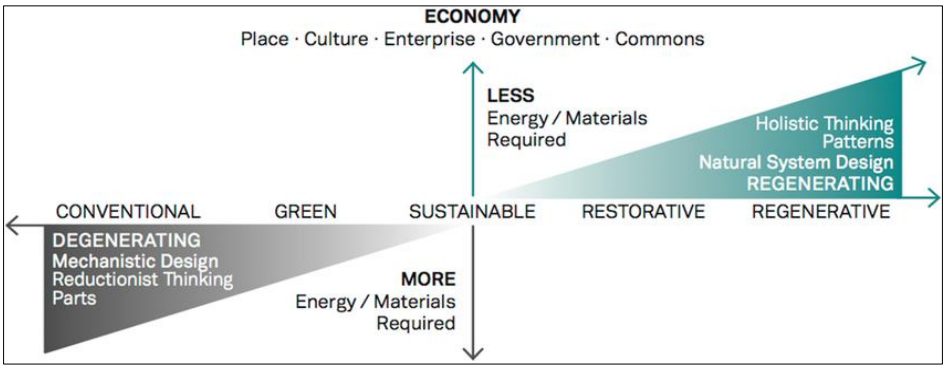


Fig 1. Stages to a regenerative economy

Source: Fullerton, J. (2015) Regenerative Capitalism; Capital Institute: Greenwich, CT, USA, p. 43.

A quantitative framework for measuring the regenerative economy was presented by Fath et al. (2019) defining 10 principles of systemic, socioeconomic health and quantitative measures of the regenerative economy. They put special emphasis on the processes of self-feeding, self-renewal and adaptive learning and conclude that a regenerative economy requires regular investments in human, social, natural and physical capital. Accordingly, the regenerative economy, and its development require adequate financial resources, i.e. financial investments. Alves et al. (2022) emphasize that monetary transformation is a key social, political and economic undertaking "which must be a global priority if we want to prevent future financial crises, reduce economic inequality and adhere to our climate agreements and sustainability goals" (Alves et al., 2022, p. 1). The authors advocate for the emergence and development of an ecological monetary economy that represents a bridge to a regenerative economy.

Bolton et al. (2023) analyze the connection between climate, i.e. climate change, and debt sustainability. They focus on ways to finance climate change and instruments such as carbon credits, government bonds, green bonds, the possibility of debt forgiveness, and the like. They conclude that no instrument is universal and suggest six proposals and policies in this context, prioritizing the creation of a legal and institutional framework when it comes to mechanisms for financing climate change, i.e. the negative effects that it entails. Yang et al. (2024) found that the impact of public debt on reducing carbon emissions is stronger in state-owned companies and companies that are large polluters. They emphasize the importance of state intervention through the use of debt in influencing corporate behavior, namely that public debt "when strategically allocated, serves as an effective tool for curbing carbon emissions, with its impact being especially pronounced in sectors where regulatory pressure to reduce emissions is higher" (Yang et al, 2024, p. 16).

Auteri et al. (2024) found a bidirectional relationship between government debt and renewable energy consumption. They point out that rising government debt hinders investment in renewable energy sources, noting that high public debt can limit government investment in green technologies. On the other hand, increasing renewable energy has a positive effect on public debt. They emphasize the importance of encouraging the use of renewable energy sources, which in the long run leads to increased fiscal benefits. Efthimiadis & Tsintzos (2023) showed that the debt default of countries with large external debt "can be combined with a policy for promoting power generation from renewable energy

sources, with positive effects for economic growth and for ensuring debt sustainability" (Efthimiadis & Tsintzos, 2023, p. 1).

Kushawaha & Jain (2025) examined the impact of public debt on investment in renewable energy. They concluded that the relationship between public debt and investment in renewable energy in developing countries is inverse, that is, that public debt supports investment in renewable energy up to a certain level, after which the growth of public debt negatively affects these investments. Understanding this relationship is important because a country's ability to invest in renewable energy directly affects the development of a regenerative economy. Kantorowicz et al. (2024) found that debt financing "increases voter support for green financing by up to 10 percentage points relative to broad-based taxes (Kantorowicz et al., 2024, p. 1). They argue that using public debt to finance green investments is politically efficient in countries with positive credit ratings and adequate access to capital markets.

On the other hand Clootens & Magris (2021) analyze public debt and public spending through the use of renewable resources. They conclude that high public debt is a threat to sustainable development, that is, it negatively affects sustainable development through reduced investment and increased resource consumption.

When it comes to analyzing public debt, it is mostly associated with economic growth and there is a lot of scientific research that analyzes the nature of this relationship. However, there is less (and mostly recent) research that analyzes the relationship between public debt and the regenerative economy. Most of this research tracks investments in renewable energy sources, environmental sustainability, or the achievement of the Sustainable Development Goals (SDGs). Therefore, this research was set up in such a way that the central hypothesis is: "Public debt significantly influences the formation of clusters of SEE countries based on the development level of their regenerative economies".

The findings of this paper can help economic policy makers in designing policies and strategies to increase national and regional competitiveness, as well as attract foreign direct investment, but also investors, given that countries with higher investment in R&D offer more favorable conditions for green investments and the development of innovations. In addition, this cluster analysis can contribute to increasing regional cooperation in SEE, given that it groups countries according to the level of development of the regenerative economy, which facilitates the identification of countries that can be leaders and carriers of regional projects, but also those that need additional support and knowledge transfer.

3. RESEARCH METHODOLOGY

This study employs a quantitative comparative research design, focusing on the SEE countries for the period 2010–2023. Due to the lack of data for all years and all countries, selected SEE countries (Bosnia and Herzegovina, Bulgaria, Croatia, Montenegro, North Macedonia, Romania, Serbia and Slovenia) and the period from 2010 to 2021 were taken for research. The goal is to identify how public debt influences the transition toward a regenerative economy – a model that integrates fiscal stability, innovation capacity, and environmental sustainability.

The research relies on secondary panel data collected from internationally recognized databases, ensuring reliability and comparability across countries and years. The variables used in the analysis are: Public Debt (% of GDP) – obtained from the International Monetary Fund (2025); Renewable Energy Share (% of total final energy consumption), CO_2 Emissions (tons per capita), R&D Expenditure (% of GDP) – from World Bank (2025); Sustainable Development Goal 15 (SDG15 Index) – from Sachs et al. (2023).

These indicators were selected to capture the fiscal (Public Debt), innovation (R&D Expenditure), and ecological dimensions (Renewable Energy Share, CO_2 Emissions) of the regenerative economy. All variables were standardized prior to clustering to ensure comparability. The data were analyzed using the STATA 15 statistical software. The methodology combines several quantitative techniques: Descriptive Statistics, Pearson Correlation Analysis and Cluster Analysis (k-means). The basic clustering method is the hierarchical clustering method, and the number of clusters is additionally confirmed by a dendrogram. To check for statistically significant differences between the formed clusters, a one-way ANOVA was applied for all five variables, using the Bonferroni post-hoc test to identify pairs of clusters that differed from each other.

4. RESULTS

Descriptive statistics of the collected data are presented in Table 1. and provide a basic insight into the characteristics of the data and the interrelationships between the key variables that were selected to assess the role of public debt in the transition to a regenerative economy.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Public Debt	96	49.391	17.787	18.97	103.47
Renewable Energy Share	96	25.495	8.557	13.2	49.3
CO_2 Emissions	96	5.667	1.212	3.88	8.38
R&D Expenditure	96	.757	.603	.1	2.56
SDG15	96	76.511	12.945	53.2	94.2

Source: Authors

The analysis of 96 observations included in the sample shows that the economic and environmental characteristics of the countries in the region are extremely heterogeneous. The average value and a standard deviation of public debt indicates significant deviations between countries and time periods. In the context of a regenerative economy, such dispersion indicates that fiscal sustainability is one of the key prerequisites for the transition to a renewable economy, as a high level of debt can limit the ability of a country to invest in green and innovative projects. However, the level of debt itself does not have to be an obstacle – what is decisive is how public debt is used: as a passive expense or as an instrument of investment in transformative processes.

The average value and the standard deviation of the share of renewable energy sources in total consumption is indicating moderate variability across countries. A a higher share of renewable sources is an indicator of a structural transition of the energy system, which is necessary to reduce the carbon footprint and preserve natural resources in the long term.

However, the success of this transition often depends on the fiscal support of the state, i.e. the ability to finance subsidies, infrastructure and research in the clean energy sector through public debt. The average value and relatively small standard deviation of CO_2 emissions per capita indicates a somewhat uniform level of emissions in the observed countries. These values reflect the fact that the countries of the region are still dominantly dependent on traditional energy sources, with limited progress in decarbonizing the economy. The role of public debt in this context is reflected in the state's ability to finance the modernization of industry, energy reforms and reduction of emissions through fiscal policy.

R&D Expenditure data clearly indicate a low level of investment in innovation and technological progress in most of the observed countries. Given that the regenerative economy implies innovative approaches to circularity, resource renewal and green technologies, such a low level of allocation indicates a structural obstacle to transformation. Public policy in this segment should use fiscal instruments, including public debt, to finance research programs, start-up innovations, technology centers and education.

SDG15 data shows that most countries have a moderate to high level of natural resource conservation, but there are differences in the capacity to protect ecosystems. Higher SDG15 values usually result from adequate institutional frameworks, but also from fiscal investments in the maintenance and restoration of natural capital. These results suggest that countries with better managed public finances achieve better environmental outcomes, as they can direct funds to projects that contribute to regenerative processes.

Table 2. Pairwise correlations

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
(1) Public Debt	1.000				
(2) Renewable Energy Share	-0.071	1.000			
(3) CO_2 Emissions	-0.296*	-0.147	1.000		
(4) R&D Expenditure	0.402*	-0.217*	0.422*	1.000	
(5) SDG15	-0.361*	0.290*	0.363*	0.120	1.000

*** p<0.01, ** p<0.05, * p<0.1
Source: Author's research

Table 2 shows the pairwise (Pearson) correlation coefficients between the five main variables analyzed in this study (correlation, not causation). The results of the correlation analysis indicate complex correlation between fiscal, innovation and environmental variables.

First of all, public debt shows significant correlation with most of the analyzed indicators. The negative correlation between public debt and SDG15 (-0.361*) suggests that countries with higher levels of debt generally perform worse in preserving terrestrial ecosystems and biodiversity. This is understandable given that high levels of public debt can limit the fiscal space for investments in environmental projects and sustainable resource management. On the other hand, public debt is positively and significantly associated with R&D expenditure (0.402*), which may indicate a long-term modernization strategy. The negative, but statistically insignificant, relationship with the share of renewable energy sources (-0.071) shows that the level of public debt does not in itself determine the energy mix, suggesting the importance of the regulatory and institutional framework.

The share of renewable energy sources shows a negative relationship with CO_2 emissions (-0.147), which confirms the expected pattern that greater use of renewable sources contributes to emission reduction. However, the negative correlation with R&D expenditure (-0.217*) may indicate that R&D funds are not sufficiently directed towards the energy sector, but towards other industries. The positive and significant connection between renewable sources and SDG15 (0.290*) additionally confirms the ecological importance of the energy transition, because countries with a higher proportion of renewable energy simultaneously achieve better results in ecosystem protection. CO_2 emissions exhibit a significant positive correlation with research and development expenditures (r = 0.422*),* which may suggest that advanced countries – despite emitting higher levels of greenhouse gases – possess greater resources for investing in innovation and potential decarbonization strategies. The positive association with SDG15 (r = 0.363*)* partially reflects the so-called "development paradox," wherein economically stronger nations tend to have more robust institutional mechanisms for biodiversity conservation.

Research and development spending shows a bidirectional relationship: it is positively associated with public debt and emissions, and negatively with renewables, while the link with SDG15 is relatively weak. These results suggest that innovation potential in itself is not a guarantee of environmental progress, but that the outcome depends on the direction in which R&D funds are directed – towards digitalization, energy efficiency or green technologies.

Finally, SDG15 shows a positive relationship with the share of renewables and emissions, but a negative relationship with public debt. Overall, environmental indicators in SEE countries remain largely dependent on fiscal capacity, institutional capacity and policies geared towards a green transition. These findings suggest that the transition to a regenerative economy requires a balanced approach: simultaneously fiscal stability, investment in R&D and consistent energy and environmental policies. Otherwise, high public debt may become a constraint, rather than a support, to long-term sustainability and regenerative growth.

The analysis of data grouped into three clusters, on the other hand, allows for a deeper understanding of the interrelationships between public debt and sustainable development indicators in the countries of Southeastern Europe. The focus of the research was on the role of public debt in the transition process towards a regenerative economy – a model that seeks not only to maintain existing resources, but also to renew and improve them through circular and inclusive practices. The results obtained indicate that fiscal policy, and in particular the level of public debt, can have different implications for the environmental performance and innovation capacities of countries.

Table 3 presents the results of the mean values of the observed variables by clusters (hierarchical clustering using the Ward method). It can be seen that cluster 1 contains countries with moderate public debt and an ecological balance without innovative momentum; cluster 2 contains countries characterized by high public debt, strong innovation and a controlled ecological price; while cluster 3 contains countries with high public debt without environmental benefits.

Table 3. Summary statistics: N mean sd min max by (clusterID)

	N	mean	sd	min	max
clusterID: 1 Bosnia and Herzegovina, Bulgaria, Croatia, North Macedonia, Romania					
Public Debt	57	42.121	17.048	18.97	84.03
Renewable Energy Share	57	28.158	10.030	13.2	49.3
CO_2 Emissions	57	5.623	1.183	3.88	7.46
R&D Expenditure	57	.525	0.272	.1	1.23
SDG15	57	84.114	5.775	76.6	94.2
clusterID: 2 Slovenia					
Public Debt	12	59.797	12.917	32.68	72.95
Renewable Energy Share	12	21.208	1.384	19.1	23.4
CO_2 Emissions	12	7.261	0.557	6.38	8.38
R&D Expenditure	12	2.191	0.233	1.87	2.56
SDG15	12	83.342	0.211	83	83.6
clusterID: 3 Montenegro, Serbia					
Public Debt	27	60.114	13.199	39.46	103.47
Renewable Energy Share	27	21.778	3.412	17	29.8
CO_2 Emissions	27	5.051	0.807	4	6.42
R&D Expenditure	27	.611	0.239	.22	.99
SDG15	27	57.426	3.736	53.2	66.2

Source: Author's research

The first cluster, which includes Bosnia and Herzegovina, Bulgaria, Croatia, North Macedonia and Romania, is characterized by moderate public debt and a relatively high share of renewable energy sources. These countries achieve solid results within the framework of the Sustainable Development Goal SDG15, which indicates relatively preserved natural resources and stable ecosystems. However, low investment in research and development indicates a lack of innovation potential, which is an obstacle to a deeper transformation towards a regenerative economy. In the context of public debt, this cluster shows that a moderate level of indebtedness can contribute to economic and environmental stability, but without strong development policies and investments in innovation, such stability remains passive and does not lead to systemic changes. Countries in this group retain traditional development patterns, where fiscal policy is primarily used to maintain budget balance, and not as an instrument for strategic investment in green and regenerative transformation.

The second cluster consists only of Slovenia, which clearly stands out across all indicators. With an average public debt of 59.80% and the highest investment in research and development, Slovenia demonstrates how a more developed economy can use public debt as a mechanism to support innovation and green technologies. Although it has slightly higher CO_2 emissions and a lower share of renewable sources, its high SDG15 value indicates a successful integration of environmental standards into industrial development. This result suggests that higher public debt does not necessarily have to be an obstacle to sustainable development – on the contrary, if used as an instrument for strategic investment in research, digitalization and green infrastructure, it can become a key driver of the regenerative economy. Slovenia thus stands out as an example of a country that has turned fiscal indebtedness into a tool for stimulating innovation, creating added value and ecological

transformation. In its case, debt is not a "burden", but a catalyst for the transition to a regenerative economy.

The third cluster, which includes Montenegro and Serbia, shows the most unfavorable structure of indicators. These countries have the highest average public debt, but at the same time very low investments in research and development and the worst SDG15 result. This indicates a situation in which public debt is used predominantly to cover current consumption and budget deficits, instead of for development and environmental investments. Their moderate level of CO_2 emissions and medium share of renewable sources cannot compensate for the lack of a systemic approach to sustainability. In the context of a regenerative economy, these countries show that high public debt without strategic orientation leads to environmental and economic stagnation. The lack of long-term investments in innovation, circular models and nature conservation makes it impossible to turn public finances into an engine of regenerative development.

The results of the ANOVA analysis show that the formed clusters are statistically significantly different on all observed variables. In the case of public debt ($F=15.23$; $p<0.001$), cluster 1 has significantly lower values compared to clusters 2 and 3. The share of renewable energy sources ($F=7.79$; $p<0.01$) is also higher in cluster 1, while clusters 2 and 3 are similar. CO_2 emissions ($F=19.24$; $p<0.001$) are highest in cluster 2, followed by cluster 1, while cluster 3 has the lowest values. Allocations for research and development ($F=211.88$; $p<0.001$) are drastically higher in cluster 2 than in other groups. Finally, SDG15 shows the biggest differences ($F=285.33$; $p<0.001$), with clusters 1 and 2 achieving high results, while cluster 3 lags behind significantly. These findings confirm that clusters have clear structural differences in key economic, environmental, and innovation indicators.

The results clearly support the central hypothesis that the impact of public debt on the regenerative transition is not determined by its level, but by its structure and purpose. Countries that allocate borrowed funds toward innovation, research, and green infrastructure (e.g., Slovenia) achieve stronger ecological and economic outcomes, while those that use debt primarily for consumption or deficit coverage (e.g., Montenegro and Serbia) experience stagnation in both domains. This confirms that the quality of fiscal spending is a more critical factor than the mere amount of debt.

5. DISCUSSION

The descriptive analysis shows that the countries covered by the research have a moderate level of public debt, but also a low level of innovation investment. Although the average values of environmental indicators (Renewable Energy Share and SDG15) suggest some progress in sustainability, it is evident that such results are not the result of systemic fiscal policies, but primarily structural and geographical advantages. In the context of a regenerative economy, these findings confirm that public debt management has the potential to accelerate the ecological and technological transition, but only if debt is used productively, that is, to create, not consume, value.

Public debt directed at research, innovation, green infrastructure and energy transformation contributes to the long-term renewal of natural and social capital. In contrast, debt without a development purpose can exacerbate fiscal pressure and delay the process of economic

regeneration. Therefore, descriptive indicators represent an important empirical basis for understanding how fiscal policy, through adequate public debt management, can become the foundation of a regenerative model of development, in which economic growth does not destroy nature, but actively restores and supports it.

The results of the correlation analysis confirm that there is a complex and bidirectional relationship between public debt, innovation and sustainability in the SEE countries. This pattern reflects the typical challenges of transition economies, which strive to simultaneously maintain fiscal stability, increase competitiveness and improve environmental performance. First, the negative correlation between public debt and SDG15 indicates that excessive borrowing can reduce the possibilities for financing projects related to the protection of terrestrial ecosystems, afforestation and sustainable land use. Countries with higher debt tend to direct funds to servicing obligations, while investments in environmental and regenerative projects are postponed or reduced. This finding supports the thesis that fiscal capacity is an important prerequisite for a green transition (e.g. according to theories of fiscal space for sustainable development).

At the same time, the positive relationship between public debt and R&D expenditure opens the possibility of a different interpretation: borrowing in some countries can be used as an instrument of transformation, if the debt is directed towards innovation and development programs. Thus, public debt, although a potential risk, can become a driver of structural change, especially if innovations are focused on energy efficiency, digitalization and the circular economy. In this sense, the findings suggest that the composition and purpose of public spending matter more than the level of debt itself. If debt is used for consumption without a development component, it worsens environmental indicators; however, if it is used for R&D and green technologies, it can have a regenerative effect.

Another important dimension concerns the relationship between innovation and sustainability. The positive correlation between CO_2 emissions and R&D expenditure may partly reflect the stage of industrial development: countries that consume more energy and pollute more often also have a greater potential for research investment. This may indicate that the transition to a low-carbon economy is not yet fully achieved, but is at an early stage in which innovation is not yet fully redirected towards decarbonisation. The positive link between renewable energy sources and SDG15, confirms that the energy transition has direct benefits for ecosystems. Countries that increase the share of renewables also achieve better results in protecting land, forests and biodiversity, which supports the concept of a "regenerative economy". At the regional level, these findings imply that SEE countries need to combine fiscal discipline with smart investments in innovation and renewables to create a sustainable growth path. Instead of the traditional approach of "fiscal austerity", the focus should be on green and inclusive investments, which simultaneously reduce debt in the long term and increase the resilience of the economy.

Cumulatively, the results of the cluster analysis clearly differentiate three development patterns of the observed SEE countries: Cluster 1 – countries with moderate debt, solid environmental performance, but low innovation investment; Cluster 2 – countries with higher debt and high investment in innovation, where debt is used productively; Cluster 3 – countries with high debt and poor environmental performance, indicating inefficient use of public funds.

The results of this study align with and expand upon several strands of existing literature. The negative correlation between public debt and SDG15 supports the conclusions of Clootens & Magris (2021), who argue that excessive public indebtedness threatens environmental sustainability by crowding out investment in natural resource preservation. Similar findings were presented by Auteri et al. (2024), who identified a bidirectional relationship between government debt and renewable energy use, showing that high debt burdens can constrain green investment capacity. Conversely, the positive relationship between public debt and R&D expenditure corresponds with the results of Yang et al. (2024) and Kantorowicz et al. (2024), who emphasize that strategically managed debt can serve as an effective tool for stimulating innovation and financing environmental reforms.

These findings suggest that debt-financed investments in technological progress may yield long-term regenerative benefits, particularly when directed toward renewable energy, digital infrastructure, and sustainable production. Moreover, the inverse U-shaped dynamic found by Kushawaha & Jain (2025) is relevant for interpreting the results of this paper – indicating that public debt supports green transition only up to a certain threshold, beyond which additional borrowing reduces fiscal and ecological efficiency. The countries in Cluster 2 exemplify this threshold effect: higher debt levels coexist with strong innovation capacity and stable environmental performance, as opposed to Cluster 3, where rising debt correlates with weaker ecological outcomes. At the same time, the positive link between renewable energy share and SDG15 reinforces the notion proposed by Efthimiadis & Tsintzos (2023) that debt-financed policies promoting renewable energy can yield mutually reinforcing benefits for both economic growth and ecosystem restoration. The SEE region thus demonstrates that fiscal discipline, when combined with targeted innovation and ecological investment, forms the foundation of a regenerative economy.

In comparison with earlier studies that primarily analyzed the nexus between public debt and economic growth, this paper extends the analytical horizon by embedding fiscal variables within a sustainability and innovation framework. The results confirm that public debt is not inherently negative, but that how it is used is crucial. Countries that have directed public resources towards research, innovation and green technologies have achieved long-term benefits and are moving towards regenerative models.

In contrast, countries that retain the traditional fiscal paradigm, which is focused on short-term budget balancing without strategic investments, are lagging behind in terms of the ecological transition. It is in this context that public policy and public debt management become key instruments of regenerative transformation. Investments financed by public debt can contribute to the restoration of ecosystems, the development of sustainable infrastructure, innovations in renewable energy sources and the creation of social values that go beyond the linear model of "take-produce-dispose". A regenerative economy requires a redefinition of fiscal responsibility: not only as cost control, but as an investment strategy for future resilience and natural renewal.

6. CONCLUSION

The research results show that public debt in SEE countries has a two-way impact on green and regenerative transition processes. On the one hand, higher levels of debt limit the fiscal space for environmental investments and the achievement of the Sustainable Development

Goals (SDG15), while on the other hand, debt can have a developmental function if it is directed towards innovation and research. The findings indicate that the structure of public spending is more important than the level of indebtedness itself: when funds are used for R&D and green technologies, debt becomes an instrument of transformation, not an obstacle. The positive correlation between renewable energy sources and environmental indicators confirms the importance of the energy transition in strengthening sustainability. Overall, the transition to a regenerative economy in the region requires a balanced approach to fiscal stability, innovation and the protection of natural resources, with public debt being a driver, rather than a constraint, of sustainable development.

In addition, the cluster analysis showed that countries with balanced fiscal policies and a focus on innovation have a greater potential for the transition to a regenerative economy. The example of Slovenia confirms that public debt, if properly directed, can be transformed into a lever for regenerative development. In contrast, countries that use public debt without a clear development vision risk deepening economic dependence and degrading natural capital. Overall, the results of the cluster analysis show clear differentiation among the observed countries. While country from Cluster 2 leads in terms of economic development and innovative investments, countries from Cluster 1 achieve better environmental indicators, but with weaker economic performance. In contrast, Cluster 3 indicates countries that face challenges on both economic and environmental levels. The results of the ANOVA analysis confirm that the identified clusters are not random, but systematically differ across all key indicators of sustainable development and economic performance, and indicate the need for more balanced policies that would link economic growth with the preservation of natural resources. Therefore, the key challenge for the countries of the region remains to redirect public finances towards long-term, regenerative goals, thereby simultaneously strengthening economic resilience and preserving the natural basis of development.

The findings confirm the hypothesis that the developmental role of public debt depends on how it is managed. When directed toward innovation and sustainability-oriented investments, debt becomes a driver of regenerative transformation. Conversely, when used for short-term consumption, it turns into a burden that limits both fiscal and ecological resilience. The main limitations stem from data availability and the exclusion of qualitative variables, such as institutional quality and governance efficiency. Nevertheless, these dimensions are indirectly captured through performance in SDG15. The study is also limited to quantitative indicators, while future research may integrate qualitative case studies or policy analyses to provide a more comprehensive understanding of fiscal-ecological dynamics.

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INSTITUTIONAL QUALITY, GROSS DOMESTIC PRODUCT AND ENTREPRENEURIAL ACTIVITY: AN EMPIRICAL ANALYSIS FOR BOSNIA AND HERZEGOVINA

ABSTRACT

The aim of this study is to examine the relationship between institutional quality, gross domestic product per capita, and entrepreneurial activity in Bosnia and Herzegovina during the period 2009–2022. Entrepreneurial activity was measured by the number of newly established limited liability companies, while institutional quality was assessed using the World Governance Indicators (WGI): regulatory quality, government effectiveness, rule of law, control of corruption, political stability, and voice and accountability. The study employed a multiple linear regression (OLS) model with log transformation of the number of newly established limited liability companies and GDP per capita. The results of the analysis show that the overall model is statistically significant; however, the individual institutional indicators do not have a direct and measurable effect on entrepreneurial activity. It is particularly important to emphasize that the results indicate that GDP per capita has a significant and positive impact on entrepreneurial activity. These findings suggest that entrepreneurial activity in Bosnia and Herzegovina is primarily determined by economic factors (improvement of economic indicators), while institutional factors likely exert an indirect influence, partly through improvements in the macroeconomic environment.

Keywords: *institutional quality, gross domestic product per capita, economic growth, entrepreneurial activity, Bosnia and Herzegovina.*
JEL: O43, L26, O11, P48, C22

1. INTRODUCTION

As one of the key economic challenges of every national economy is to determine the ways that will lead to economic growth, numerous attempts have been made to provide answers to this issue. Among the many factors that can influence economic growth, entrepreneurship itself is particularly important. Entrepreneurship and entrepreneurs are considered vital drivers of economic growth, as they contribute to job creation, innovation, and the stimulation of competition and competitiveness (Stoica et al., 2020). Moreover, entrepreneurship has long been recognized as a key mechanism of economic development (Stam & van Stel, 2009). Today, every modern economy places entrepreneurship at the top of its priority list. In the case of developing countries, it is important to emphasize that the promotion of entrepreneurship has been strongly encouraged as one of the main elements for enhancing economic growth and reducing dependence on state intervention. The World Bank, as a highly influential institution, has implemented a large number of programs and policies aimed at supporting entrepreneurship, as well as small and medium-sized enterprises in developing countries (Zouita, 2021). In addition to the World Bank, the importance of

entrepreneurship is also highlighted by many other institutions, organizations, and individuals around the world.

"Entrepreneurial activity is a human endeavor directed toward creating value through the establishment or expansion of economic activity, by identifying and exploiting new products, processes, or markets." (Ahmad & Seymour, 2008, p. 14). Within the framework of the World Bank, there is a Global Entrepreneurship Database, which serves as a unique source of comparable cross-country data on business registration, published to better understand the dynamics of private enterprises worldwide. Entrepreneurial activity is operationalized through the indicator called "Number of new limited liability companies." The World Bank (2025a) defines this indicator as the number of newly registered limited liability companies (or their equivalents) within a calendar year.

Entrepreneurship can have both qualitative and quantitative dimensions. Specifically, institutions can play a crucial role in shaping both the quality and quantity of entrepreneurship (Chowdhury et al., 2019). Sendra-Pons et al. (2022) emphasize that the impact of institutional factors on the level of entrepreneurship varies depending on the socioeconomic characteristics of a country. The institutional configuration can lead to either the presence or the absence of entrepreneurial activity. Furthermore, the improvement of institutional quality within a country also shapes how the availability of natural resources influences entrepreneurial activity (Medase et al., 2023).

Institutional quality refers to the efficiency and effectiveness of a country's institutions, encompassing governmental, legal, and social structures that guide its development and mutual relations. The Worldwide Governance Indicators (WGI) represent a research dataset developed by the World Bank that measures institutional quality through six dimensions: Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption (World Bank, 2024). The operationalization of variables in this study follows approaches used in previous research such as Haini et al. (2023), Ali (2023), Polemis and Stengos (2020), Agostino et al. (2020), Chambers and Munemo (2019), and Pham (2024).

Contrary to the above, numerous authors emphasize that the assumption of positive effects of entrepreneurship is not always justified. Many researchers take the positive impact of entrepreneurship for granted, without considering that entrepreneurial activities may also have destructive or neutral effects (Almodóvar-González et al., 2020). However, the specific effects of entrepreneurship on economic growth are not the subject of this study. Moreover, it is common practice in economic research to examine the impact of entrepreneurship on economic growth, while studies analyzing the reverse relationship—the impact of economic and institutional factors on entrepreneurship—remain relatively underexplored. Economic growth is most commonly observed through gross domestic product per capita (GDP per capita), which represents the sum of gross value added by all resident producers in the economy plus product taxes (less subsidies not included in the value of output), divided by the estimated population (World Bank, 2025b). As such, the growth of GDP per capita is considered a broad measure of overall economic growth.

Despite the extensive discussion and recognition of the importance of entrepreneurship for accelerating economic growth, the institutional framework in Bosnia and Herzegovina

remains insufficiently stimulating for the development of new business ventures. Numerous studies indicate that countries with lower institutional quality tend to have slower growth in entrepreneurial activity, often measured by the number of newly established firms. Institutions and institutional quality contribute to entrepreneurship in various ways, while entrepreneurship, in turn, increases economic activity, ultimately leading to economic growth. Although Bosnia and Herzegovina has for years implemented reforms aimed at strengthening institutional capacity—largely driven by aspirations for European Union membership—there are concerns that the country still lacks sufficiently stimulating institutional conditions.

In the context of Bosnia and Herzegovina, there is a noticeable lack of research that connects institutional quality (as measured by the World Governance Indicators) with entrepreneurial activity. Therefore, the key question arises: to what extent do institutional quality and GDP per capita influence the number of newly established limited liability companies in Bosnia and Herzegovina during the period 2009–2022?

The subject of this research is the analysis of the relationship between institutional quality (measured by the World Bank's WGI indicators), gross domestic product (expressed in USD), and entrepreneurial activity (measured by the number of newly registered companies) in Bosnia and Herzegovina. In addition to examining the impact of GDP per capita on entrepreneurial activity, the primary focus is placed on assessing the influence of institutional quality on entrepreneurship. For Bosnia and Herzegovina—a country characterized by low institutional quality, political instability, and modest economic growth—this analysis is particularly significant. It represents not only an academic contribution but also a practical challenge for policymakers seeking to design strategies that can stimulate sustainable economic growth and entrepreneurship in Bosnia and Herzegovina.

2. PREVIOUS RESEARCH AND THEORETICAL BACKGROUND

Research on institutional quality and entrepreneurial activity indicates that institutional quality plays an important role in shaping entrepreneurial dynamics. Numerous studies show that institutional factors—such as regulatory quality, government effectiveness, rule of law, and control of corruption—can either facilitate or hinder the process of establishing new firms. However, it is important to note that the results across studies are not uniform. In countries with lower institutional quality, such as Bosnia and Herzegovina, economic factors (e.g., GDP per capita) tend to play a more significant role in influencing entrepreneurial activity, while institutional factors often exhibit indirect or delayed effects. The impact of institutional quality on entrepreneurial activity (measured by the number of newly established firms) also largely depends on the level of development of the national economy.

In a study examining the impact of institutional quality on income inequality and entrepreneurial activity, using a sample of 100 developed and developing countries over the period 2006–2018, Haini et al. (2023) demonstrated that both institutional quality and income inequality have a positive and statistically significant impact on entrepreneurial activity. The authors measured entrepreneurship through the establishment of new firms, which they identified as a limitation of the study since it focuses solely on formal entrepreneurial activity, neglecting the informal economy. Similarly, Ali (2023), using dynamic panel data models and the Worldwide Governance Indicators (WGI) alongside

measures of entrepreneurship for the period 1999–2018, aimed to explore why and how institutional quality influences the initiation of business ventures in high- and middle-income countries, while controlling for institutional and macroeconomic factors. The author concluded that good governance (institutional quality) significantly promotes entrepreneurship in high-income countries, while its effect is moderate in middle-income countries. Furthermore, the study highlights that the magnitude and strength of the relationship between institutional quality and entrepreneurship depend on both the level of economic development and the indicator used to measure entrepreneurship.

According to a study on the impact of institutional quality on the establishment of new firms in Italy during the period 2004–2012, it was found that institutional quality positively influences firm entry rates, with the effect being more pronounced in high-technology industries. Among the dimensions of institutional quality, the rule of law was found to be more important in the economically lagging southern regions, while regulatory quality had greater significance in the more developed northern regions of Italy (Agostino et al., 2020). Polemis and Stengos (2020) focused their research on studying the effects of regulatory quality on entrepreneurial activity in 30 OECD countries using a partially linear panel model. Their findings revealed that the deterioration of efficiency and implementation of government regulations negatively affects the initiation of business activities in the observed countries.

A study that linked the Worldwide Governance Indicators (WGI) — including the regulatory quality indicator — with entrepreneurship, using Pearson correlation and multiple linear regression, for the period 2014–2018 and across 126 countries with varying levels of economic development, produced similar findings. The research used gross national income as an independent variable, while the number of formally registered limited liability companies as a percentage of the working-age population served as the dependent variable. The correlation analysis revealed a moderate and statistically significant relationship between dependent and independent variables, while regression results showed that all WGI indicators except "voice and accountability" had a statistically significant impact on entrepreneurship (Abegaz et al., 2023). Chambers and Munemo (2019), in their study covering 119 countries over the period 2001–2012, obtained results consistent with theoretical expectations, confirming that a one-standard-deviation increase in institutional quality is associated with a 34% increase in entrepreneurial activity.

Research based on a sample of 70 countries between 2005 and 2015 demonstrated that institutions (institutional quality) play a crucial role in determining both the quality and quantity of entrepreneurial activity. The authors concluded that there are clear differences between developing and developed countries in terms of entrepreneurial outcomes (Chowdhury et al., 2019). Pham (2024) investigated the relationship between institutional quality and entrepreneurship with a moderating variable — the shadow economy. His study, which included 79 countries from 2006 to 2018 and applied fixed-effects and GMM estimation, found that improvements in institutional quality increase entrepreneurial activity, while the expansion of the shadow economy reduces it.

For African countries, using data from the UNDP, Transparency International, and the World Bank (WGI indicators) and applying pooled OLS and fixed-effects methods, it was found that 32% of the variation in entrepreneurial activity originates from changes in institutional

quality. A particularly interesting finding was that the absence of voice and accountability, one of the WGI dimensions, had a negative and statistically significant relationship with entrepreneurship (Olong, 2021). Furthermore, some authors identified a negative association between certain dimensions of institutional quality and entrepreneurial activity. Bjørnskov and Foss (2008) showed that government size is negatively related to entrepreneurship. The success of entrepreneurial activity is influenced by a combination of institutional quality dimensions, including voice and accountability, political stability, regulatory quality, and rule of law (Lv et al., 2021). Similar findings were reported by Munir (2025), Li et al. (2024), and others.

3. METHODOLOGY OF THE EMPIRICAL RESEARCH

3.1. Selection of variables and data sources

The research uses secondary annual data for Bosnia and Herzegovina covering the period 2009–2022. The dependent variable is entrepreneurial activity, operationalized through the number of newly registered limited liability companies (World Bank – Entrepreneurship Database; World Bank, 2025a). The independent variable is institutional quality, represented by the Worldwide Governance Indicators (WGI) from the World Bank database: *Regulatory Quality (RQ), Government Effectiveness (GE), Control of Corruption (CC), Rule of Law (RL), Political Stability and Absence of Violence/Terrorism (PS), and Voice and Accountability (VA).*

In addition, the model includes another independent variable — GDP per capita (in constant U.S. dollars), obtained from the World Development Indicators (WDI; World Bank, 2025b). All variables are expressed on an annual basis. To stabilize variance and ensure interpretative consistency, a logarithmic transformation was applied to the dependent variable and GDP (ln(new firms) and ln(GDP per capita)).

3.2. Econometric model

For the purpose of estimating the impact of institutional quality and economic growth on entrepreneurial activity, the multiple linear regression (OLS) model was applied, where the number of newly established limited liability companies represents the dependent variable, while the WGI indicators and GDP per capita represent the independent variables.

The model is specified as follows:

$$\ln(\text{NewFi.}_t) = \beta_0 + \beta_1 RQ_t + \beta_2 GE_t + \beta_3 CC_t + \beta_4 RL_t + \beta_5 PS_t + \beta_6 VA_t + \beta_7 \ln(GDP_t) + \varepsilon_t$$

Where:

- $\ln(\text{NewFi.}_t)$ enotes the logarithm of the number of newly established firms in a given year t;
- RQ, GE, CC, RL, PS, VA represent the institutional quality indicators (WGI);

- $\ln(GDP_t)$ denotes the logarithm of gross domestic product per capita;
- ε_t represents the random error term of the model.

The analysis was conducted using IBM SPSS Statistics software, and several regression diagnostics were performed to assess the model. These included the Durbin–Watson test for residual autocorrelation, multicollinearity checks using VIF and Tolerance values, and residual analysis through a P–P plot diagram. The ANOVA test was used to evaluate the overall statistical significance of the model, while the individual effects of variables were examined using t-tests of coefficients.

4. RESULTS AND DISCUSSION

According to the results of the regression analysis, the model that includes six WGI indicators representing institutional quality and GDP per capita demonstrates a strong explanatory power in explaining the number of newly established firms in Bosnia and Herzegovina during the period 2009–2022. The coefficient of determination ($R^2 = 0.904$) indicates that the model explains approximately 90.4% of the variability in the dependent variable, while the adjusted R^2 value (0.792) also suggests a high level of model stability and reliability.

Table 1. Summary of the Regression Model

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error	Durbin-Watson
1	.951[a]	.904	.792	.08279	1.973

a. Predictors: (Constant), LNGDP, Regulatory Quality (RQ), Government Effectiveness (GE), Control of Corruption (CC), Rule of Law (RL), Political Stability and Absence of Violence/Terrorism (PS), and Voice and Accountability (VA).

b. Dependent Variable: NewFi.

Source: Author's calculations based on IBM SPSS Statistics 23 software

The high correlation coefficient (R = 0.951) shows a strong relationship between institutional indicators and entrepreneurial activity. The standard error of the estimate (0.08279) is relatively low, indicating precise model predictions.

Furthermore, the Durbin–Watson statistic (1.973) falls within the optimal range, confirming the absence of autocorrelation among residuals and supporting the model's robustness and reliability.

These findings suggest that institutional quality and economic growth together play an important role in explaining the trends of entrepreneurial activity in Bosnia and Herzegovina.

The ANOVA table shows that the regression model is statistically significant (F = 8.080; p = 0.011). Since $p < 0.05$, it can be concluded that the set of independent variables (WGI

indicators and GDP per capita) jointly explain the changes in the number of newly established firms in Bosnia and Herzegovina in a statistically significant way.

Thus, institutional quality and economic development together have a significant impact on entrepreneurial activity. This result directly confirms the main hypothesis at the model level.

Table 2. ANOVA Test of Regression Model Significance

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.388	7	.055	8.080	.011[b]
	Residual	.041	6	.007		
	Total	.429	13			

a. Dependent Variable: NewFi.

b. Predictors: (Constant), LNGDP, Regulatory Quality (RQ), Government Effectiveness (GE), Control of Corruption (CC), Rule of Law (RL), Political Stability and Absence of Violence/Terrorism (PS), and Voice and Accountability (VA).

Source: Author's calculations based on IBM SPSS Statistics 23 software.

Table 3. Coefficients of the Regression Model

Coefficients[a]							
Model 1	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Err.	Beta			Tolerance	VIF
(Constant)	6.550	.316		20.726	.000		
Regulatory Quality	-1.437	.737	-.412	-1.950	.099	.358	2.795
Control of Corruption	.006	.536	.005	.011	.991	.073	13.678
Government Effectiveness	1.556	.720	1.977	2.160	.074	.019	52.425
Political Stability and Absence of Violence/Terror	.614	.398	.632	1.540	.174	.095	10.532
Rule of Law	-3.43	2.096	-1.444	-1.636	.153	.021	48.776
Voice and Accountability	-.511	.946	-.298	-.540	.609	.053	19.025
LNGDP	.000	.000	1.439	2.984	.025	.069	14.546

a. Dependent Variable: NewFi

Source: Author's calculations based on IBM SPSS Statistics 23 software.

The coefficients indicate that only GDP per capita (LNGDP) has a statistically significant positive effect on the number of newly established firms ($p = 0.025$), suggesting that economic growth plays a key role in the development of entrepreneurial activity in Bosnia and Herzegovina. Individually, regulatory quality ($p = 0.099$) and government effectiveness

(p = 0.074) show borderline significance, indicating that they may have a certain but not sufficiently strong effect within this sample.

Other institutional quality indicators were found to be statistically insignificant. Overall, GDP per capita makes the strongest contribution to the model, while the institutional quality indicators collectively enhance the model's explanatory power but are not individually dominant.

According to Figure 1, the points closely follow the diagonal line with only minor deviations, indicating that the residual distribution aligns well with the normal distribution. This confirms that the model is stable and that the assumptions of linear regression have not been violated.

Although institutional quality often plays an important role in entrepreneurial activity, in the context of Bosnia and Herzegovina, no clear or direct impact is observed on the number of newly established limited liability companies.

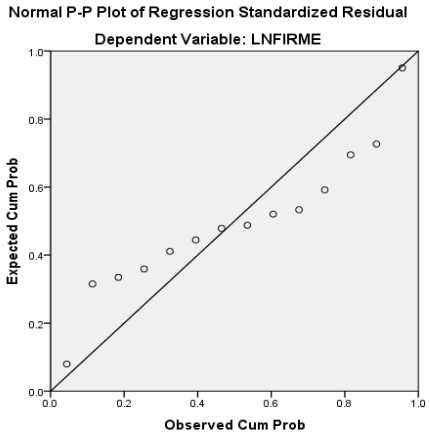


Fig. 1. Normal P–P Plot of Standardized Residuals

These findings are consistent with those of Estrin and Mickiewicz (2010), who also highlighted the indirect influence of institutional factors in transition economies. The key role in explaining entrepreneurial activity is instead played by economic indicators, particularly GDP per capita, which is confirmed as a significant predictor of entrepreneurship, in line with previous research.

The insignificance of some institutional coefficients may be interpreted as a reflection of the weak institutional framework in Bosnia and Herzegovina. Nevertheless, the statistical significance of the overall model confirms that institutional quality and GDP per capita together possess strong explanatory power, which is consistent with findings from numerous international studies.

5. CONCLUSIONS AND POLICY RECOMMENDATIONS

The model that includes institutional quality indicators and gross domestic product per capita demonstrates a high explanatory power in predicting the level of entrepreneurial activity in

Bosnia and Herzegovina. The coefficient of determination ($R^2 = 0.904$) indicates that the combination of observed variables explains over 90% of the variability in the number of newly established limited liability companies, while the Durbin–Watson statistic (1.97) confirms the model's stability and the absence of residual autocorrelation.

The ANOVA test ($F = 8.080$; $p = 0.011$) confirms that the model as a whole is statistically significant, meaning that institutional (WGI) and economic (GDP per capita) factors jointly contribute to explaining entrepreneurial activity. When observed individually, none of the institutional indicators are statistically significant ($p > 0.05$), whereas GDP per capita is the only independent variable with a significant and positive effect on the number of newly established limited liability companies ($p = 0.025$).

According to the results, entrepreneurial activity in Bosnia and Herzegovina, measured by the number of newly established limited liability companies, is primarily driven by economic factors, particularly GDP per capita. Although institutional quality has been confirmed as highly important in many international studies, it does not exhibit a direct and measurable impact on firm creation in Bosnia and Herzegovina. This suggests that the effect of institutional quality likely manifests indirectly, through improvements in economic conditions that stimulate growth and stability.

Economic policy recommendations should therefore focus on strengthening economic growth indicators (GDP per capita) while simultaneously initiating institutional reforms aimed at creating a measurable effect on entrepreneurial activity. It is necessary to enhance regulatory quality and government effectiveness, the two institutional dimensions that showed borderline significance and have potential to become significant with further reform. Future research could explore the broader relationship between institutions and entrepreneurship using extended models (e.g., the ARDL approach), which could yield more complex and dynamic results.

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NOW-OR-NEVER INCENTIVES: HOW HUNGARY'S BABY-EXPECTING LOAN AND FAMILY HOUSING ALLOWANCE (CSOK) SHAPED BORROWING AND FERTILITY

ABSTRACT

The study examines the effects of Hungary's family policy credit programmes—particularly the Baby-expecting loan and the family housing allowance (CSOK) scheme—from a behavioral economics perspective. While these programmes were designed to promote childbearing and improve access to housing, birth trends suggest that their impact has been temporary rather than lasting. The analysis draws on time series from 2010 to 2024, statistics from the Hungarian Central Statistical Office (KSH) and the National Bank of Hungary (MNB), as well as survey evidence. The research focuses specifically on decision-making biases: present bias, "now-or-never" framing, and over-optimism.

Our findings indicate that although the programmes did contribute to a short-term increase in births, they primarily generated brought-forward births rather than a durable demographic turnaround. In addition, the side effects of the subsidies distorted the housing market: they contributed to rapid house-price growth, reinforced social inequalities, and further widened regional disparities.

The research is novel in that it assesses the effects of family policy loans not only within an economic framework but also through a behavioral lens. It shows that well-targeted subsidies, on their own, are insufficient to achieve sustainable demographic growth if they overlook households' psychological decision-making biases and the long-term social consequences.

Keywords: *Behavioral economic, Fertility, Housing market, Baby-expecting loan and family housing allowance (CSOK), Present bias.*
JEL: D91, J13

1. INTRODUCTION

Hungary, like many developed countries, is facing a persistent demographic decline that threatens long-term economic and social sustainability. The decrease in population stems from persistently low fertility rates, high mortality, and continued emigration. In response, the Hungarian government has introduced several family policy and financial incentive programmes over the past decade - most notably the Family Housing Allowance (CSOK) and the Baby-Expecting Loan (Babaváró) - aimed at encouraging childbearing and improving access to housing.

While these measures generated short-term positive outcomes, including a temporary increase in birth rates and higher household investment, they also produced unintended consequences. Easy access to subsidised credit contributed to an overheated housing market, rapid price escalation, and widening regional disparities. As a result, policies intended to address demographic challenges may have inadvertently reinforced existing social and economic inequalities.

This research investigates these dual effects from a behavioural economics perspective, analysing how psychological and financial incentives shape decision-making in family planning and housing. The Hungarian experience may offer valuable insights for other countries facing similar demographic pressures, demonstrating how family policies can better balance short-term incentives with long-term social and economic sustainability.

2. RESEARCH METODOLOGY

This study is based on secondary data analysis that integrates statistical, institutional, and academic sources. The research primarily draws on datasets from the Hungarian Central Statistical Office (KSH) and the National Bank of Hungary (MNB), including macro-level time series on fertility rates, housing prices, and household credit volumes between 2010 and 2024. In addition, relevant academic literature, policy reports, and MNB working papers were reviewed to provide a comprehensive understanding of the economic and behavioural implications of family policy programmes such as the Family Housing Allowance (CSOK) and the Baby-Expecting Loan (Babaváró).

The analysis employs a descriptive and comparative approach to examine how these policy instruments influenced financial decision-making, credit behaviour, and demographic trends over time. Quantitative indicators were interpreted through the lens of behavioural economics, focusing on cognitive biases such as present bias, optimism, and framing effects that may shape household responses to financial incentives.

3. PREVIOUS RESEARCH ON THE TOPIC

3.1. Baby-Expecting Loand (Babaváró) – Free Money?

The Baby-Expecting Loan (Babaváró) was introduced in Hungary on 1 July 2019 as part of the government's family policy programme, with the aim of increasing willingness to have children and improving the financial situation of young married couples. The scheme is a

state-subsidised, freely usable, unsecured loan, initially capped at 10 million HUF and increased to 11 million HUF from 2024.

The loan becomes interest-free if at least one child is born within five years of disbursement; upon the birth of a second child, 30% of the outstanding principal is forgiven, and after the birth of a third child, the entire remaining debt is cancelled. If no child is born within five years, the interest subsidy must be repaid and the loan is converted into a market-rate product.

The loan is available exclusively to married couples and is subject to an age condition for the wife: the original limit of 18–40 was reduced to 30 in 2024, and will be raised again to 35 from 2025. The maximum loan term is 20 years, and after the birth of a child, repayment may be suspended for up to three years.

Eligibility requires that only married couples may apply, and if one spouse already has a child, it must be the first marriage of the other partner. At least one spouse must have a minimum of three years of continuous social security contribution history, which may include periods of higher education and parental benefits. Additional requirements include permanent residence in Hungary, a clean public dues record, a clean criminal record, and the absence of any listing for loan default in the Central Credit Information System (KHR).

The purpose of the partial or full debt relief provided through state-financed principal reduction is to strengthen childbearing intentions and enhance the financial security of young families (Fellner et al., 2021).

3.2. Family Housing Allowance (CSOK)

The Family Housing Allowance (CSOK) was introduced in Hungary on 1 July 2015 with the aim of improving housing conditions for families with children or those planning to have children, thereby indirectly encouraging higher fertility. The scheme provides a non-refundable state grant, which may be supplemented by a subsidised mortgage loan. Support can be used for purchasing, constructing, or extending new or existing residential property, with the amount of the allowance depending on the number of children and the type of property.

Eligibility criteria include being married or in a registered partnership, having a permanent residence in Hungary, no outstanding public debt, and a clean criminal record. At least one applicant must also have a verified period of social security coverage, and the supported property must serve as the applicants' primary residence. The property cannot be sold or rented out during the mandatory restriction period; otherwise, the grant must be repaid.

Since its introduction, the CSOK programme has undergone several revisions. In 2019, it was expanded to allow the subsidised loan to be used for purchasing existing homes, whereas previously it had been restricted to new properties. In 2020, the "rural CSOK" option was launched, offering higher levels of support in disadvantaged rural settlements to stimulate construction and renovation activities.

From 2024, the classic nationwide CSOK scheme was discontinued and replaced by CSOK Plus, which provides subsidised loans with interest rates of up to 3% for child-raising married couples, subject to stricter age and eligibility requirements (Plöchl & Obádovics, 2021).

Table 1. Maximum Amount of CSOK Grant and Loan in 2025 (Own compilation)

Number of Children (existing or planned)	Support	Loan
1	1 000 000 Ft	15 000 000 Ft
2	4 000 000 Ft	30 000 000 Ft
3+	15 000 000 Ft	50 000 000 Ft

The introduction of the Family Housing Allowance (CSOK) had a significant impact on the Hungarian housing market and macroeconomic developments. The programme increased housing demand—particularly for newly built properties—and contributed to the expansion of the construction sector. At the same time, the resulting surge in demand also led to rising housing prices, partly offsetting the intended purchasing power effect of the subsidy. According to research (MNB, 2022; KSH, 2023), CSOK was primarily accessible to middle-class households with stable incomes, implying notable distributional effects: wealthier families were better positioned to benefit from the programme, while lower-income households faced more limited access.

From a demographic perspective, CSOK may have increased willingness to have children in the short term; however, long-term data suggest that the programme mainly generated brought-forward births rather than a sustained improvement in fertility. Regionally, the effects of CSOK were particularly pronounced in major cities and suburban areas, whereas demand increased more moderately in rural regions with lower property prices.

Overall, CSOK can be regarded as a complex economic policy instrument that sought to improve housing conditions while simultaneously promoting demographic goals. Nevertheless, its side effects—especially rising prices, increasing social segregation, and widening territorial disparities—highlight that the effectiveness of housing subsidy policies depends heavily on targeting, underlying market conditions, and the extent to which household behavioural characteristics are incorporated into policy design (MNB, 2024).

3.3. Social Impact – Changes in Birth Rates over Time: The Challenge of a Declining Population (2010-2024)

While the world's population continues to grow at a rapid—and in many regions seemingly uncontrollable—pace, Hungary's population has been declining year after year, posing serious social and economic challenges. The country has become part of the demographic transformation observable across developed market economies and is experiencing its negative consequences. The fertility rate has remained consistently below the level required for population replacement, mortality remains high, and life expectancy at birth is lower than the EU average. Although the government has significantly increased family policy expenditures over the past decade, Hungary continues to be among the fastest-shrinking populations globally (Government of Hungary, 2019).

Despite recent family policy measures that have generally moved in a favourable direction and the government's considerable efforts to support families, these initiatives have not yet produced the expected outcomes. Achieving a lasting improvement in fertility indicators requires a comprehensive, complex, and scientifically grounded demographic strategy that addresses the deeper social, economic, and cultural roots of the problem. At the centre of such a strategy must be the creation of a genuinely child- and family-friendly social environment. This also necessitates rethinking the role of the family, the conditions under which it functions, and its relationship to paid work and economic participation in the interest of sustainable social renewal (Government of Hungary, 2019).

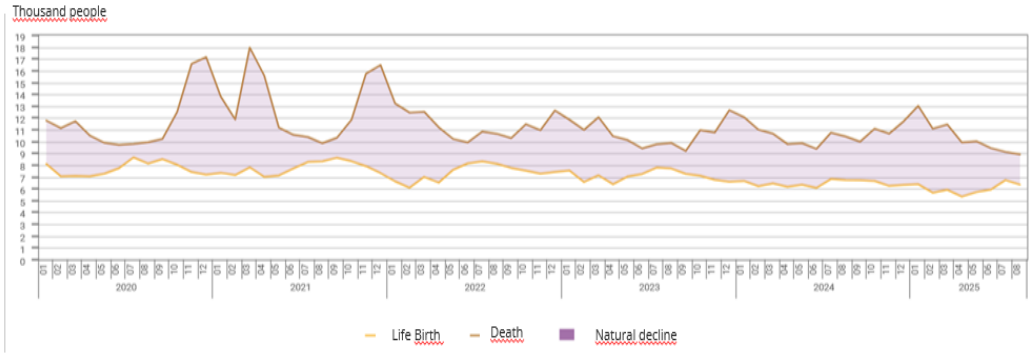


Fig. 1. Number of live births and deaths by month, 2020–2025.
Source: Hungarian Central Statistical Office (KSH, 2025)

The figure illustrates the monthly trends in live births and deaths in Hungary between 2020 and 2025. The curves clearly demonstrate the persistent phenomenon of natural population decline: throughout the observed period, the number of deaths exceeded the number of live births in every month, resulting in continuous population decrease. A significant surge in the number of deaths can be observed in 2020–2021, which is directly linked to the effects of the COVID-19 pandemic. In parallel, the number of live births slightly decreased, further amplifying the rate of natural population loss. From 2022 onward, the number of deaths returned to pre-pandemic levels; however, the trend in live births did not show any substantial improvement.

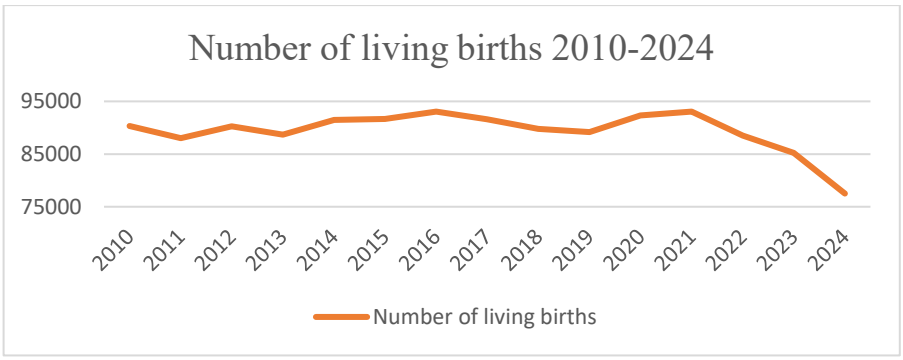


Fig. 2. Number of Live Births, 2010–2024.
Source: Hungarian Central Statistical Office (KSH, 2025)

The period between 2021 and 2025 is characterised by a slow but continuous decline in the number of live births, while the number of deaths remained relatively stable. As a result, the rate of natural population decrease has continued to be significant. This suggests that family policy measures—such as CSOK and the Baby-Expecting Loan—have so far been unable to permanently counteract the broader trends of demographic decline.

Numerous studies have examined the positive effects of these subsidies on childbearing intentions. Their findings indicate that CSOK may contribute to an increased willingness to have children in the future; however, the effectiveness of family policy interventions in this field depends strongly on the overall standard of living, as well as on moral and value-related factors associated with family life and child-rearing (Plöchl & Obádovics, 2021).

3.4. Economic and Credit Martket Impact

The economic impact of the Baby-Expecting Loan presents a mixed picture. According to the MNB's 2020 online survey, the loan was primarily used for home purchases, home renovations, and consumption-related expenditures. However, in many cases its effect was largely substitutive, as these goals could have been achieved through other forms of credit or from households' own financial resources. By contrast, in the case of liquidity needs, consumption, and car purchases, the Baby-Expecting Loan played an additional role, meaning that such expenditures would not have been realised without the programme.

In the short term, the subsidy contributed to increased consumption and higher economic activity; however, it was less effective in stimulating new investment and long-term economic growth.

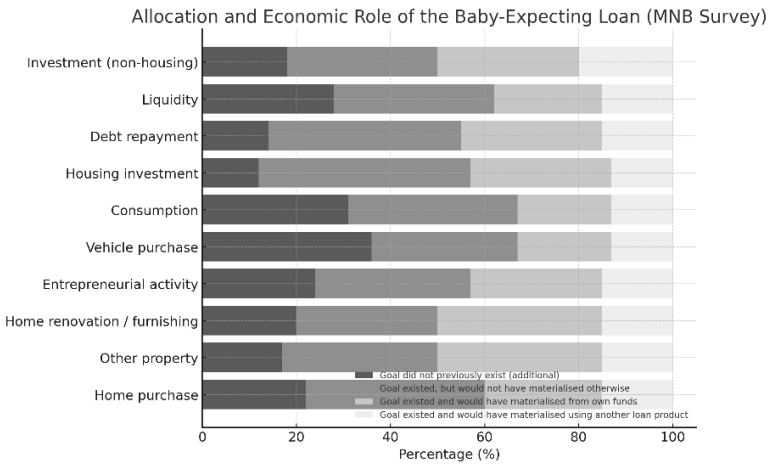


Fig. 3. Substitution and Additional Effects of the Baby-Expecting Loan by Purpose.
Source: Fellner et al. (2021)

The Figure 3 presents the results of the MNB's online survey on the Baby-Expecting Loan and illustrates the extent to which the subsidy influenced households' decisions through substitution effects or by generating additional (new goal-creating) effects. The introduction of the Baby-Expecting Loan significantly increased household borrowing activity, particularly among women under the age of 30 and middle-income married couples.

According to analyses by the Hungarian National Bank (MNB), the overall impact of the scheme can be considered additional, as the Baby-Expecting Loan did not substantially crowd out either market-based housing loans or consumer loans, but instead generated new loan demand within the household sector. However, for certain purposes—primarily home purchases and renovations—substitution effects can also be observed, meaning that some households replaced their previous or intended market loans with this subsidised instrument.

In the short term, the expansion of the loan portfolio stimulated both consumption and housing investment, which, according to MNB estimates, increased Hungary's GDP by 0.2–0.3 percentage points in 2020. Usage data show that the Baby-Expecting Loan was used predominantly for housing purposes (40–45%), as well as for consumption and liquidity-related expenditures (30–35%). The programme also contributed to a temporary rise in housing prices - particularly in regions popular among young married couples—further intensifying overheating in the property market.

Although the rapid growth of the loan portfolio increased the fiscal burden of state interest subsidies, it also boosted consumption and economic activity indicators in the short run. In this sense, the programme can be interpreted as a Keynesian demand-stimulating instrument; at the same time, it cannot be regarded as a structural demographic policy measure capable—on its own—of generating a substantial and lasting reversal in population trends (Fellner et al., 2021).

3.5. Real Estate Market Impact

The figure illustrates the quarterly evolution of the nominal housing price index between 2015 and 2024, shown separately for the used and new housing markets. The curves clearly reveal a continuous and steep price increase throughout the entire period, with prices more than doubling – and in some cases nearly tripling – by 2024 compared with the 2015 baseline. The rate of appreciation was more pronounced in the market for newly built homes, leading to a particularly visible divergence from the price trajectory of used homes after 2021.

The evolution of the trend is closely linked to the family-oriented housing policies introduced from 2016 onward—most notably CSOK, followed by the Baby-Expecting Loan from 2019. As a non-refundable grant combined with a preferential loan scheme, CSOK significantly increased housing demand, primarily among households with children or those planning to have children. However, the surge in subsidised demand was not accompanied by an adequate expansion in supply, resulting in an overheated market and a particularly sharp increase in the price of newly built homes.

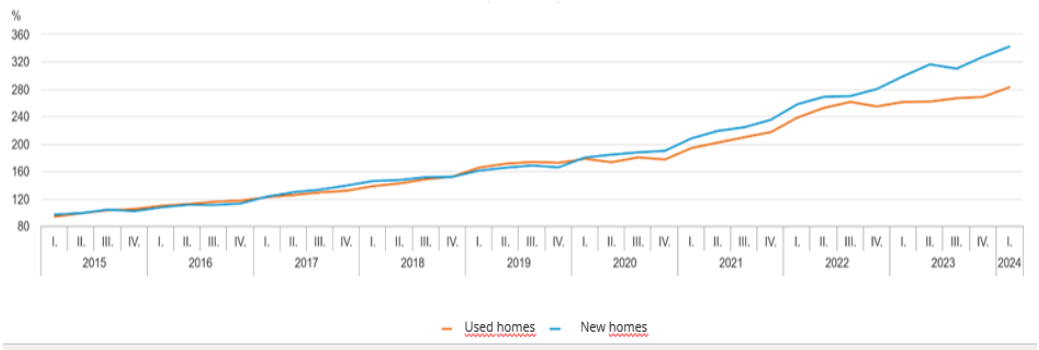


Fig. 4. Nominal housing price index in Hungary, 2015–2024 (2015 = 100%).

Source: Hungarian Central Statistical Office (KSH, 2023)

The introduction of the Baby-Expecting Loan in 2019 further amplified this demand pressure, as a substantial share of the interest-free, freely usable credit flowed into the housing market. According to research, 40–45% of borrowers used the loan for home purchase or renovation (Fellner et al., 2021). Because the Baby-Expecting Loan could also be used as a down payment, it enabled market entry for households that would not otherwise have appeared as buyers. As a result, the demand-side effects were compounded: targeted housing support through CSOK, combined with the additional purchasing power generated by the Baby-Expecting Loan, jointly pushed prices upward—especially in regions preferred by younger age groups.

Overall, the figure demonstrates that Hungarian family policy subsidies stimulated the housing market in the short run, but also triggered sustained increases in housing prices, making market entry more difficult—particularly for young first-time buyers. In this sense, the subsidies partially "priced themselves out," as artificial demand stimulation contributed significantly to the rise in housing costs (MNB, 2022).

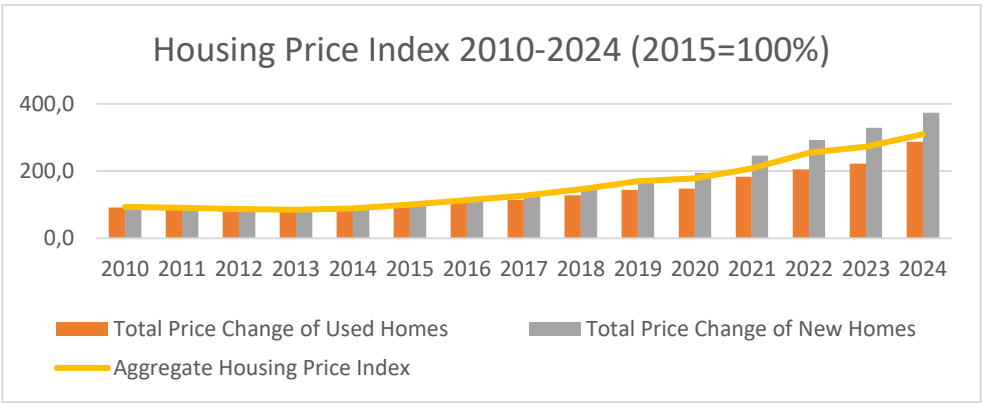


Fig. 5. Housing Price Index 2010–2024 (2015 = 100%).

Source: Hungarian Central Statistical Office (KSH, 2023)

3.6. Subsidy Bubble Effect

The essence of the subsidy bubble phenomenon is that state subsidies do not improve housing affordability but instead act as price-inflating mechanisms, as the additional demand generated by households is capitalised by the market in the form of rising prices. In the case of CSOK and the Baby-Expecting Loan, these subsidies triggered a centralised, short-term demand shock in the rigid Hungarian housing market, leading to immediate and substantial housing market inflation. As a consequence, a significant share of the subsidies was absorbed by the market as a price premium, meaning that the ultimate beneficiaries of public funds were not the buyers but the supply side—primarily sellers. The subsidy bubble therefore operated as a self-reinforcing process in which subsidies generated overvalued expectations, speculative price spirals, and unsustainable price levels.

From a behavioural economics perspective, the subsidy bubble emerged rapidly following the introduction of CSOK and the Baby-Expecting Loan because household decisions were shaped by several mutually reinforcing cognitive biases. Due to the anchoring effect, the amount of the subsidy became a psychological reference point, making higher prices appear acceptable to buyers. Herding behaviour amplified demand: as "everyone was buying," households aligned themselves with collective behaviour, driving the market into an irrational price spiral. At the same time, present bias and hyperbolic discounting led households to overvalue the immediate benefits of subsidies and undervalue long-term risks. Consequently, instead of fostering rational housing decisions, the subsidies encouraged impulsive and time-advanced purchases, further fuelling bubble formation (Popa, 2013).

4. PSYCHOLOGICAL AND BEHAVIORAL ASPECTS

4.1. Credit Market Attitudes and Borrowing Patterns

The literature consistently describes consumer borrowing not as a purely rational financial decision, but as a process strongly influenced by psychological, social, and cognitive factors. Contrary to the assumptions of classical economics—which posit that individuals make choices based on full information and rational cost–benefit calculations—behavioural economic research has shown that households frequently rely on heuristics and mental shortcuts when making borrowing decisions (Tversky & Kahneman, 1974, 1981). Elliehausen (2010) argues that consumers often fail to evaluate the real cost of all alternatives, instead relying on partial information, emotions, and simplified decision rules, which may lead to distorted and time-inconsistent choices.

Research further demonstrates that borrowing willingness is shaped by several systematic behavioural biases. Due to present bias, individuals tend to overvalue immediate benefits while undervaluing future obligations, which explains impulsive borrowing and debt spirals (Frederick et al., 2002). Over-optimism and the illusion of control also play a significant role: households frequently overestimate their future income or repayment capacity, leading them to assume greater credit risk than their objective financial situation would justify (Weng & Hermansson, 2024). The framing effect highlights that the way a loan is "packaged"—for example, as a subsidy, discount, or "opportunity"—can trigger emotional responses that substantially increase borrowing propensity, even when the product entails long-term financial risks (Prelec & Loewenstein, 1998).

Overall, the literature suggests that borrowing attitudes are strongly behaviour-driven: decisions are shaped not only by economic rationality, but also by emotions, social norms, cognitive biases, and the level of financial literacy. This perspective is particularly relevant when analysing Hungarian family policy loan schemes—such as the Baby-Expecting Loan and CSOK—because these programmes provide not only material incentives, but also evoke psychological reactions that influence households' borrowing and childbearing decisions. Moreover, the loan had a notable impact from a behavioural economics perspective as well: it reinforced present bias and "now-or-never" decision-making patterns which, while increasing borrowing appetite in the short run, may have contributed to credit market distortions and higher household indebtedness over the longer term.

4.2. Hyperbolic Discounting

From the perspective of Hungarian credit and family policy, the CSOK and Baby-Expecting Loan schemes provide immediate financial rewards that households can access quickly through state subsidies. The interest-free and freely disposable nature of the Baby-Expecting Loan, along with CSOK's direct housing support, makes these programmes particularly attractive to individuals prone to hyperbolic discounting.

However, the schemes also require long-term commitments that borrowers often underestimate, including repayment obligations, childbearing expectations, and the risk of losing interest-free status. As future burdens are undervalued, many households make hasty decisions and overlook long-term risks such as income loss, divorce, or childlessness. Social pressure and persuasive messaging further amplify these emotion-driven choices.

While these incentives stimulate consumption and housing activity in the short run, they may also lead to indebtedness, financial strain, and diminished trust in the state over time. The Baby-Expecting Loan and CSOK clearly illustrate how behavioural biases shape financial decisions: although they capitalise on short-term thinking, they offer limited support for responsible long-term planning. For this reason, such policies should be complemented by financial education and psychological guidance.

5. CONCLUSION

This study examined how Hungary's Baby-Expecting Loan and the Family Housing Allowance (CSOK) shaped borrowing behaviour and fertility decisions, with particular emphasis on the psychological mechanisms underlying household choices. While the programmes mobilised substantial resources and generated short-term behavioural responses, their demographic effects proved temporary and their market impacts uneven.

The findings show that both schemes acted as now-or-never incentives, leading primarily to brought-forward births. Present bias, over-optimism, herding, and hyperbolic discounting amplified short-term thinking and encouraged rapid, emotion-driven commitments—explaining the initial increases in births and credit uptake, but not long-term demographic change.

At the same time, the programmes significantly distorted the housing market. By boosting demand in a supply-constrained environment, they contributed to a subsidy-driven price bubble that worsened affordability—particularly for young first-time buyers—while increasing regional inequalities.

The study highlights that family policy cannot be evaluated through economic indicators alone. Sustainable demographic outcomes require behavioural awareness and structural reforms, including housing supply expansion, a stronger rental market, and financial guidance to mitigate cognitive biases. Hungary's experience shows that financial incentives alone cannot reverse demographic decline; only a policy mix that integrates economic instruments with behavioural and institutional solutions can support lasting demographic stability.

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REGENERATIVE TOURISM: A PATHWAY TO TOURISM DEVELOPMENT IN BOSNIA AND HERZEGOVINA

ABSTRACT

This paper explores the potential of regenerative tourism as a sustainable development pathway for Bosnia and Herzegovina (BiH). Renowned for its rich cultural heritage, diverse natural landscapes, and complex post-conflict socio-economic context, BiH has seen tourism emerge as a vital economic sector, contributing approximately 10–11% of GDP and 12% of total employment prior to the COVID-19 pandemic. Recent growth in tourist arrivals and overnight stays underscores the sector's importance for national development. Regenerative tourism represents a paradigm shift beyond conventional and sustainable models, emphasizing ecosystem restoration, community empowerment, and socio-economic resilience while enhancing BiH's tourism products and experiences.

This study employs a mixed-methods approach, combining a desk review and qualitative content analysis of key tourism strategies from both BiH entities with a survey of 46 stakeholders, including tourism professionals, hospitality providers, local authorities, NGOs, and academics. The conceptual framework, grounded in regenerative tourism and development literature, centers on five design dimensions: place-based orientation, systems thinking, ethical stewardship and regenerative action, collaborative governance, and transformative learning. Strategic documents were evaluated against these dimensions, and survey data were analyzed descriptively to assess stakeholders' knowledge, attitudes, and readiness for regenerative tourism.

Findings indicate that while entity-level tourism strategies incorporate sustainability, inclusiveness, and competitiveness—focusing on product development, destination marketing, and human resource capacity—they lack explicit regenerative goals such as ecosystem restoration, net-positive impact, and transformative learning. Stakeholders exhibit moderate conceptual awareness but limited training, experience, and collaboration mechanisms to implement regenerative practices. The study contributes to academic and policy debates by situating regenerative tourism within BiH's post-conflict development context, highlighting key opportunities and challenges, and providing strategic recommendations for policymakers and practitioners. Ultimately, regenerative tourism

emerges as a transformative pathway for BiH to enhance environmental restoration, social cohesion, and economic resilience while positioning itself as a competitive and responsible destination in the global market.

Keywords: *regenerative tourism, sustainability, governance, tourism policy, Bosnia and Herzegovina.*
JEL: Z30, Z32, Z38, Q56

1. INTRODUCTION

The tourism sector in Bosnia and Herzegovina (BiH) is increasingly recognized by government institutions and local entrepreneurs for its potential to become one of the key drivers of economic growth and territorial development. With its unique geographic position, diverse natural landscapes, and rich cultural heritage, BiH has the potential to serve as an attractive tourist destination that must be carefully developed to ensure environmental, cultural, and social sustainability.

In recent years, a shift toward sustainable tourism practices in BiH has become evident in multiple initiatives and strategic approaches, including entity and canton-level tourism strategies that emphasize sustainability principles and impact minimization. These strategies embed sustainable tourism concepts, such as environmental protection, community involvement, and resource efficiency, yet remain heterogeneous, as they are adopted at different governance levels and with varying degrees of coordination. Moreover, they tend to emphasize sustainability rather than regeneration, focusing on reducing negative impacts rather than actively restoring and enhancing socio-ecological systems.

Emerging global and local challenges related to environmental degradation, social inequality, cultural erosion, and climate change (Daly, 1996; Jackson, 2009; Meadows et al., 1972; Raworth, 2017) require a paradigm shift toward regenerative tourism—a holistic and proactive approach that prioritizes restoration, renewal, and system flourishing. Over the last decade, a growing body of research has examined theoretical, methodological, and empirical aspects of regenerative approaches to tourism and development (Bellato et al., 2022; Dredge, 2022; Fullerton, 2015; Wahl, 2016).

This paper aims to explore the existing literature on regenerative tourism and provide a roadmap for transforming BiH's tourism development from a sustainability-oriented model to a regenerative one. Specifically, the research asks: To what extent do current tourism strategies and stakeholder perceptions in BiH reflect regenerative tourism principles, and what opportunities and challenges exist for transitioning from sustainability to regeneration?

The paper is organized as follows. In the first section of the paper, a literature review on the shift from sustainability to regeneration is explored. The second section of the paper provides an overview of conceptual framework on regenerative tourism, focusing on defining regenerative tourism and regenerative dimensions. The third section of paper discusses the methodology for data collection and analysis, following the chapter on data analysis and discussion. The final section includes conclusions and recommendations for future strategic tourism development

2. SHIFTING FROM SUSTAINABILITY TO REGENERATION IN TOURISM - SUCCINCT LITERATURE REVIEW

The transition from traditional to regenerative economics represents a paradigmatic shift in how societies conceptualize and pursue (economic) development. Traditional economic models, grounded in logics and linear production–consumption patterns (take-make-dispose concept), have prioritized growth and efficiency often at the expense of ecological integrity and social equity (Jackson, 2009; Daly, 1996). In response to the environmental degradation and systemic inequalities that these traditional models have produced, sustainable economics and sustainable development emerged, emphasizing the reduction of negative impacts and the pursuit of balance between economic progress and ecological limits (Meadows et al., 1972; Raworth, 2017).

However, sustainability alone has been insufficient to address cumulative ecological damage and systemic fragility (Elkington, 2018). Regenerative economics moves beyond the goal of maintaining systems to actively restoring and renewing the natural and social foundations upon which economies depend (Fullerton, 2015; Wahl, 2016). From this perspective, economic activity is embedded within living systems, and the objective is not merely to minimize harm but to generate net-positive outcomes for ecosystems and communities (Capra & Luisi, 2014). This conceptual evolution provides the theoretical foundation for reimagining sustainability practices in sectors such as tourism through a regenerative lens that aspires to heal, enrich, and revitalize both places and people.

The evolution from sustainable to regenerative tourism reflects this broader theoretical and ethical transformation in how tourism relates to social–ecological systems. Sustainable tourism has long sought to minimize negative environmental and social impacts and has been aligned with the United Nations Sustainable Development Goals (Butler, 1999; Saarinen, 2006). Yet, it often remains focused on maintaining existing conditions rather than reversing degradation or enabling systemic renewal. Critics argue that sustainability discourse in tourism has been largely anthropocentric and managerial, emphasizing efficiency, competitive advantage, and continuity of business operations rather than ecological and community flourishing (Higgins-Desbiolles, 2018).

Regenerative tourism emerges as an alternative paradigm that draws on regenerative economics, systems thinking, and relational worldviews to position tourism as a restorative and co-creative process that actively contributes to the health and vitality of destinations (Fullerton, 2015; Wahl, 2016). It emphasizes reciprocity, resilience, and the integration of local and Indigenous knowledge in tourism design and management (Ateljevic, 2020; Bellato et al., 2022; Sheldon, 2021).

Rather than viewing destinations as resources to be sustained for future use, regenerative tourism conceptualizes them as living systems capable of continuous evolution and regeneration through the active participation of visitors, communities, and ecosystems (Cave & Dredge, 2020; Duxbury et al., 2021). In this paradigm, tourists are participants who actively contribute, with the goal not only to benefit from the destination but to leave it better than it was before their arrival.

Three main approaches have been proposed to conceptualize the relationship between sustainable and regenerative tourism: The Complementary and overlapping approach is the first approach. This perspective views regenerative and sustainable tourism as closely related concepts, often discussed side by side (Husamoglu et al., 2025; Inversini et al., 2023). Regenerative tourism is seen as extending sustainability by overcoming inherent limitations of the "do no harm" paradigm.

The Transcendence approach is the second approach**.** Here, regenerative tourism is interpreted as going beyond sustainable tourism. While sustainability aims to minimize harm ("do less damage"), regeneration aims to restore, renew, and enhance the social, cultural, and ecological systems influenced by tourism (Çakar & Uzut, 2020; Dredge, 2022; Duxbury et al., 2021; Ateljevic & Sheldon, 2022; Gerke et al., 2023).

Finally, the Evolutionary successor approach is the third approach**.** In this view, regenerative tourism is considered an evolutionary step forward from sustainable tourism, sharing foundational values but emphasizing proactive restoration and co-creation over maintenance and harm minimization (Becken & Kaur, 2022; Luong et al., 2023). Regenerative tourism builds on sustainability principles but aspires to leave destinations better than they were found, offering experiences that restore rather than consume resources.

In this paper, we adopt the evolutionary successor approach, conceptualizing regenerative tourism as an enhanced and more ambitious form of sustainable tourism that seeks net-positive socio-ecological outcomes.

3. CONCEPTUAL FRAMEWORK(S) AND CRITICAL ANALYSIS OF REGENERATIVE TOURISM'S FOUNDATIONS

The emergence of regenerative tourism represents a paradigmatic shift in how tourism is conceptualized, practiced, and governed. Moving beyond the sustainability paradigm, regenerative tourism reframes tourism as a restorative and co-evolutionary process that enhances the capacity of places, communities, and ecosystems to flourish. The concept builds on regenerative development and living systems theory, aligning with Indigenous and holistic epistemologies that view humans as integral components of the natural world rather than separate exploiters of it (Bellato, Frantzeskaki & Nygaard, 2022).

Although a single accepted definition of regenerative tourism has yet to be established, various scholars have proposed working definitions that reflect differing conceptual approaches. Table 1 synthesizes several widely cited definitions of regenerative tourism and highlights their core themes, such as human–nature integration, reciprocity, net-positive impact, and living systems thinking (Cave & Dredge, 2020; Dredge, 2022; Duxbury et al., 2021; Owen, 2007; Sheldon, 2021).

Table 1. Definitions of Regenerative Tourism in Academic Literature

Author(s) / Year	Exact or Closely Paraphrased Definition	Conceptual Emphasis
Owen (2007), p. 180	Regenerative tourism involves actively and thoughtfully interacting with a place to generate a constructive influence, recognizing humans as an integral part of the natural world and linking environmental concerns with socio-political action. "*Regenerative tourism lies in a more critical engagement with place in the design of ecotourism facilities*"	Human–nature integration; early ecotourism design focus
Duxbury et al. (2021), p. 3	"Regenerative tourism goes beyond sustainable tourism to focus on "giving back" and contributing to the proactive regeneration of communities, cultures, heritage, places, landscapes, and so forth."	Beyond sustainability; restoration and reciprocity
Cave & Dredge (2020)	Defined as *ensuring travel and tourism reinvest in people, places, and nature, supporting the long-term renewal and flourishing of social-ecological systems*, thereby promoting *social, physical, and mindful wellbeing*.	Flourishing systems; holistic wellbeing
Dreage, D. (2022), p 271	Regenerative tourism is defined as an approach that ensures travel and tourism reinvest in people, places, and nature, supporting long-term renewal and flourishing of social-ecological systems, requiring a mindset shift from individualism to collective thinking and from scientific management to a holistic, adaptive approach. *„Regenerative tourism, at its simplest, seeks to ensure travel and tourism reinvest in people, places and nature and that it supports the long-term renewal and flourishing of our social-ecological systems."*	Flourishing systems; holistic wellbeing
Bellato, Frantzeskaki & Nygaard (2022), p.9.	"*Regenerative tourism is a transformational approach that aims to fulfil the potential of tourism places to flourish and create net positive effects through increasing the regenerative capacity of human societies and ecosystems. Derived from the ecological worldview, it weaves Indigenous and Western science perspectives and knowledges. Tourism systems are regarded as inseparable from nature and obligated to respect Earth's principles and laws. In addition, regenerative tourism approaches evolve and vary across places over the long term, thereby harmonising practices with the regeneration of nested living systems."*	Transformational paradigm; living systems thinking
Bellato, Frantzeskaki & Nygaard (2024),p.1	Regenerative tourism is a transformational approach to healing relationships between tourism, places, and communities, with potential to support regenerative development of social-ecological systems, but often dominated by extractive approaches.	Transformational paradigm; living systems thinking

Source: *Authors' research*

Drawing on this literature, Bellato et al. (2022) propose a conceptual framework for regenerative tourism that consists of five design dimensions with integration of seven

practice principles. Table 2 illustrates the relationship between design dimensions, linked practice principles, and the types of outcomes envisioned for regenerative tourism.

Table 2: Conceptual Relationship between Dimensions, Principles, and Outcomes of Regenerative Tourism

Design Dimension What?	**Linked Practice Principles How?**	**How the Dimension Informs the Principle(s) Why?**
1. Place-Based Orientation: recognizing that regeneration begins with understanding the unique ecological, cultural, and social identities of places	1. Acting from Place-Based Awareness	Encourages deep understanding of place and relational engagement with its community and ecosystems. This means preserving and promoting authentic local culture, gastronomy, and tradition
2. Systems Thinking: positioning tourism as part of interconnected living systems rather than as isolated industry activity	2. Working with Living Systems; 6. Adapting Contextually and Iteratively	Promotes awareness of feedback loops, interdependence, and the need for adaptive, holistic approaches to regeneration. Such as encouraging the planting of trees, cleaning the environment, preserving biological diversity
3. Ethical Stewardship: emphasizing reciprocal relationships between hosts, visitors, and non-human entities	3. Practicing Reciprocity and Care; 7. Striving for Flourishing and Net-Positive Impact	Guides ethical and restorative action ensuring tourism gives back more than it takes, aiming for long-term flourishing. Therefore, this includes encouraging local production, reducing waste and recycling.
4. Collaborative Governance fostering co-creation among diverse stakeholders	4. Co-Creating Collaboratively; 3. Practicing Reciprocity and Care	Promotes shared decision-making, activities, and co-ownership of regenerative outcomes. Involving local residents in decision - making and benefits from tourism is crucial.
5. Transformative Learning cultivating awareness and consciousness that enables regenerative mindsets	5. Engaging in Transformative Learning and Reflexivity; 6. Adapting Contextually and Iteratively	Encourages learning-by-doing, reflexivity, and mindset shifts necessary for regenerative practice and adaptation. Possible activities of walking, cycling around the city, tourists participating in environmental or social projects.

Source: Adapted from Bellato et al. (2022)

These dimensions capture what regeneration means in theory and how it can be interpreted within tourism systems. Subsequent work has extended this framework to different contexts, including urban rivers, destination-level planning, and regenerative hospitality (Bellato et al., 2024; Iddawala & Lee, 2025; Inversini et al., 2023; Luong et al., 2023; Dredge, 2022).

In this study, the five design dimensions and associated practice principles serve as both (a) a diagnostic lens for analyzing tourism development strategies in BiH and (b) a structural framework for the survey instrument used to assess stakeholder perceptions. This dual application bridges theoretical understanding and empirical assessment, enabling us to evaluate how regeneration is understood and operationalized in a specific fragmented governance context, such as BiH.

4. RESEARCH METHODOLOGY

4.1. Research Design

A mixed-methods research design was employed to assess the potential for transitioning toward regenerative tourism in BiH. The research integrates qualitative content analysis of strategic tourism documents with quantitative survey data collected from key tourism stakeholders. This design allows for the combination of conceptual and policy-level insights with empirical evidence on stakeholder knowledge, attitudes, and perceived readiness.

4.2. Document Analysis

The desk research focused on key strategic documents on tourism development in BiH, specifically the Federation of BiH Tourism Development Strategy (2022–2027) and the Republika Srpska Tourism Development Strategy (2021–2027). These documents represent the primary policy frameworks guiding tourism development at the entity level.
A qualitative content analysis was undertaken to examine the extent to which these strategies reflect regenerative tourism principles, using the five design dimensions developed by Bellato et al. (2022).

4.3. Survey Design and Sampling

The quantitative component consisted of a survey designed to capture stakeholders' knowledge of regenerative tourism and their perceptions across the five dimensions of the conceptual framework. The questionnaire was developed based on the literature on regenerative tourism (e.g., Bellato et al., 2022; Dredge, 2022; Luong et al., 2023) and adapted to the BiH context. It was pre-tested with a small group of tourism experts and practitioners to ensure clarity and relevance.
The final survey included 30 closed-ended items structured into sections on knowledge of regenerative tourism, place-based orientation, systems thinking, collaborative governance and regenerative action, transformative learning, and ethical stewardship/experience of place. Each statement was rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). A short demographic section collected information about respondents' stakeholder type, age, gender, education, and location. A snowball sampling technique was used to reach respondents involved in tourism planning, management, and promotion, including tourism professionals, hospitality operators, representatives of local authorities, NGOs, community associations, and academics. In total, 46 respondents completed the survey. Given the non-probabilistic nature of the sample, findings are interpreted as exploratory and indicative rather than statistically generalizable.

4.4. Data Analysis

Quantitative data were analyzed using descriptive statistics (frequencies, percentages, means, and standard deviations) to identify general patterns. Where appropriate, items corresponding to each conceptual dimension were aggregated into composite scores to provide an overview of stakeholders' perceptions of place-based orientation, systems thinking, collaborative governance and regenerative action, transformative learning, and ethical stewardship/experience of place.

Table 3: Sociodemographic characteristics of respondents

Sociodemographic characteristics		Frequency	Percent (%)
Type of stakeholder	NGO	4	8,7
	Academia	6	13,04
	Student	8	17,39
	Tour operator	6	13,04
	Hospitality operator	3	6,52
	Local community	19	41,3
	Total	46	100
Age group	18-25	16	34,8
	26-35	9	19,6
	36-45	13	28,3
	46-60	7	15,2
	60+	1	2,2
	Total	46	100
Gender	Male	15	32,6
	Female	31	67,4
	Total	46	100
Education	PhD	7	15,2
	Master degree	7	15,2
	Bachelor	29	63
	Higher education	1	2,2
	Secondary school	2	4,3
	Total	46	100

Source: *Authors' research*

The results from the survey were triangulated with the findings from the strategic document analysis to develop an integrated understanding of the readiness and capacity of BiH's tourism sector to adopt regenerative tourism principles.

5. RESULTS AND DISCUSSION

5.1. Analysis of the Strategic Context for Tourism Development in BiH

The analysis of the Federation of BiH Tourism Development Strategy (2022–2027) and the Republika Srpska Tourism Development Strategy (2021–2027) indicates that both documents strongly emphasize sustainable tourism, product diversification, destination

marketing, workforce development, and digital transformation. Sustainability, gender equality, accessibility, and community involvement are articulated as guiding principles of tourism development.

Both strategies explicitly recognize the diversity of regional identities (e.g., Herzegovina, Una-Sana, Sarajevo, Tuzla) and core natural assets such as national parks, rivers, and spa resources. They highlight ecotourism, adventure tourism, rural tourism, and local gastronomy as priority products, which demonstrates awareness of the intrinsic value of local landscapes and communities. However, while authenticity and locality are emphasized, place-based elements are predominantly framed as market differentiators and competitiveness assets, rather than as vehicles for ecological regeneration or socio-cultural renewal. Thus, the place-based dimension is partially addressed but lacks explicit regenerative objectives such as ecosystem restoration or community-led conservation consistent with regenerative frameworks (Bellato et al., 2022; Duxbury et al., 2021).

Both strategies show weak-to-moderate systems thinking. They acknowledge linkages between tourism, agriculture, the environment, and local economies and align tourism development with sustainable resource management and broader development goals. Nevertheless, the primary focus remains on economic indicators and institutional reforms. Ecological interdependencies, cumulative impacts, and systemic resilience receive relatively less attention than would be expected in a fully regenerative approach (Capra & Luisi, 2014; Wahl, 2016).

Ethical principles are implicit in commitments to sustainable and inclusive growth, gender equality, and accessibility for persons with disabilities. References to environmental protection and international ethical codes (e.g., the UNWTO Global Code of Ethics for Tourism) suggest a degree of ethical orientation. Yet, neither strategy fully embeds reciprocal ethics as a regenerative value system or provides explicit guidance for net-positive environmental and social outcomes. Regenerative action—such as deliberate ecosystem restoration, circularity, or net-positive impact—is not a central organizing principle, echoing critiques that sustainability strategies often remain within a "do less harm" paradigm (Elkington, 2018; Higgins-Desbiolles, 2018).

The Federation strategy demonstrates relatively strong alignment with collaborative governance principles, having been developed through an inclusive process involving public, private, and academic stakeholders. This is consistent with regenerative tourism's emphasis on co-creation and shared stewardship (Cave & Dredge, 2020; Bellato et al., 2022). The Republika Srpska strategy also includes stakeholder consultations but appears more centralized, with less emphasis on institutionalized, long-term participatory mechanisms and co-management structures.

Both strategies emphasize human capacity-building and training in tourism, but primarily in relation to skill enhancement, competitiveness, and workforce quality. They pay limited attention to transformative learning, such as fostering ecological literacy, systemic awareness, emotional intelligence, and reflexive practice among tourism actors, which are central to regenerative approaches (Bellato et al., 2022; Sheldon, 2021).

Overall, the strategic context in BiH reflects a trajectory toward sustainable tourism rather than a fully regenerative model. Strategies focus on participatory planning, destination management, and resource efficiency but fall short of embracing restorative and co-evolutionary principles at the heart of regenerative tourism.

5.2. Analysis of Perceptions on Regenerative Tourism Development in BiH

The survey data offer insights into how stakeholders perceive regenerative tourism and its dimensions in practice. Results indicate a moderate level of conceptual awareness of regenerative tourism. Many respondents report familiarity with the concept and an understanding of how it differs from sustainable tourism, and they recognize its potential benefits for local communities. However, relatively few respondents report having received training or guidance on regenerative tourism practices, and only a minority feel confident explaining regenerative tourism to colleagues or stakeholders. This suggests that while regenerative tourism is emerging in discourse, it has not yet been mainstreamed into professional practice or formal education, mirroring broader observations in the literature (Becken & Kaur, 2022; Luong et al., 2023).

Table 4: Respondents' knowledge of regenerative tourism

Dimensions	*Strongly Disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly agree*	*Obs*	*Mean*	*Std. Dev.*
I am familiar with the concept of regenerative tourism.	8,7	15,22	23,91	30,43	21,74	46	3,41	1,24
I understand the difference between sustainable and regenerative tourism.	13,04	10,87	15,22	41,3	19,57	46	3,43	1,29
I am aware of the benefits regenerative tourism can bring to local communities.	10,87	6,52	21,74	36,96	23,91	46	3,57	1,24
I have received training or guidance on regenerative tourism practices.	26,09	39,13	19,57	8,7	6,52	46	2,30	1,15
I am confident in explaining regenerative tourism to colleagues or stakeholders.	17,39	19,57	26,09	28,26	8,7	46	2,91	1,24

Source: Author's research

The survey data show participants' familiarity and confidence regarding the regenerative tourism concept and principles. Overall, the results reveal moderate conceptual awareness but low levels of practical training and applied confidence. The respondents believe that tourism development is place-oriented (see table below). The respondents agree that local tourism planning takes into consideration the cultural and ecological specifics of the local places (76%), tourism promotes cultural heritage (82,61%), improves the well-being of local communities (80,43%), and that visitors are meaningfully interacting with local places and tradition (82,61%). On the other hand, opinion on the inclusion of local stakeholders in tourism planning is rather divided, where more than 50% of respondents are either neutral or do not agreeing with the statement that local stakeholders are included in tourism planning.

Table 5: Respondents' perception of place-based orientation in tourism planning and management

Dimensions	*Strongly Disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly agree*	Obs	Mean	Std. Dev.
Tourism planning in my area considers local cultural and ecological characteristics.	4,35	2,17	17,39	54,35	21,74	46	3,87	0,93
Local tourism activities promote the preservation of cultural heritage.	0	4,35	13,04	60,87	21,74	46	4,00	0,73
Tourism development prioritizes the well-being of local communities.	2,17	2,17	15,22	50	30,43	46	4,04	0,87
Visitors are encouraged to interact meaningfully with local places and traditions.	2,17	6,52	8,7	58,7	23,91	46	3,96	0,89
Local stakeholders are actively involved in tourism planning decisions.	2,17	26,09	26,09	45,65	0	46	3,15	0,89

Source: Author's research

With respect to system thinking integration in tourism development, respondents provide some evidence of cross-sectoral integration and system thinking in linking tourism with the local ecosystem (see table below), key performance indicators remain economic, with less attention to ecosystem health or social wellbeing.

Table 6: Respondents' perception on system thinking integration in tourism planning and management

Dimensions	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree	Obs	Mean	Std. Dev.
Tourism initiatives in my area consider environmental, social, and economic impacts together.	0	19,57	26,09	43,48	10,87	46	3,46	0,94
There is collaboration between tourism businesses and environmental organizations.	0	17,39	45,65	34,78	2,17	46	3,22	0,76
Tourism planning acknowledges the interdependence of human and natural systems.	0	17,39	21,74	54,35	6,52	46	3,50	0,86
Decisions about tourism take long-term ecological sustainability into account.	2,17	23,91	30,43	41,3	2,17	46	3,17	0,90
Stakeholders actively monitor and adapt tourism practices based on ecosystem health.	6,52	21,74	45,65	26,09	0	46	2,91	0,86

Source: Author's research

The ethical stewardship dimension assesses how tourism experiences embody values of respect, reciprocity, and mutual benefit between visitors, local communities, and the natural environment. The responses suggest a moderately strong ethical orientation in tourism experiences, though with room for deeper integration of ecological and cultural reflection (see table below).

Table 7: Respondents' perception of ethical stewardship

Dimensions	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree	Obs	Mean	Std. Dev.
Tourism experiences in my area foster a strong connection between visitors and the local environment.	0	8,7	26,1	50	15,2	46	3,72	0,83
Tourism encourages meaningful interactions between visitors and local communities.	0	4,7	20,9	55,8	18,6	43	3,88	0,76
Visitors are guided to slow down and immerse themselves in local culture and nature.	2,2	8,9	44,4	26,7	17,8	45	3,49	0,97
Tourism experiences emphasize the unique identity of each destination.	4,3	4,3	17,4	52,2	21,7	46	3,83	0,97
Tourism helps visitors understand the ecological and social systems of the destination.	4,3	15,2	17,4	47,8	15,2	46	3,54	1,07

Source: Author's research

Over 65% of respondents agreed or strongly agreed that tourism in their area strengthens the connection between visitors and the environment, with only 8.7% disagreeing. This result reflects solid awareness of environmental engagement, indicating that many tourism activities successfully encourage visitors to appreciate and interact with nature. Respondents also largely agreed that tourism experiences promote connection with the local environment (mean = 3.72, SD = 0.83, with 65% agreement) and support social engagement, reflecting alignment with regenerative tourism principles of reciprocity and place-based awareness. However, lower scores regarding opportunities for visitors to slow down and immerse themselves in local life (mean = 3.49, SD = 0.97) and to understand the ecological and social systems of destinations (mean = 3.54, SD = 1.07) indicate that these practices are not yet widespread or systematically embedded. Overall, while ethical awareness and community connection are recognized strengths, deeper integration of experiential learning and ecological interpretation is needed to advance from sustainable to fully regenerative tourism practice.

The analysis of the collaborative governance dimension reveals that tourism in the assessed destinations demonstrates a moderate level of collaborative and regenerative engagement, with tourism initiatives increasingly oriented toward generating positive socio-environmental outcomes (see the table below).

Table 8: Respondents' perception on collaborative governance and regenerative actions in tourism

Dimensions	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree	Obs	Mean	Std. Dev.
Tourism projects actively restore or enhance natural and cultural resources.	2,2	17,4	37	43,5	0	46	3,22	0,81
Tourism initiatives in my area contribute to the regeneration of local ecosystems.	4,3	15,2	50	28,3	2,2	46	3,09	0,84
Businesses implement practices that reduce waste, reuse resources, and recycle materials.	6,5	32,6	37	21,7	2,2	46	2,80	0,93
Tourism encourages practices that support local food systems and livelihoods.	4,3	21,7	21,7	43,5	8,7	46	3,30	1,05
Tourism projects are designed to generate net-positive impacts for the environment and community.	15,2	0	32,6	45,7	6,5	46	3,43	0,83

Source: Author's research

Respondents showed the highest agreement with items reflecting community-oriented and net-positive tourism practices (mean = 3.43, SD = 0.83, with 52% agreement) and support for local food systems and livelihoods (mean = 3.30, SD = 1.05, with 52% agreement), suggesting a growing awareness of tourism's role in strengthening local economies and contributing to community well-being. Moderate scores related to the restoration of natural and cultural resources (mean = 3.22, SD = 0.81) and the regeneration of local ecosystems (mean = 3.09, SD = 0.84) indicate that while collaborative intentions exist, practical implementation of regenerative actions remains limited. The lowest mean value, reflecting circular economy practices such as waste reduction and resource reuse (mean = 2.80, SD = 0.93), highlights a significant gap in business-level environmental responsibility. Overall, the findings suggest that although collaborative governance structures and awareness of regenerative objectives are emerging, deeper integration of cross-sector partnerships, community co-management, and resource circularity is required to advance tourism governance from a sustainable to a fully regenerative model.

The analysis of the transformative learning dimension reveals that tourism in the assessed destinations demonstrates a moderate level of learning orientation, with some evidence of openness to new approaches but limited structured opportunities for education and knowledge exchange (see table below).

Table 9: Respondents' perception on transformative learning

Dimensions	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree	Obs	Mean	Std. Dev.
Tourism businesses provide learning opportunities for staff about sustainability and regeneration.	4,3	23,9	47,8	19,6	4,3	46	2,96	0,89
Visitors are educated about the environmental and social impacts of tourism.	6,5	21,7	39,1	28,3	4,3	46	3,02	0,98
Tourism activities encourage reflection on personal and community responsibility toward nature.	8,7	10,9	26,1	45,7	8,7	46	3,35	1,08
There are programs to share regenerative knowledge among tourism stakeholders.	8,7	23,9	39,1	28,3	0	46	2,87	0,93
Stakeholders are open to learning new approaches to improve tourism's social and ecological outcomes.	2,2	10,9	34,8	43,5	8,7	46	3,46	0,89

Source: Author's research

Respondents expressed the highest agreement with statements reflecting stakeholder openness to learning and innovation (mean = 3.46, SD = 0.89, with 52% agreement) and the

encouragement of reflection on personal and community responsibility toward nature (mean = 3.35, SD = 1.08, with 54% agreement), indicating an emerging awareness of the need for mindset transformation within the tourism sector. Moderate results were observed for the education of visitors about the environmental and social impacts of tourism (mean = 3.02, SD = 0.98, with 33% agreement) and for the provision of learning opportunities for staff related to sustainability and regeneration (mean = 2.96, SD = 0.89, with 24% agreement), suggesting that capacity-building remains underdeveloped and largely ad hoc. The lowest score was recorded for the existence of programs to share regenerative knowledge among tourism stakeholders (mean = 2.87, SD = 0.93, with 28% agreement), reflecting a clear gap in institutionalized learning systems and collaborative knowledge networks. Overall, the results indicate that while individual openness and awareness are present, transformative learning is not yet systematically embedded in tourism practice, highlighting the need for structured education, inter-stakeholder learning platforms, and the integration of regenerative principles into professional training and visitor experiences.

Taken together, these results illustrate that tourism development in BiH, while increasingly sustainable, remains short of being regenerative. Strategies are still oriented toward economic growth, marketing, and infrastructure improvement, rather than toward restoring the ecological and social vitality of places.

6. CONCLUSIONS AND RECOMMENDATIONS

This paper investigates the transformative potential of regenerative tourism as a next step beyond traditional sustainable tourism for BiH. While current tourism strategies in BiH emphasize sustainability, inclusiveness, and economic growth, they largely lack explicit focus on regenerative principles of net-positive impact creation or systemic thinking. The analysis of entity-level tourism strategies shows that BiH's tourism policies emphasize sustainability, inclusiveness, product diversification, and competitiveness, and partially integrate place-based, participatory, and ethical principles. However, they lack explicit commitments to regenerative objectives such as net-positive impact, ecosystem restoration, and transformative learning.

Empirical findings reveal moderate stakeholder awareness of regenerative tourism concepts and limited practical application and collaborative governance mechanisms. Advancing regenerative tourism in BiH requires embedding ecological and cultural knowledge locally, shifting from impact minimization toward net-positive effects. The regeneration mindset must be cultivated through education and capacity-building that promotes reflexivity, empathy, and interdependence among all tourism actors.

This study makes several key contributions to the literature on regenerative tourism and sustainable development. First, it contextualizes regenerative tourism within a post-conflict and fragmented governance environment, illustrating how the legacies of conflict and decentralization continue to shape tourism development in Bosnia and Herzegovina (BiH). This contextualization highlights the importance of adaptive governance and participatory processes in achieving regenerative outcomes in complex socio-political landscapes. Second, the study empirically operationalizes a regenerative tourism framework based on Bellato et al. (2022) in a new regional setting, providing empirical insights into how regenerative dimensions align—or fail to align—with existing strategic discourse and

stakeholder perceptions. By applying this framework to BiH, the research extends the theoretical reach of regenerative tourism to post-socialist, transitional economies where structural constraints and fragmented institutional systems pose unique challenges. Finally, the study develops a set of context-specific recommendations designed to bridge sustainability and regeneration. These recommendations are aimed at policymakers, destination managers, and community organizations seeking to advance tourism practices that simultaneously promote economic vitality, ecological restoration, and social wellbeing.

To advance regenerative tourism in BiH, several strategic actions are proposed. First, regeneration should be explicitly integrated into future tourism strategies at both entity and canton levels. Such revisions should include clear regenerative objectives that emphasize ecosystem restoration, cultural heritage renewal, and net-positive socio-ecological outcomes. Second, strengthening collaborative and inclusive governance is essential. Building upon existing participatory mechanisms, multi-stakeholder platforms should be institutionalized to co-create tourism visions, projects, and monitoring systems in alignment with regenerative governance principles (Cave & Dredge, 2020; Hartman & Heslinga, 2023). Third, regenerative indicators and monitoring frameworks should be developed to complement traditional economic metrics. These indicators should capture ecological health, social cohesion, and cultural vitality, reflecting regenerative and doughnut-economy perspectives (Raworth, 2017; Hartman & Heslinga, 2023). Fourth, investment in capacity-building and transformative learning is critical. Training programs for tourism professionals, local authorities, and community organizations should incorporate regenerative concepts, systems thinking, and participatory design, while tourism and hospitality education should embed experiential learning approaches that foster ecological and social awareness (Sheldon, 2021; Wahl, 2016). Finally, policies and support mechanisms should encourage the development of regenerative products and experiences. Such initiatives could include environmental stewardship projects, community festivals, and slow travel experiences that engage visitors in place-based learning and restoration efforts. Collectively, these strategic actions can help position BiH as a leader in regenerative tourism within the Western Balkans region.

This study is exploratory and based on a small, non-probability sample of stakeholders, which limits the generalizability of its findings. Additionally, the document analysis was confined to entity-level tourism strategies, excluding canton and municipal plans that might offer further insights into local implementation of regenerative principles. Future research should expand on this work by conducting larger-scale surveys, in-depth qualitative case studies of regenerative initiatives, and comparative analyses involving other post-conflict or post-socialist destinations. Longitudinal research could also be valuable in tracing how regenerative discourse and practice evolve over time within BiH's tourism sector. Despite these limitations, the findings underscore that regenerative tourism offers a promising framework for aligning economic development with environmental restoration and social cohesion. By embedding regenerative principles in tourism governance, planning, and experience design, Bosnia and Herzegovina can move beyond sustainability toward a tourism model that actively contributes to the flourishing of people, places, and ecosystems.

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THE IMPACT OF STATE-OWNED ENTERPRISES ON REGIONAL DEVELOPMENT: THE ROLE OF PIK BELJE IN BARANJA IN THE SECOND HALF OF THE 20TH CENTURY

ABSTRACT

The research examines the role of the state-owned enterprise PIK Belje in the Baranja region during the second half of the 20th century, with particular attention to the 1970s and 1980s. The region has traditionally been characterized by strong agricultural capacities, yet it suffered long-term economic stagnation due to the loss of its natural markets following the Treaty of Trianon. In this context, PIK Belje emerged as a key driver of modernization and local development. The enterprise not only purchased agricultural products from the region—wine, grapes, and cereals—but also created new opportunities for small producers through targeted loans and contractual arrangements. Such support was deliberately tied to technological renewal, such as vineyard modernization and mechanization, thereby enhancing productivity. By guaranteeing demand and integrating local farmers into broader market structures, PIK Belje functioned simultaneously as a stabilizer and a catalyst of regional growth. My research shows that state-owned enterprises can contribute to mitigating market failures and promoting rural development in peripheral regions.

Keywords: *Baranja, PIK Belje, state-owned enterprise, rural development, market integration.*
JEL: N54, R11

1. INTRODUCTION

This study examines the impact of the state-owned enterprise PIK Belje on the economic development of the Baranja region between 1945 and 1991. Today, Baranja is in the north-eastern part of Croatia, bordered by the rivers Danube and Drava. Prior to the First World War, however, it belonged to the Kingdom of Hungary, forming part of Baranya County. The territory was officially annexed to the Kingdom of Serbs, Croats and Slovenes in 1922 (Merki, 2020, pp. 35–45). The origins of the Belje estate date back to the late 17th century, when Emperor Leopold I granted the territory to Prince Eugene of Savoy in 1687 as a reward for his successful military campaigns against the Ottomans. The estate later became one of the most significant agrarian-economic centres of the Habsburg dominions, already possessing a developed system of land management and extensive water regulation works by the 18th century. By 1911, the Belje estate was the largest landed property in the region, covering 109,062 cadastral holds (Kaposi, 2022, p. 11). The Belje estate region possesses exceptional natural endowments: the loess hills, humus-rich plains, and flood-prone lowlands all contributed to the development of agriculture and fishing. This diverse environment established the economic significance of the landscape already in the early period. The estate owners played a crucial role in expanding arable land and developing

infrastructure. In the first half of the 19th century, large parts of the Drava region were still marshy and unsuitable for cultivation. One of the most important milestones in the area's economic development was the construction of the Albrecht embankment. The 32-kilometre-long flood defence was built between 1827 and 1840 between Zmajevac and Grabovac and later reinforced and extended to Kopačevo between 1868 and 1877. The project was initiated and financed by Archduke Albrecht of Habsburg-Teschen, owner of the Belje estate. The flood protection system transformed large floodplain areas previously unsuitable for cultivation into arable land, laying the foundation for the agrarian development of the region in the 19th century (Közgazdasági Értesítő, 1882, p. 27). By the late 19th century, the region's economic development became increasingly tied to infrastructure expansion. One of the most significant examples of this was the construction of the Drava Valley Railway, which was primarily driven by the economic interests of large estates and the growing volume of agricultural production. To ensure the efficient transport of goods, landowners recognised that railway connections were essential for market expansion. The establishment of the railway not only facilitated transportation, but also promoted the economic integration of large estates, serving as a model for the modernisation processes that would later characterise the Drava region in the 20th century (Pécsi Napló, 1910, p. 11). During the Austro-Hungarian Monarchy, particularly after the Compromise of 1867, the effects of economic growth and modernisation became increasingly visible in Baranja. The technological progress and mechanisation characteristic of the Dualist era significantly increased agricultural yields, with the Belje estate leading this process. The estate was among the pioneers in introducing modern machinery and agricultural technologies, achieving a level of organisation and efficiency in production that far exceeded that of surrounding farms. In this period, the Belje estate became the driving force of agricultural development in Baranja, laying the foundations for its central role in the 20th century (Albrecht főherceg, 1883, pp. 224–230).

Following World War I, the Austro-Hungarian Monarchy emerged as one of the defeated powers, and because of the Treaty of Trianon, part of the former Baranya County was separated from Hungary and annexed to the Kingdom of Serbs, Croats and Slovenes. This territory corresponds to the area known today as Baranja, which now forms part of Croatia. The territorial change had a profound impact on the region's economy. From a commercial perspective, Baranja became completely isolated, as the previously established trade routes could no longer be used (Tarnai, 2025b, p. 142). The estates were plundered, and a significant portion of their land was redistributed among the newly settled South Slavic population. Many settlers received up to five hectares of fertile farmland, marking a radical transformation in local land ownership and agricultural structure (Taslidžić, 2021, pp. 77–85). Despite the state's stabilisation efforts, it was impossible to restore the former production levels on the large estates. A clear example of this decline is the sugar factory in Branjin Vrh, which had produced 1,800 wagons of sugar annually before the annexation, but by 1921 its output had fallen to only 140 wagons. Similarly, the Dairy Company in Beli Manastir produced 800–1,200 kilograms of butter per day before 1918, whereas by the spring of 1921, daily production had dropped to just 40 kilograms (Kaposi, 2022, p. 21). However, the confiscation of the estates represented a serious long-term setback. The machinery was looted, part of the skilled workforce left, and most of the new settlers required training. Central efforts to stabilise the situation, combined with the frequent replacement of management, only increased dissatisfaction and corruption. Although, thanks to intensive logging, the Belje estate, which operated under the authority of the Ministry of Finance of

the Kingdom of Serbs, Croats and Slovenes, managed to show a positive balance by 1926, the remaining production equipment had become obsolete over the years, and the number of workers had to be increased merely to maintain production capacity (Kolar-Dimitrijević, 1998).

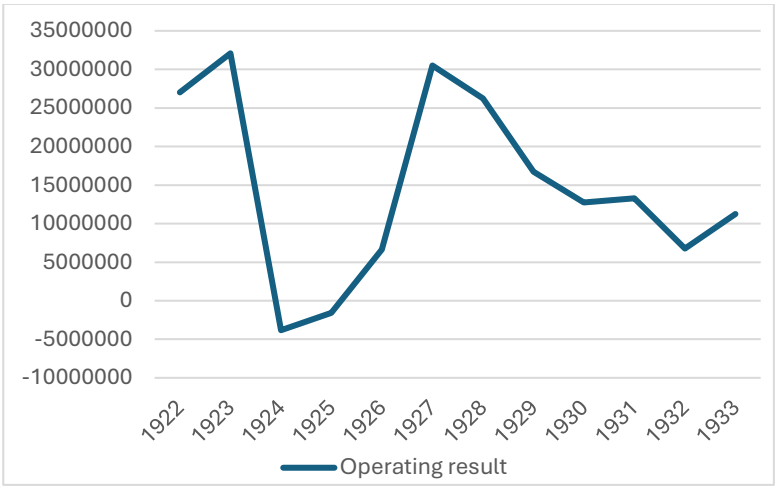


Fig. 1. Operating results of the state-owned company Belje, 1922–1933 (in dinars)
Source: Based on Čupić (1935), own compilation

An examination of Belje's financial performance between 1922 and 1933 (Figure 1) shows that during the first two years, the state-owned enterprise achieved significant profits. At that time, efforts were made to sell all assets and raw materials that had remained in the company's possession after the annexation.

By 1924–1925, however, the enterprise was already operating at a loss. In 1927, Belje's operating profit once again exceeded 30 million dinars, but subsequently began to decline steadily. This downturn can be attributed to the lack of modern machinery and technological progress (Čupić, 1935, p. 9). The company's successful operation was further hampered by the major flood of 1926. The Kingdom of Serbs, Croats and Slovenes did not allocate sufficient funds or attention to the maintenance of the flood protection system (Vízügyi Közlemények, 1928, pp. 21–24). Pumping the water and maintaining the dikes were extremely costly tasks, most of which had been financed by the former large landowners until 1918. After the dissolution and nationalisation of the estates, the responsibility for maintaining the embankments and pumps fell to the new state. According to contemporary sources, by 1877 the annual cost of maintaining the flood protection system built between 1827 and 1877 was estimated at more than 35,000 forints. This amount covered the operation of pumps, the maintenance of canals and embankments, as well as the employment of one engineer and four dike guards (Közgazdasági Értesítő, 1882, p. 27). This amount would have been difficult to bear for the Kingdom of Serbs, Croats and Slovenes, whose economy was standing on uncertain foundations.

In the summer of 1926, heavy rainfall caused flooding, during which the Danube broke through the embankments at Tikveš and Batina, while the Drava breached the dike near Belje. Numerous settlements were submerged, and railway transport had to be suspended

(Čiček, 1973). In the area of the Belje estate, two-thirds of the crops were destroyed, around two thousand deer and several hundred wild boars drowned, and the total damage was estimated at 21,952,370 dinars (Privredni pregled, 1926). At that time, not only the crops were lost in the flooded areas, but part of the production equipment as well. Some of the damaged modern machinery was later dismantled, and the usable parts were sold (Dunántúl, 1926, p. 4). As a result, part of the arable land remained flooded for a long time, and the lack of production equipment further increased the demand for labour, while simultaneously reducing the company's efficiency. The stable operation of the enterprise was further undermined by the Great Depression, which also affected Yugoslavia and led to a 56% drop in agricultural product prices and a 25% decline in industrial goods between 1925 and 1930 (Bíró, 2014, p. 68). The period of economic stagnation was finally broken in the early 1940s, when the region was re-annexed to Hungary. Archduke Albrecht of Habsburg moved the administrative staff of the reduced Belje estate from Sátorhely back to Kneževo, the former estate centre. The talented and experienced archduke aimed to transform the declining Belje estate once again into a model farm (Kaposi, 2025, pp. 107–118).
This endeavour was ended by the Second World War and the subsequent changes of borders.

2. LITERATURE REVIEW, METHODOLOGY AND THEORETICAL FRAMEWORK

The study builds on a diverse body of Yugoslav economic history literature and contemporary analyses of the PIK Belje enterprise, with particular emphasis on the multi-volume collection Tri stoljeća Belja (Three Centuries of Belje), published in 1986 (Karpati, 1986; Juriša, 1986; Grčić et al., 1986; Jeličić, 1986; Mandić & Guljaš, 1986; Polonji et al., 1986; Rilke, 1986; Rilke et al., 1986; Stipetić, 1986). These works provide essential insights into the company's long-term organisational development, technological modernisation and socio-economic role within socialist Baranja. To complement this Yugoslav literature, the analysis also draws on relevant Hungarian scholarship on economic history and regional development (Kaposi, 2022, 2025; Bíró, 2014; Merki, 2020; Tarnai, 2025a, 2025b), as well as archival documents, statistical records, contemporary newspapers and water-management reports that together offer a multidimensional empirical foundation.

Systematic literature on state-owned enterprises in Central and Eastern Europe further contextualises PIK Belje's regional role. Across socialist Hungary, Poland, Romania and the GDR, large state-owned enterprises functioned not only as major production units but also as drivers of local infrastructure, employment and technological upgrading. They often acted as stabilising regional anchors and development poles, particularly where private-sector capacities were limited (Szarzec & Nowara, 2017, pp. 375–379). Comparative performance studies show that the largest state-owned firms maintained strong regional influence well into the post-socialist period, especially in agriculture, energy and heavy industry (Szarzec & Nowara, 2017, pp. 381–387). This broader Central and Eastern European experience provides an essential comparative backdrop for interpreting the functions of PIK Belje.

Against this background, the study addresses four interrelated research questions:

1. *To what extent did PIK Belje contribute to the economic and social transformation of Baranja after the Second World War?*

2. *How did collectivisation and state agricultural policy shape regional development, and what mechanisms linked Belje to local restructuring processes?*
3. *In what ways did the enterprise influence employment, technological change, infrastructure development and the market integration of small farms?*
4. *How did state ownership and regional coordination interact with wider centre–periphery dynamics within Yugoslavia?*

Methodologically, the study combines historical and economic-geographical approaches. Archival research, the analysis of primary sources, statistical datasets and company reports, as well as spatial analysis of settlement patterns, production sites and transport infrastructure, make it possible to reconstruct Belje's regional role with precision. Source selection was based on relevance, representativeness and the availability of longitudinal data; however, the analysis acknowledges the limitations inherent in socialist-era documents, which often emphasised successes and may contain institutional or political biases. Triangulating multiple sources therefore remains essential for ensuring the reliability of the empirical findings.

The theoretical framework integrates three complementary approaches to regional development to interpret PIK Belje's position within Baranja's socialist economy. First, growth pole theory conceptualises economic development as spatially concentrated around dynamic enterprises that generate multiplier and spillover effects (Dobrescu & Dobre, 2014, p. 265). Growth emerges at specific "poles" that exert centrifugal and centripetal forces through input–output linkages (Darwent, 1969, pp. 6–7), unfolds via sequential stages of concentration, expansion and diffusion (Amos, 1990, pp. 38–39), and is driven by propulsive industries capable of inducing cumulative structural change (Thomas, 1975, pp. 5–7). This provides a useful lens for interpreting PIK Belje as a regionally embedded growth centre with significant influence over agricultural modernisation.

Second, unequal exchange theory offers a structural perspective on Baranja's historically peripheral position by emphasising the uneven flow of value between low-wage peripheries and high-wage centres (Ricci, 2019, p. 226). Wage differentials and pricing mechanisms cause peripheral producers to sell below value (Birkan, 2015, p. 157), while technological advantages and cyclical dynamics reinforce the centre's dominant position (Love, 1980, pp. 46–57). As a structural feature of the international division of labour (Bernal, 1980, p. 5), unequal exchange helps contextualise the constraints faced by Baranja and explains why Belje's integrative functions – input provision, marketing coordination and employment – were essential in mitigating regional disadvantages.

Finally, the theory of the state as a developmental actor highlights that large-scale structural transformation requires strong state capacity and coordinated intervention beyond what markets can achieve (Kerstenetzky & Kerstenetzky, 2023, pp. 4–8). Developmental states rely on capable and strategically oriented bureaucracies (Cai, 2010, pp. 1–3), regulate economic activity and provide services that build legitimacy (Clancy, 2018, pp. 6–7), and guide firms and sectors through long-term strategic planning (Routley, 2012, pp. 4–11). This perspective is particularly relevant in the Yugoslav context, where PIK Belje operated as a regional developmental instrument whose investments, coordination mechanisms and social functions contributed directly to Baranja's post-war economic transformation.

3. THE EXPERIMENT OF SOCIALIST COLLECTIVISATION IN BARANJA (1945–1953)

Following the Second World War, the economy of Baranja was completely paralysed. Industrial and agricultural capacities were either destroyed or ceased to function. The lands of the expelled or killed German population remained vacant and neglected. Livestock was taken away by retreating military units, while much of the arable land was flooded or lay fallow. The authorities sought to remedy this situation by establishing a socialist-type land ownership structure. One of its key instruments was land redistribution, from which mainly landless peasants and war veterans benefited.

During the colonisation wave associated with this reform, several thousand families settled in Baranja, mostly from the mountainous regions of Dalmatia, Bosnia, and Montenegro. However, the newcomers struggled to adapt to the new environmental conditions and often lacked agricultural knowledge. The central element of socialist economic policy became collectivisation. The state's objective was to organise peasants into agricultural labour cooperatives, which were, in principle, based on common ownership and collective management.

Baranja served as a pilot area for this process, where collective farming was implemented most intensively. By 1946, eight cooperatives had been established, and by 1949 this number had risen to fifty-seven, a national record. At that time, 90% of peasant farms in Baranja belonged to some cooperative. However, due to the lack of mechanisation and skilled labour, productivity gradually declined, while corruption, theft, and disorganisation characterised the cooperatives. The political leadership eventually recognised that the kolkhoz-type collectivisation had failed.

In 1953, the state decreed that cooperatives must either operate profitably or be dissolved. As a result, forty of the fifty-four cooperatives in Baranja were disbanded. The new form of agricultural organisation became the so-called "general agricultural cooperative", which represented a looser, cooperation-based structure. (Juriša, 1986, pp. 252–256)

4. THE SYSTEM OF COOPERATION BETWEEN PIK BELJE AND SMALL FARMS

The land reform also had a significant impact on the expansion of Belje's territory. After the war, portions of land previously owned by banks, churches, and private individuals were transferred to the state enterprise Belje, which from the 1950s operated as a "socialist agricultural estate". In this role, it demonstrated modern forms of socialist production, served as a model farm for surrounding smaller units, and played a key role in introducing technological innovations such as mechanisation, irrigation, seed production, and breeding material development.

The development of PIK Belje cannot be understood independently of agricultural policy. The company's objectives, strategies, and instruments were defined by the state. Moreover, modernisation efforts were primarily financed from state resources. Consequently, the enterprise functioned simultaneously as an ideological unit and as an economic model–

where state intervention both ensured progress (through mechanisation and infrastructure) and limited market autonomy (through price and credit controls).

After the dissolution of collectivisation in 1953, Yugoslav agricultural policy took a new direction. The emphasis gradually shifted from the unification of ownership forms towards economic integration and social cooperation. One of the most significant embodiments of this transformation was PIK Belje, which within the agrarian structure of socialist Yugoslavia operated not merely as a state agricultural enterprise, but as a regional agro-integrator.

From the mid-1950s onwards, Belje was gradually incorporated into the system of associated labour. The former state farm was transformed into a "kombinat" (agro-industrial complex), encompassing several basic organisations of associated labour (osnovne organizacije udruženog rada – OOUR). The organisation not only managed its own production but also coordinated the operations of surrounding small farms, cooperatives, and individual producers. In this way, PIK Belje became a vertical integrator within the Yugoslav agrarian model, creating a unified economic chain from raw material production through processing to marketing (Rilke et al., 1986, pp. 481–487; Rilke, 1986, pp. 488–492).

Subsequently, the company integrated the small farms and cooperatives of the surrounding villages into its production system through contractual relationships, providing them with technical and financial support. In this way, Belje assumed the role of a regional integrator within the Yugoslav agrarian model, making modern technology, expertise, and market access available to the peripheral areas as well. The 1970s marked the most intensive phase of development (Stipetić, 1986, pp. 149–168).

The agro-industrial complex functioned as a centre of modernisation and technological renewal during this period. In addition to mechanisation, water management, and product procurement, Belje provided high-quality seeds, fodder, breeding livestock, and machinery services to cooperating farmers. By the 1970s, approximately 70% of agricultural production in the surrounding villages was linked to Belje in some form. Agricultural cooperatives, processing plants, and the organisational units of the agro-industrial complex operated through joint planning and distribution, thereby creating a closed, self-sustaining production system.

The influence of the agro-industrial complex also reshaped the social structure: the proportion of the agricultural population decreased from 67% in 1954 to 22% in 1981, while part of the rural population found employment in Belje's industrial and service units. At the same time, the productivity of individual farms also increased, owing to Belje's professional and technological support.

By 1984, Belje had evolved into a complex regional system encompassing meat processing, a sugar factory, a winery, a seed plant, a feed factory, and numerous other processing units. Through the "business community" model, producers, cooperatives, and industrial plants participated jointly in economic planning and revenue sharing (Polonji et al., 1986, pp. 660–682).

5. THE ORGANISATIONAL STRUCTURE OF PIK BELJE

Within the Belje system, several production units operated, each striving to maximise its own income. Strong technological interconnections existed among these units: meat processing relied on fodder production, while grapes for winemaking were sourced partly from the company's own estates and partly from small local producers. The enterprise also produced input materials, most of which were used for raw material production.

Table 1: The hierarchical structure of the company

Level	Designation	Function
Level I	PIK Belje – Central Office	Central management, planning, finance, foreign trade
Level II	Work Organisations	Large sector-based units (agriculture, livestock breeding, food processing, etc.)
Level III	Basic Units	Specific production units: farms, plants, stations, factories

Source: Based on Grčić et al. (1986), own compilation.

The company's organisational model was aligned with the principles of Yugoslav self-management and consisted of three levels: central management, sectoral work organisations (RO), and basic production units (OOUR). The central unit, located in Beli Manastir, was responsible for planning, finance, foreign trade, and development functions. At the sectoral level, the work organisations (RO) coordinated the associated basic units (OOUR), which represented specific production areas such as crop farming, livestock breeding, and food processing.

The company's development and coordination functions were managed by the "Department of Cooperation and Development" within the work organisations, which oversaw contractual production with cooperatives and individual farmers and provided agronomic and technical advisory services to rural communities. Another key pillar of the system was the "Department of Community Services", which ensured infrastructure, mechanisation, irrigation, and maintenance (through machinery stations, water management, and construction units), while the "Sales and Services Department" organised commercial and hospitality activities, including product export and the management of local tourism facilities.

The organisational system of Belje was vertically integrated: all activities – from agricultural raw material production through industrial processing and marketing to foreign trade – were carried out within a single corporate structure. Geographically, the enterprise extended across the entire Baranja region, encompassing more than forty settlements, with approximately 31,000 hectares of cultivated land and an additional 11,000 hectares under cooperative production (Grčić et al., 1986, pp. 443–463).

6. THE IMPACT OF PIK BELJE ON SETTLEMENT DEVELOPMENT

From the 1950s onwards, the economic and settlement transformation of Baranja was closely linked to the growing role and development policy of PIK Belje. In the post-war years, the company played a decisive role not only in the reorganisation of agricultural production but

also in the modernisation of regional infrastructure and housing (Jelinović, 1986, pp. 93–110).

In the 1960s, Belje established its own construction division, the Investment and Construction Directorate in Darda, which employed around 200–250 workers and was equipped with a modern machinery fleet as well as its own carpentry and metalworking workshops. The directorate not only met the internal needs of the enterprise but also actively contributed to the development of surrounding settlements. Through its construction units, the company played a major community role by building roads, housing, schools, cultural facilities, and service apartments. During this period, new economic and residential zones emerged in and around Beli Manastir, Darda, Karanac, and Kneževi Vinogradi. Belje's self-financed investments created an infrastructural network that linked previously isolated villages and economic centres. The housing estates and workers' colonies – such as Mirkovac, Kneževo II, and the so-called "poljski centri" near Podunavlje – were integrated into the company's production structure, giving rise to new agro-industrial forms of settlement (Milošić, 1986, p. 726).

The development of the transport network also contributed significantly to the modernisation of the region. In 1951, Belje constructed a new railway network known as the "economic railway", which connected the company's production units to the Yugoslav state railway system (Jeličić, 1986, pp. 380–384). The reconstruction and expansion of Belje's industrial railway lines (such as Darda–Topolik and Jasenovac–Kneževi Vinogradi) enabled closer integration between production centres and settlements. Road investments carried out between 1960 and 1980, including the Osijek–Bilje–Beli Manastir main road, further enhanced rural mobility and improved access to public services (Jelinović, 1986, pp. 93–110).

From the 1950s onwards, extensive land reclamation and flood control works were carried out across the Belje estate. During this process, the previously flood-prone grazing areas were gradually drained and protected from flooding. By the mid-1960s, more than 11,000 hectares of land had been brought under cultivation, transforming meadows and pastures into mechanised, intensively farmed arable land. By the 1970s, the entire Belje area had become a flood-protected and efficiently utilised agricultural landscape, significantly increasing both the size of the arable land and the overall productivity of agricultural production (Bošnjak & Marjanović, 1986, pp. 574–578).

Between the 1950s and 1980s, PIK Belje played a decisive role in transforming the settlement structure of Baranja. Following post-war reconstruction and the development of transport infrastructure, the former agricultural settlements (such as Mirkovac) gradually became depopulated, as residents moved towards larger central towns – primarily Beli Manastir, Darda, and Kneževi Vinogradi. The establishment of industrial capacities – including a meat-processing plant, dairy, feed factory, and winery – together with infrastructural investments, created a new regional hierarchy in which Belje's production centres became the main hubs of economic and social life.

The floods of the 1960s and 1970s, along with state-organised relocation programmes, further accelerated the depopulation of villages and the process of urbanisation. Urban growth took on a planned form, as several smaller settlements merged with the emerging

urban centres – Bilje acquired a suburban function towards Osijek, Beli Manastir merged with the settlement known as Šećerana, and the zone between Darda and Mece became a continuous built-up area. Thus, the enterprise functioned not only as an economic actor but also as a spatial organising force: its decisions shaped the settlement network, influenced migration flows, and defined the patterns of urbanisation across the region (Jeličić, 1986, pp. 380–384).

7. THE IMPACT OF PIK BELJE ON EMPLOYMENT

The employment structure at PIK Belje underwent a profound transformation in the decades following the Second World War. In 1948, more than 7,400 people were employed by the company, primarily in the agricultural sector. However, in the early 1950s, mechanisation and rationalisation led to a 40 per cent reduction in the workforce.

Table 2: Employment Trends at PIK Belje (1948–1984)

Year	Total Employees	1948 = 100	Comment
1948	7 416	100	Post-war baseline
1952	4 882	66	Decline due to mechanisation and restructuring
1960	5 936	80	Industrialisation and organisational consolidation
1971	4 473	60	Agricultural rationalisation – lowest employment point
1980	6 354	86	Growth driven by industrial and processing sectors
1984	7 254	98	Nearly returned to 1948 levels, but with a completely different structure

Source: Based on Mandić & Guljaš (1986), author's compilation

The authors interpret this not as a social regression but as an indicator of increased economic efficiency. By the 1960s, Belje had already established industrial and processing divisions, and the employment structure gradually shifted towards agro-industrial integration. Between 1956 and 1983, the number of agricultural workers declined from 2,835 to 1,543, while processing units – such as meat, dairy, and feed plants – continued to expand. By the 1970s, the company had become the largest employer in the Beli Manastir district: in 1981, two-thirds of those employed in the public sector, around 9,260 people (7,160 permanent and 2,100 seasonal workers), worked for Belje. This structural shift was accompanied by a marked rise in educational attainment. Between 1964 and 1984, the proportion of employees with higher education increased from 1.6% to 4.5%, while those with secondary education grew from 4.7% to 15%, and the share of unskilled labour fell from 39% to 29%. At the same time, employee turnover declined sharply – from 20–25% in the 1960s to just 2.6% by 1984. The surge in productivity – for instance, a 43% improvement in wheat yields and a 56% reduction in labour time for dairy production – was the result of technological advances and a more skilled workforce. The average annual income per employee increased more than twentyfold between 1970 and 1982, further strengthening Belje's role as an economic and social stabilising force.

Overall, during the examined period, the company became not only the region's largest employer but also one of the key drivers of social mobility and rural resilience. The transition from agricultural overemployment to an integrated, industrial-type structure positioned

Belje simultaneously as an economic engine and a pillar of social stability in the Baranja region (Mandić & Guljaš, 1986, pp. 394–401).

8. THE ROLE OF PIK BELJE IN REGIONAL TRADE

Between the 1950s and 1980s, PIK Belje became one of the most successful models of market integration within the Yugoslav socialist agrarian economy. Established as a nationalised enterprise after the war, it gradually shifted towards market-based operations in the early 1950s with the introduction of the economic self-management system ("privredni račun"). The company developed its own commercial network, processing industry, and brand, which made Belje products well known and sought after across the Yugoslav markets. For the previously isolated Baranja region, this was of particular importance, as the combine directly ensured the marketing of products and provided the necessary technological background, thereby eliminating the market isolation that had been the main obstacle to development in the post-war years. The system of vertical integration enabled Belje not only to respond to market demands but also to shape them. The company's export activities–particularly in the meat, dairy, and wine industries–achieved significant success beyond Yugoslavia, especially in the markets of the Federal Republic of Germany, Italy, and Austria. Foreign trade created new sources of revenue and directly connected Baranja's economy to international market flows.

By the 1970s, Belje had become a model of a market-oriented combine: through its own sales, procurement, and foreign trade departments, it coordinated the relationship between production and the market. The commercial sector became the central hub for information exchange between production and sales – a particularly crucial function in a peripheral region such as Baranja, where market infrastructure had been weak following the border changes. Thus, Belje functioned not only as an economic actor but also as a regional integrator, linking local producers, cooperatives, and industrial units, and thereby setting the region's agrarian economy on a new and sustainable path of development (Karpati, 1986, pp. 727–739).

By providing market access to other economic actors as well, Belje influenced overall supply and fundamentally transformed several sectors of production. One notable example was viticulture. The company accepted only those grape varieties that it cultivated itself, which led to the disappearance of some previously dominant local varieties, such as "Kadarka", while others, like Graševina, became prevalent. Belje also influenced the methods of grape cultivation: producers who entered into contractual partnerships with the company were required to adopt modern, standardised agricultural practices (Tarnai, 2025a, p. 34).

9. PIK BELJE IN THE CONTEXT OF SOCIALIST STATE-OWNED ENTERPRISES

Large state-owned agro-industrial enterprises represented a characteristic institutional form across socialist Eastern Europe, serving not only as major production units but also as instruments of regional development. In Hungary, the rapid modernisation of agriculture during the 1960s-1970s led to the emergence of large, vertically integrated farms whose scale and organisational complexity resembled that of PIK Belje. The Bábolna State Farm offers the closest parallel: by the 1970s it had become a highly modern agro-industrial

complex combining crop and livestock production, feed manufacturing, food processing and research divisions (Csizmadia, 1975, pp. 6–7, 12). Contemporary reports highlight Bábolna's integrative role, as it supplied day-old chicks, standardised technology and coordinated a wide network of partner farms, significantly improving regional productivity (Szeinay, 1967, pp. 52–54). Other major Hungarian state farms—such as Nádudvar or Bóly—exhibited similar structures, blending large-scale cultivation with processing capacities and exerting considerable influence on rural labour markets and settlement development (Csizmadia, 1975, pp. 15–17).

The Yugoslav case also provides an instructive comparison. The Poljoprivredni kombinat Beograd (PKB) became the organisational backbone of Belgrade's food-supply system, producing most of the city's socialised agricultural output and embodying the policy of tightly integrating production with processing (Bajagić, 2005, p. 243). Like Belje, PKB operated as a large, technically advanced, vertically integrated enterprise whose activities extended beyond agriculture to regional provisioning and organisational coordination. Yet the two enterprises differed markedly in their regional functions: PKB was primarily an urban-oriented complex shaped by metropolitan demand, specialising in intensive sectors such as dairy, horticulture and meat processing, while PIK Belje was embedded in a predominantly rural, economically peripheral area where it assumed broader developmental responsibilities. Belje invested heavily in infrastructure, housing, social services and the integration of small producers—roles that exceeded those typically undertaken by Hungarian state farms or the more urban-focused PKB.

Taken together, these comparisons show that although PIK Belje shared structural similarities with other Eastern European state farms, its territorial embeddedness, multifunctional regional role and the developmental autonomy afforded by Yugoslavia's self-management system made it exceptionally influential in reshaping Baranja's economic and social landscape.

10. CONCLUSION

It is evident that after 1950, the management of the Belje state enterprise drew considerable inspiration from the pre-1918 estate economy of Belje. The company placed great emphasis on flood protection, infrastructure development, skilled labour, and technological advancement. By the 1980s, Belje had once again become a model agricultural enterprise. Although operating within a socialist framework, its structure was based on early forms of market-oriented management, making it one of the most successful examples of Yugoslav agrarian modernisation.

The company not only reorganised agricultural production but also established new types of economic relations, market mechanisms, and social cooperation that fundamentally transformed the region's structure. The first stage of development involved the centralised yet flexible reorganisation of the production system. Modelled after earlier state farms but operating under a self-management system, Belje effectively coordinated the activities of its various production units. The vertically integrated structure – encompassing everything from crop production to processing and marketing – enabled efficient coordination and contributed to the creation of stable markets across the region.

The second key factor was the modernisation of land use and infrastructure. Through land reclamation and flood control works, more than 11,000 hectares of new arable land were created, allowing for intensive, mechanised agriculture. The transformation of arable land benefited not only the enterprise itself but also surrounding smallholders, who gained access to cultivable land under similar conditions.

One of the most important drivers of economic growth was the cooperative system established with small farmers. From the 1960s onwards, Belje consciously built contractual partnerships with individual producers and cooperatives, who produced under guaranteed purchasing conditions with the technological, advisory, and financial support provided by the enterprise. This system integrated small-scale producers into industrial-scale production while ensuring them stable market access. Belje's purchasing and processing activities thus offered not only economic integration but also social security to rural inhabitants, for whom the company represented access to markets, technology, and stable income.

Another foundation of development was infrastructural and settlement modernisation. Through its own investments, the company built roads, railways, housing, and public facilities, which improved not only production logistics but also the quality of life in the region. Around industrial centres, new residential zones and services emerged, while former agricultural settlements were gradually absorbed into the central settlement network. Belje therefore played not only an economic but also an infrastructural and social-organising role.

The fifth pillar of regional development was market integration and foreign trade. Through its own sales network, Belje directly linked producers from Baranja to Yugoslav and international markets. The export of meat, dairy, and wine products – mainly to Austria, Italy, and West Germany – generated foreign exchange revenues and encouraged improvements in quality and efficiency among both small and large producers. Consequently, the previously peripheral region gradually became economically self-sufficient and competitive.

Overall, by the 1980s Belje had developed a complex development model in Baranja, where large-scale integration and smallholder cooperation reinforced one another in driving regional modernisation. The company's operations demonstrated that the key to rural development lies not solely in large-scale production, but in the effective combination of market, technological, and organisational cooperation.

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COMPARATIVE ANALYSIS OF MACROECONOMIC AGGREGATES OF THE WESTERN BALKAN COUNTRIES

ABSTRACT

This paper examines a comparative analysis of key macroeconomic aggregates in the Western Balkan countries, with a particular focus on Bosnia and Herzegovina. The objective is to identify similarities and differences in economic developments through indicators such as unemployment, inflation, real GDP growth, GDP per capita, foreign direct investment inflows, foreign trade, and research and development expenditures. Croatia and Slovenia are included as reference countries from Southeast Europe, providing a clearer benchmark for positioning the Western Balkans, given their successful transition, EU membership, and higher level of macroeconomic stability. The analysis is based on World Bank data, while projections for Bosnia and Herzegovina for the period 2024–2027 were obtained using linear regression and trend line methods. The main contribution of this research lies in the comparative positioning of Western Balkan economies within the broader European context and in offering empirically grounded recommendations for strengthening economic policies and fostering regional integration.

Keywords: *macroeconomics, Western Balkans, GDP, comparative analysis, economic projections.*
JEL: E01, O52, C53

1. INTRODUCTION

The Western Balkan countries, as a specific regional area in transition, face numerous economic challenges. For this reason, a comparative analysis of macroeconomic aggregates in the Western Balkans represents an important contribution to understanding regional development dynamics, as well as economic similarities and differences among the countries.

In accordance with this, the research is oriented toward the following key question: Which patterns of macroeconomic trends have dominated the Western Balkan countries over the

past decade, and what implications do they have for future economic projections of Bosnia and Herzegovina?

The subject of this paper is the analysis and comparison of key macroeconomic indicators such as GDP, inflation, unemployment rate, GDP per capita, and others in the Western Balkan countries, with a particular focus on Bosnia and Herzegovina and the projection of economic trends for the period 2024–2027. The general objective of the research is to analyze macroeconomic aggregates of the Western Balkan countries through a comparative approach, both theoretically and empirically, in order to identify trends and highlight similarities and differences among the countries in the region.

2. METHODOLOGY

This study relies on secondary data sources, primarily from the World Bank, European Commission, IMF, and OECD databases. A combination of descriptive, comparative, and regression analysis methods was applied. Economic projections for Bosnia and Herzegovina for the period 2024–2027 were estimated using linear regression and trend line models, based on historical data from 2012–2023. The regression model was applied using the FORECAST.LINEAR function in Microsoft Excel to predict future values of key indicators such as inflation, real GDP growth, and GDP per capita. The results are indicative and serve to highlight long-term trends rather than provide exact forecasts.

3. MACROECONOMIC AGGREGATES: THEORETICAL FRAMEWORK

Macroeconomic aggregates represent overall economic variables that measure the total economic activity of a country, enabling comparisons of economic development among countries and the analysis of broader economic trends in a global context. They are particularly important for transition economies, including the Western Balkan countries, as they provide insight into the success of the transition from centrally planned to market economies and reveal structural weaknesses and development potential (Dornbusch, Fischer & Startz, 2014, p. 14).

Gross Domestic Product (GDP) is the fundamental macroeconomic indicator and the most comprehensive measure of the final output of an economy within a country over a specific period—annually or quarterly (Hodžić & Handalić Plahonjić, 2022, p. 47). It reflects the total market value of all final goods and services produced by the factors of production within a national economy.

Another important indicator is GDP per capita, which represents the average economic output per person and is calculated by dividing total GDP by the population. This indicator is often used as a measure of living standards and economic development, as it provides a clearer picture of a country's real economic strength compared to total GDP alone (Krugman & Wells, 2018, p. 134).

The unemployment rate represents the share of unemployed persons in the total labor force of an economy. The labor force includes both employed and unemployed persons who are actively seeking work (Lipsey & Chrystal, 2015, p. 676). This is one of the key macroeconomic indicators because it reflects labor market conditions, economic cycles, and

social stability. High unemployment typically indicates economic difficulties, insufficient investment activity, structural problems in the economy, or a mismatch between the education system and labor market needs (Begg et al., 2014, p. 568).

Inflation refers to a general increase in the price level or a decline in the value of money. It represents the devaluation of monetary income, rising production costs, and disturbances in monetary flows, occurring when the volume of money in circulation exceeds the volume of goods and services. The inflation rate indicates how much additional money is needed to purchase the same basket of goods and services as twelve months earlier (Kasumović, 2011, pp. 147–148).

Foreign Direct Investment (FDI) contributes to economic development and poverty reduction in developing countries. However, a country must continuously work on creating an environment attractive to foreign investors through appropriate economic policies. In terms of economic impact, the most beneficial form of FDI has proven to be greenfield investments, which bring new jobs, new production technologies, and new products (Babajić, 2025, p. 149).

Exports are a key component of economic growth as they enable increased production, the generation of foreign exchange earnings, and enhanced international competitiveness. A higher volume of exports generally indicates greater productivity and diversification of economic activities, contributing to national economic stability and reducing dependence on domestic demand. In developing countries such as those in the Western Balkans, exports play a crucial role in attracting foreign investment and integrating into global economic flows (Krugman, Obstfeld & Melitz, 2018, p. 45).

4. MACROECONOMIC OVERVIEW OF THE WESTERN BALKANS: DEVELOPMENT CONSTRAINTS AND RESILIENCE TO GLOBAL ECONOMIC SHOCKS

The Western Balkans comprise six countries: Albania, Bosnia and Herzegovina, Montenegro, Kosovo, North Macedonia, and Serbia. These countries share a common transition history, similar economic structures, and aspirations toward European Union membership. The economies of the region are characterized by low GDP per capita, high unemployment, limited technological development, slow industrial modernization, and strong dependence on imports of essential products and energy. Most countries rely on foreign direct investment and remittances from abroad as key drivers of growth, while labor productivity remains below the EU average and the private sector is underdeveloped (European Commission, 2023). The main macroeconomic challenges in the region include fiscal vulnerability, high public debt, and persistent trade deficits, particularly in Bosnia and Herzegovina and Montenegro (World Bank, 2023). The labor market remains structurally inefficient, with high youth unemployment, while long-term emigration causes a loss of labor force and reduces growth potential (Hajdini et al., 2020). Although Serbia has made progress in industrial development and North Macedonia has strengthened its export capacity through technological zones, the region as a whole still shows limited competitiveness in global markets (OECD, 2021). The COVID-19 pandemic in 2020 led to a recession in all Western Balkan countries, with GDP declining between –3% and –15%, with Montenegro and Albania, both heavily dependent on tourism, being the most affected

(wiiw, 2020). The crisis increased unemployment, fiscal deficits, and public debt, while recovery measures additionally burdened public finances (IMF, 2021). After the pandemic, economies showed signs of recovery in 2021, but a new shock followed due to the war in Ukraine in 2022. The war in Ukraine caused strong inflationary pressures in the region due to rising energy, food, and raw material prices. Inflation exceeded 14% in Serbia and Bosnia and Herzegovina, and reached double-digit levels in North Macedonia and Montenegro (European Commission, 2023). Energy dependence on Russian gas created additional risks for the economies of Bosnia and Herzegovina and Serbia, while countries such as Albania and North Macedonia accelerated the transition toward renewable energy sources (Friedrich Ebert Stiftung, 2024). Geopolitical tensions further increased economic uncertainty, reduced investment inflows, and slowed trade flows.

5. ECONOMIC DYNAMICS OF THE WESTERN BALKANS: COMPARISON OF MACROECONOMIC INDICATORS

In addition to the Western Balkan countries, this analysis also includes Croatia and Slovenia as reference examples of post-transition economies. Including these countries provides a more relevant comparative perspective, as they have achieved a higher level of institutional development, EU integration, and macroeconomic stability compared to the Western Balkans.

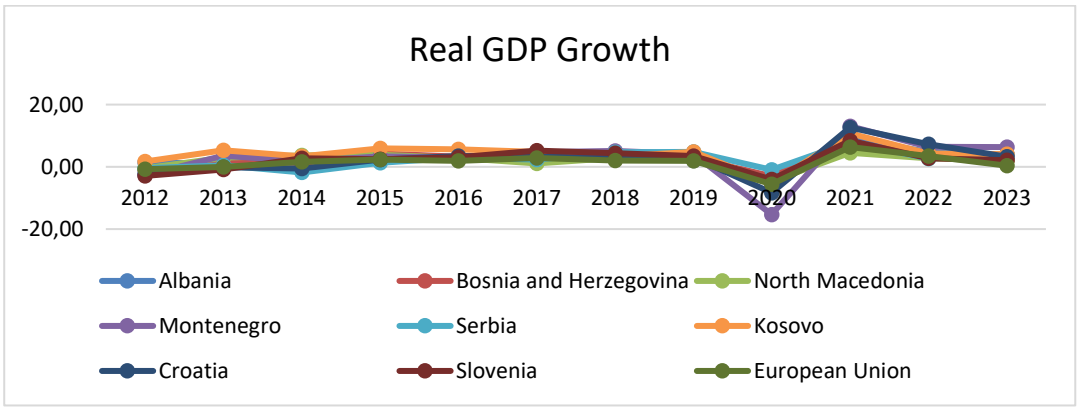


Fig. 1. Real GDP Growth (2012–2023)

Source: World Bank

As shown in Figure 1, during the period 2012–2023, the Western Balkan countries experienced moderate cyclical economic growth with a pronounced downturn in 2020 caused by the COVID-19 pandemic. Bosnia and Herzegovina recorded stable but modest growth (2019: 2.9%; 2023: 2.2%), remaining below Serbia and Montenegro in most years, indicating a slower convergence dynamic. The strongest post-pandemic recovery was recorded in Montenegro (2021: 13.0%) and Albania, driven by tourism and capital inflows, while Serbia maintained the most stable long-term growth rate. Slovenia and Croatia followed the economic patterns of EU member states, experiencing a deeper decline in 2020 and a strong recovery in 2021. In contrast, Bosnia and Herzegovina performed below the regional average in most years, pointing to weak domestic demand and low productivity.

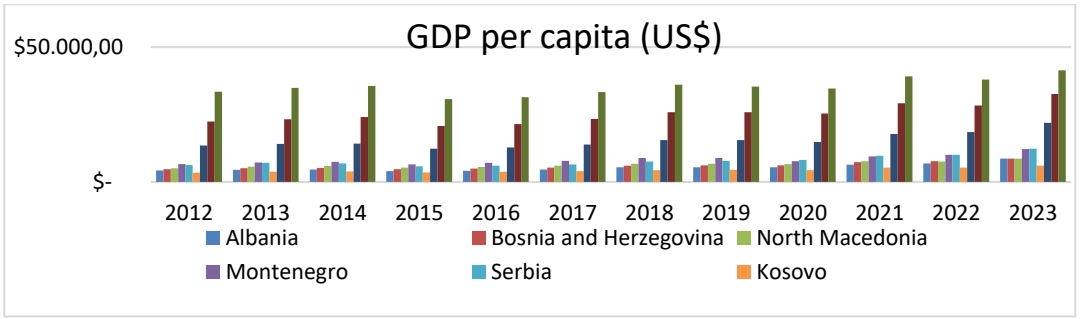


Fig. 2. GDP per Capita (US$)

Source: World Bank

GDP per capita data clearly indicate structural disparities between Western Balkan countries and EU member states. In 2023, Bosnia and Herzegovina, with a GDP per capita of 8,639 USD, recorded a nearly identical level of income per capita as Albania and North Macedonia, but significantly lagged behind Serbia (~12,281 USD) and Montenegro (~12,221 USD). The gap compared to Croatia (21,865 USD) and especially Slovenia (32,610 USD) suggests a deep divide in productivity and economic sophistication. Although Bosnia and Herzegovina shows gradual economic convergence (GDP per capita growth of +84% between 2012 and 2023), the pace remains insufficient to narrow the development gap compared to the EU average.

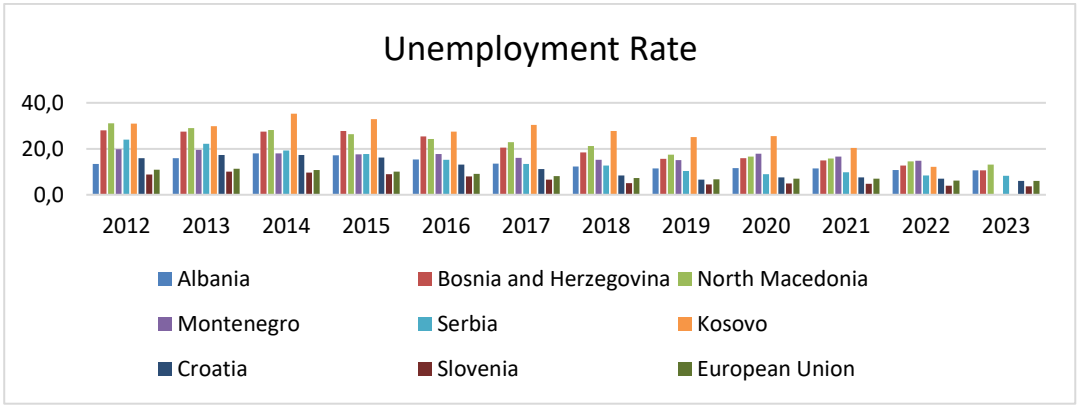


Fig. 3. Unemployment Rate

Source: World Bank

The unemployment rate in Bosnia and Herzegovina experienced the most substantial improvement among macroeconomic indicators in the analyzed period, dropping from 28.0% (2012) to 10.7% (2023). Despite this progress, Bosnia and Herzegovina still has a higher unemployment rate compared to Serbia (8.3%), Croatia (6.1%), and Slovenia (3.7%), but fares better than North Macedonia (13.2%), Montenegro (14.9%), and Kosovo (12.1%). Given the sharp decline in unemployment after 2017, the trend in Bosnia and Herzegovina indicates increased economic activity and partial labor market formalization, but it may also reflect significant labor force emigration.

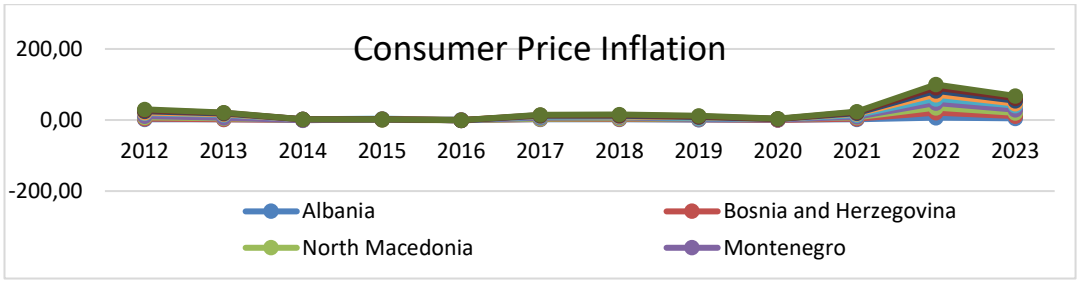


Fig. 4. Consumer Price Inflation

Source: World Bank

Inflation trends in the region show a sharp increase in price levels in 2022, mainly due to disruptions in global energy and food markets. Bosnia and Herzegovina recorded an inflation rate of 14.0% in 2022, slightly below North Macedonia (14.2%) and above the EU average (~8.8%). In 2023, all countries recorded disinflation, with Bosnia and Herzegovina achieving one of the better results (6.1%), below Serbia (12.4%) and Montenegro (8.6%), indicating price stabilization despite continued import dependency on energy markets.

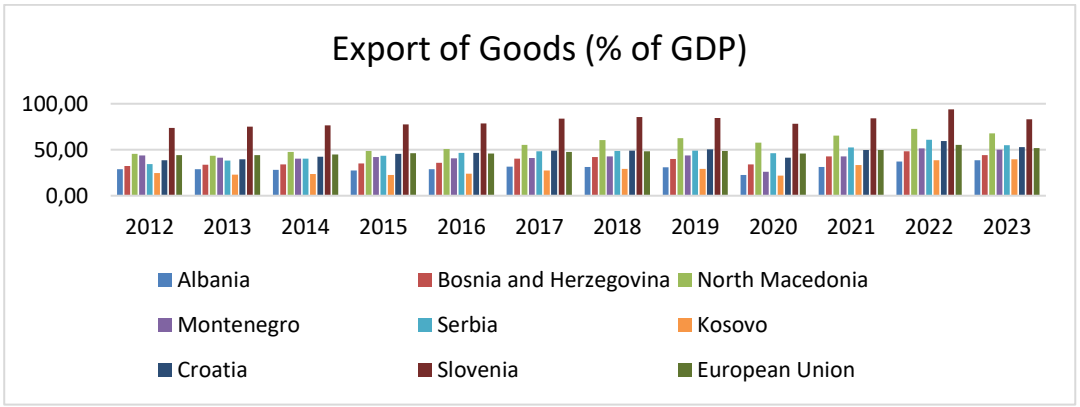


Fig. 5. Export of Goods (% of GDP)

Source: World Bank

Bosnia and Herzegovina's export intensity increased from 32.4% of GDP (2012) to 44.1% (2023), yet it remains below Serbia (55.1%) and especially North Macedonia (67.8%), both of which are better integrated into international production chains. Croatia and Slovenia demonstrate significantly stronger export capacities (52.9% and 83.3% of GDP), reflecting higher levels of industrial diversification and technological advancement. Bosnia and Herzegovina achieved export growth, but the structure remains dominated by low- and medium-low-tech sectors (metal processing and wood industry), limiting long-term competitiveness.

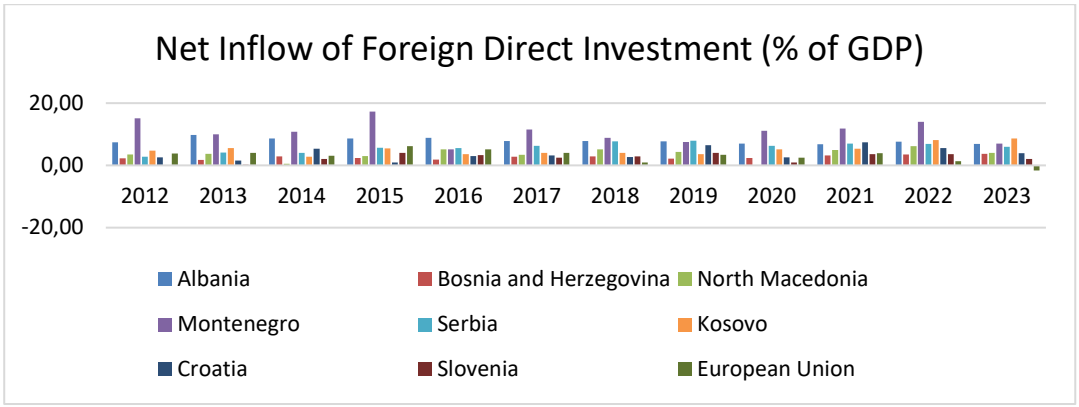


Fig. 6. Net Inflow of Foreign Direct Investment (% of GDP)

Source: World Bank

Foreign direct investment inflows in Bosnia and Herzegovina are stable but insufficient for stronger industrial growth. In 2023, net FDI inflows accounted for 3.8% of GDP, below regional leaders Albania (6.9%), Montenegro (7.0%), and Serbia (6.0%). Bosnia and Herzegovina remains a less attractive investment destination compared to its neighbors due to institutional constraints, fragmented markets, and weaker infrastructure. Furthermore, FDI inflows are largely based on reinvested earnings rather than new investment ventures.

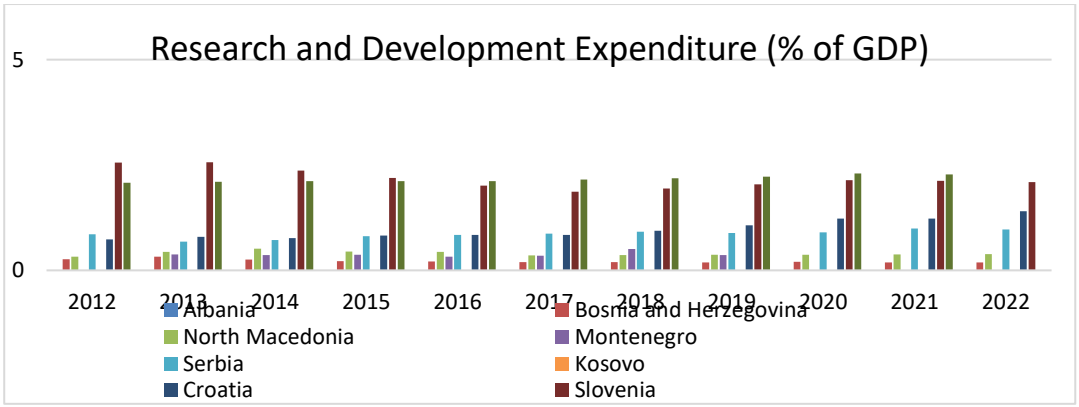


Fig. 7. Research and Development Expenditure (% of GDP)

Source: World Bank

Bosnia and Herzegovina invests the least in research and development (R&D) in the region—only 0.19% of GDP (2022), far below Serbia (0.97%), Croatia (1.40%), and Slovenia (2.10%), the only country close to the EU target of 3% of GDP. This data confirms a structural problem of low technological advancement and limited capacity for productivity growth and export sophistication, which directly slows economic convergence.

6. MACROECONOMIC PROJECTIONS OF KEY INDICATORS FOR BOSNIA AND HERZEGOVINA (2024–2027)

Macroeconomic projections for Bosnia and Herzegovina are based on World Bank data for 2012–2023 and include three indicators: inflation, real GDP growth, and GDP per capita.

Forecasts for 2024–2027 were generated using linear regression (FORECAST.LINEAR function in Excel) and a linear trend equation ($y = ax + b$) to estimate future values from historical data. The results are indicative and do not account for potential external shocks or structural changes.

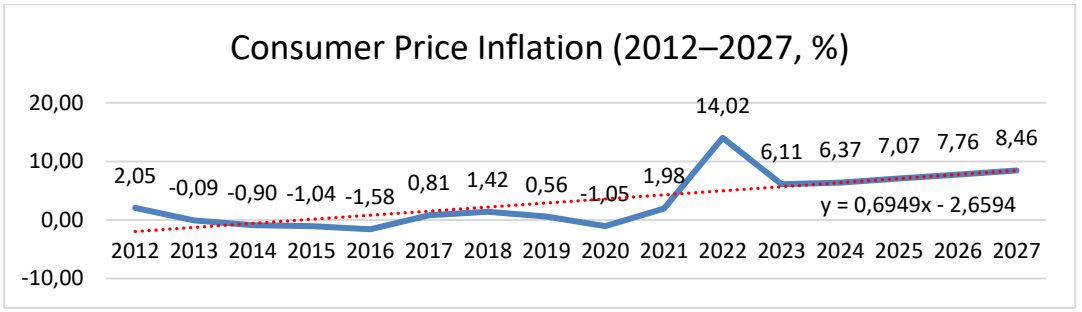


Fig. 8. Consumer Price Inflation (2012–2027, %)

Source: Author's calculations based on World Bank data

Figure 8 shows that after a significant decline in inflation in 2023 (6.11%), projections indicate a renewed increase in consumer price levels in the period 2024–2027. Inflation is expected to reach around 6.38% in 2024, rising gradually to 7.07% in 2025 and 7.77% in 2026, reaching approximately 8.46% by 2027. This upward trend suggests persistent inflationary pressures within the domestic economy, largely driven by rising import prices, energy costs, and weak productive capacity. Elevated inflation in the medium term may negatively affect real incomes and domestic consumption, as well as reduce economic competitiveness. These projections highlight the need for responsible fiscal policy and supply-side strengthening through structural reforms, especially considering the limited scope of monetary policy under the currency board arrangement in Bosnia and Herzegovina.

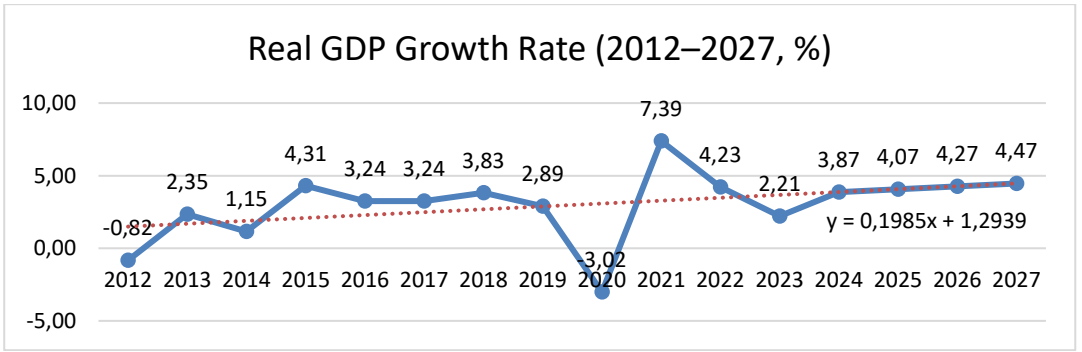


Fig. 9. Real GDP Growth Rate (2012–2027, %)

Source: Author's calculations based on World Bank data

Figure 9 illustrates that real GDP growth in Bosnia and Herzegovina is expected to remain moderate but stable in the period 2024–2027. According to projections, real GDP growth will reach 3.16% in 2024, followed by gradual acceleration to 3.30% in 2025, 3.44% in 2026, and 3.58% in 2027. This trend suggests a gradual economic recovery, driven primarily by private consumption, moderate export growth, and stable inflows of remittances from abroad, which continue to support domestic demand. However, projections also indicate that Bosnia and Herzegovina will continue to grow below its potential, primarily due to low

investment levels, labor market inefficiencies, and limited productivity. While growth projections are positive, they also point to the need for structural reforms to prevent long-term growth stagnation and improve competitiveness.

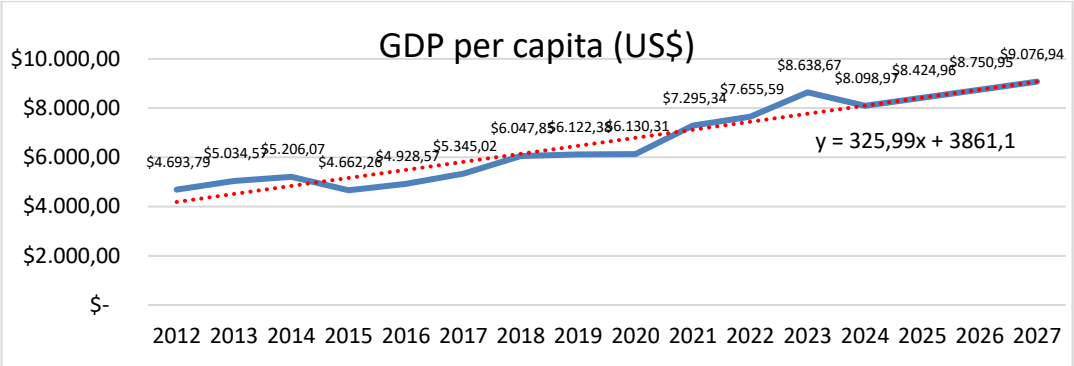


Fig. 10. GDP per capita (2012–2027, US$)

Source: Author's calculations based on World Bank data

Figure 10 shows that GDP per capita in Bosnia and Herzegovina is expected to continue its gradual growth in the period 2024–2027, indicating slow economic convergence with neighboring countries. According to projections, GDP per capita will reach 8,098 USD in 2024, rising to 8,425 USD in 2025, 8,751 USD in 2026, and 9,077 USD by 2027. While this growth is positive, the pace of economic convergence remains slow due to the absence of significant structural changes in productivity and industrial complexity. Although projected growth can be partially attributed to increased economic activity and moderate FDI inflows, Bosnia and Herzegovina will continue to lag behind regional economies such as Serbia, Montenegro, and especially Croatia and Slovenia in terms of living standards and productivity. This indicates that without deeper structural reforms, Bosnia and Herzegovina will face challenges in accelerating long-term socioeconomic development.

7. CONCLUSION

The analysis of macroeconomic aggregates of the Western Balkan countries shows that the region shares similar economic challenges: low GDP per capita, high unemployment, strong dependence on imports, and limited industrial diversification. Although some progress has been made in achieving macroeconomic stability, economic growth remains moderate and vulnerable to external shocks, as confirmed by the impact of the COVID-19 pandemic and the energy crisis. However, differences among the countries are evident, as Serbia and North Macedonia have achieved more export-oriented growth, Montenegro records high FDI inflows, while Albania shows progress in the services and energy sectors. Compared to these countries, Bosnia and Herzegovina achieves slower economic progress due to a complex institutional structure, underdeveloped business environment, and low levels of investment in productive sectors. Progress is visible in declining unemployment and increasing GDP per capita, but the country continues to lag in export competitiveness and attracting foreign investment. The weak innovation system and limited investment in research and development additionally constrain productivity growth and long-term economic convergence. In comparison to neighboring EU member states, particularly Croatia and Slovenia, the key challenge for Western Balkan countries remains the slow pace of structural

reforms. Slovenia represents a successful model of industrial and innovation-led development, while Croatia accelerated institutional and infrastructural development through EU accession. In contrast, the Western Balkan countries remain in a prolonged transition phase with insufficient institutional efficiency and weak economic governance.

In conclusion, sustainable development and economic convergence require stronger institutions, a better investment climate, export growth, and regional cooperation. For Bosnia and Herzegovina, long-term growth depends on structural reforms, higher productive investments, and deeper integration into European markets.

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THE DEVELOPMENTAL CONSEQUENCES OF SUBNATIONAL PUBLIC DEBT: EVIDENCE FROM THE CANTONS OF THE FEDERATION OF BOSNIA AND HERZEGOVINA

ABSTRACT

This study analyses the impact of public debt on the development level of cantons in the Federation of Bosnia and Herzegovina. The research covers the period from 2018 to 2024. Four indicators were used to measure the independent variable public debt: external debt, internal debt, total absolute canton debt, and the relative indicator of public debt calculated as total public debt / budget revenues of the canton. The dependent variable, canton development, was measured using the Development Index published by the Development Programming Institute of FB&H. To examine the impact of public debt on canton development, panel regression analysis was applied. In addition, correlation analysis was used to investigate the relationship between public debt and canton development, grouping cantons into three categories according to their level of development. The results indicate that public debt has a statistically significant effect on the development level of cantons. This effect is stronger and more positive in less developed cantons, whereas in more developed cantons, additional borrowing may be associated with a reduction in development. The study concludes that a differentiated approach to public debt management, tailored to the level of canton development, is necessary in order to optimize the developmental effects of public borrowing.

Keywords: *subnational public debt, economic development, development index, panel regression, Federation of Bosnia and Herzegovina.*
JEL: E62, H63, O23

1. INTRODUCTION

To ensure the smooth execution of their constitutional responsibilities, support economic growth, and finance budget deficits, government institutions often rely on borrowing to obtain the necessary funds. The debt incurred in this way is referred to as public debt. Investing financial resources in the economy creates jobs, increases purchasing power, and, as a result, leads to growth in national income (Khattwa & Alnagrat, 2024).

Public debt represents the accumulation of previous government budget deficits. In other words, it is the sum of outstanding obligations that the government owes to domestic and foreign creditors (Blanchard, 2012). Halebić (2021) states that public debt refers to the total

liabilities incurred by the state through borrowing for the purpose of financing public expenditures, with a distinction made between internal and external debt. A sustainable level of public debt is one of the key conditions for maintaining fiscal stability and the economic development of any country. Any irresponsible borrowing can limit the state's fiscal space, hinder the financing of infrastructure and social projects, increase interest costs, reduce the country's credit rating, and create risks of macroeconomic instability. On the other hand, if debt is used optimally, it can enable countries to finance development projects, stimulate investment and economic progress, while at the same time preserving fiscal discipline.

Public debt, borrowing, and guarantees in the Federation of Bosnia and Herzegovina are regulated by the Law on Debt, Borrowing, and Guarantees in the Federation of Bosnia and Herzegovina ("Official Gazette of FB&H", No. 45/10). This Law represents the key legal framework that defines the rules, procedures, and limitations related to public borrowing by the Federation of Bosnia and Herzegovina and its lower levels of government, including the cantons. The primary objective of the Law is to ensure the sustainability of public debt through clearly defined fiscal mechanisms and control over the assumption of obligations that may have long-term implications for budgetary stability. In addition to institutional oversight, the Law also prescribes quantitative limits. According to Article 21, the total annual amount of principal repayments, interest, and other costs arising from debt may not exceed 10% of the total realized budget revenues of the canton from the previous year. This limitation has a dual function: on the one hand, it prevents excessive borrowing and reduces the risk of illiquidity, while on the other hand, it also constrains the investment capacity of the cantons, as it narrows their ability to use debt as an instrument for financing development projects.

Economic development is a complex and multidimensional process that encompasses changes in the economic, social, institutional, and environmental aspects of a country or region. Although it is often used together with the concept of economic growth, economic development goes beyond the increase in gross domestic product (GDP) and includes broader aspects of improving quality of life and institutional capacity (Mićić, 2017). It is a phenomenon that is multidisciplinary and complex. For this reason, measuring economic development is challenging and cannot be reduced solely to traditional economic indicators; instead, it requires a combination of quantitative and qualitative measures.

Given the specific socio-economic and institutional circumstances in the Federation of Bosnia and Herzegovina, as well as the need for more precise monitoring of development levels at the regional level, a special Development Index was created by the Development Programming Institute of FB&H. This index was designed to integrate local indicators from various dimensions: economic, social, institutional, and infrastructural, in order to provide a comprehensive and realistic picture of the development level of cantons and municipalities/cities within the Federation. This enables a better understanding of developmental disparities among cantons, the identification of priority areas for intervention, and the monitoring of progress in achieving the entity's strategic development goals. The Development Index is a composite indicator calculated as a weighted average of several basic socio-economic indicators used to measure the level of development of cantons or units of local self-government.

Considering the above findings, the main research objective of this paper is to assess and explain the impact of canton-level public debt in the Federation of Bosnia and Herzegovina on the development level of cantons, whereby development is measured through the Development Index.

2. PREVIOUS RESEARCH

An analysis of previous research shows that authors have recognized the importance of linking public debt with indicators of economic development, although to a much lesser extent than the relationship between public debt and economic growth. One potential reason for this limited number of studies may be the complexity involved in calculating and interpreting composite indices of economic development, which encompass multidimensional aspects of living conditions and overall quality of life. Nevertheless, some studies have examined this relationship, emphasizing that the significance of public debt is best understood within the context of economic development, as this perspective provides insight into how borrowing can contribute to improving quality of life and overall well-being.

Saini and Muniyoor (2022), using structural equation modeling (SEM) based on secondary data from 1985 to 2018, examined, among other things, the relationship between public debt and economic development in India. Their findings indicate that economic development, measured through movements in the HDI index, has a negative relationship with public debt, measured as the debt-to-GDP ratio. This suggests that the accumulation of public debt tends to decrease as economic development progresses. In other words, improvements in the overall well-being and quality of life of the population are associated with reductions in the nation's public debt. The authors acknowledge that improvements in socioeconomic conditions are likely to enhance general welfare and thereby create more productive resources within the economy.

Two groups of authors from Nigeria — Julius and Odom (2024), as well as Ogbonna et al. (2023) — examined the effects of public debt on Nigeria's economic growth and development. Per capita income was used as the dependent variable, while economic development was measured using the HDI index. On the other hand, public debt as the independent variable was observed through domestic and external public debt individually, but also at the aggregate level.

The results obtained by the first group of authors indicate that neither external debt nor domestic debt was individually able to stimulate economic development, whereas total public debt — representing the combination of domestic and external public debt — positively drives economic growth, thereby improving per capita income. The second group of authors reached a similar conclusion, noting that neither external nor domestic debt has a significant impact on per capita income or the Human Development Index. It was recommended that, although public debt is inevitable — especially for a developing nation such as Nigeria — new borrowing should be undertaken with the condition that most of the funds go toward sustainable projects with promising prospects, and that the nation shifts from consumption to production (Ogbonna et al., 2023).

Most of the available empirical analyses indicate that borrowing can temporarily ease the financing of development programs and stimulate economic growth, but that in the long run, high levels of public debt may constrain fiscal space and slow down investment in key sectors such as education, infrastructure, and healthcare (Égert, 2015; Panizza & Presbitero, 2014; Reinhart & Rogoff, 2010). These findings highlight the need to analyze public debt not only through the lens of economic growth but also through the broader dimension of overall development, as only then can we fully understand the real contribution of borrowing to improvements in quality of life and social well-being.

Similar results for the broader European context are presented by Égert (2015), who shows that public debt begins to negatively affect GDP growth once it exceeds a threshold of around 85% of GDP. In a similar study, Checherita-Westphal and Rother (2012), analyzing eurozone countries, conclude that debt levels above 90% of GDP have a significant negative effect on long-term growth rates. These findings are further confirmed in the work of Panizza and Presbitero (2014), who emphasize that the relationship between debt and growth is not necessarily causal but depends on the institutional and economic context of each country.

3. RESEARCH METHODOLOGY

The assessment of the impact of canton public debt on the development level of cantons in the Federation of Bosnia and Herzegovina was carried out using panel regression analysis. The reason for applying panel regression analysis lies in the fact that the collected data contain both a cross-sectional component — the cantons — and a time-series component covering the period 2018–2024. In other words, the spatial dimension includes 10 cantons in the FB&H, while the time dimension spans 7 years.

The specified initial regression model is as follows:

$$Y_{it} = \alpha + \beta X_{it} + \varepsilon_{it}$$

Where:

- Y_{it} – dependent variable, the development level of canton i in year t, measured by the Development Index,
- β – coefficients of the independent variable(s),
- X_{it} – independent variable(s), representing public debt indicators for canton i in year t (external debt, internal debt, total debt, or debt-to-revenue ratio),
- α – intercept term,
- ε_{it} – error term capturing unobserved factors for canton i in year t.

To calculate the indicator of the dependent variable, the Development Index, data from the Federal Office of Statistics are used. Specifically, the min-max method is applied, whereby the normalized value of each indicator is divided by the normalized value of the indicator at the Federation level, according to the following formula:

$$X_i^* = \frac{\frac{x_i - x_{i,min}}{x_{i,max} - x_{i,min}}}{\frac{x_{i,FBiH} - x_{i,min}}{x_{i,max} - x_{i,min}}} = \frac{x_i - x_{i,min}}{x_{i,FBiH} - x_{i,min}}$$

Where Xi represents the value of the indicator for a canton, X_{min} and X_{max} represent the minimum and maximum values of the indicator at the canton level, and X_{FBiH} represents the value of the indicator at the Federation level. The weight assigned to each indicator used in

the calculation of the Development Index is determined according to the following percentages:

- Personal income tax revenues per capita 25%;
- Employment level 20%;
- Population dynamics 20%;
- Share of the elderly population 15%;
- Population education level 20%.

According to the development index in the Federation, cantons are classified into three development groups, where a higher group number indicates a lower level of development: I group (>1.25), II group (<0.60-1.25>), III group (<0.60).

The panel analysis was conducted in several steps to ensure the validity and reliability of the results. First, Pooled Ordinary Least Squares (POLS), Fixed Effects (FE), Generalized Least Squares (GLS), and Random Effects (RE) models were applied. Standard panel regression tests were used to select the most appropriate model: the Hausman test was employed to assess whether the effects are random or fixed, i.e., to determine whether there is a correlation between the independent variables and individual effects; the F-test was applied to test the significance of individual effects in the fixed effects model compared to the pooled model; and the Breusch–Pagan Lagrange Multiplier test was used to assess the presence of random individual effects relative to the POLS model. Based on the results of these tests, the POLS models were selected as the most suitable for analysis, as they demonstrated better fit to the data and less bias in coefficient estimates compared to the FE and RE models. After selecting the model, a detailed diagnostic check of the panel regression assumptions was performed. Specifically, the Durbin–Watson test was used to assess whether there is serial correlation among the model residuals. The White test was applied to verify whether the variance of the residuals remains constant. Normality of the residuals was checked using normality tests and Q-Q plots. Based on the results of these tests, all assumptions were satisfied.

4. RESEARCH RESULTS AND DISCUSSION

Before analyzing the panel regression results, the descriptive statistics of the observed variables are presented, including the number of observations, mean, standard deviation, minimum, and maximum values for each variable in the model.

Table 1. Descriptive statistics of the variables

Variables	Obs	Mean	Std. Dev.	Min	Max
Development index	70	.8437	.4943014	.2	2.04
External debt	70	27.8133	51.24617	.07	325.75
Internal debt	70	23.3173	39.6138	0	205.29
Total debt	70	51.3633	88.4004	1.49	517.42
Debt/revenue ratio	70	.150829	.097466	.00637	.4260816

Source: Authors' calculations, STATA

According to the descriptive statistics presented in the previous table, it can be concluded that the analysis is conducted on balanced data. The number of observations for each variable is 70, which corresponds to ten cantons over a period of seven years.

The following table presents the results of the POLS model for the independent variable, canton external debt, and the dependent variable, canton development, measured using the Development Index.

Table 2. POLS model results for independent variable public external debt

Number of obs	=	70	Development Index	β-coef.	Std. err.	T	P > t
F (1, 68)	=	61.61	External debt	.0066501	.0008473	7.85	0.000
Prob > F	=	0.0000	const.	.6587532	.049128	13.41	0.000
R-squared	=	0.4753					
Adj R squared	=	0.4676					

Source: Authors' calculations, STATA

The first relationship modeled using panel regression examines the connection between the dependent variable, the Development Index, and the level of external debt. According to the results obtained, there is a positive and statistically significant relationship at the 0.01 significance level. The estimated beta coefficient is positive, indicating that an increase in external debt positively affects the Development Index. This result implies that an increase in external debt by 1 million BAM leads, on average, to an increase in the Development Index of 0.00665 units, assuming all other factors remain constant. Expressed on a more realistic scale, an increase in external debt of 100 million BAM corresponds to an increase in the Development Index of approximately 0.665. Given that the index values in the observed sample range from 0.2 to 2.00, this effect is both significant and economically relevant, demonstrating the developmental potential of external debt. The model's F-statistic confirms that the model itself is statistically significant, while the coefficient of determination at 0.4753 indicates a model with high explanatory power. In other words, 47.53% of the variation in the Development Index can be explained by changes in the level of cantonal external public debt.

The following table presents the results of the POLS model for the independent variable, canton internal public debt.

Table 3. POLS model results for independent variable public internal debt

Number of obs	=	70	Development index	β-coef.	Std. err.	T	P > t
F (1, 68)	=	55.49	Internal debt	.0083642	.0011229	7.45	0.000
Prob > F	=	0.0000	const.	.6486827	.0513411	12.63	0.000
R-squared	=	0.4493					
Adj R squared	=	0.4412					

Source: Authors' calculations, STATA

The second relationship modeled using panel regression examines the connection between the dependent variable, the Development Index, and the level of internal debt. According to the results, there is a positive and statistically significant relationship at the 0.01 significance level. The estimated beta coefficient is positive, indicating that an increase in internal debt positively affects the Development Index. Specifically, an increase in internal debt by 1 million BAM leads, on average, to an increase in the Development Index of 0.008364 units, assuming all other factors remain constant. On a more realistic scale, an increase in internal debt of 100 million BAM corresponds to an increase in the Development Index of approximately 0.8364. Given that the index values in the observed sample range from 0.2 to 2.00, this effect is both significant and economically relevant, suggesting that growth in internal debt has greater developmental potential than growth in external debt. The model's F-statistic confirms that the model is statistically significant, while the coefficient of determination of 0.4493 indicates high explanatory power. In other words, 44.93% of the variation in the Development Index can be explained by changes in the level of cantonal internal public debt.

The following table presents the results of the POLS model for the independent variable, total public debt of the cantons, which represents the sum of internal and external public debt of each canton.

Table 4. POLS model results for independent variable total public debt

Number of obs	=	70	Development index	β-coef.	Std. err.	T	P > t
F (1, 68)	=	67.73	Total public debt	.00395	.0004799	8.23	0.000
Prob > F	=	0.0000	const.	.640802	.0488067	13.13	0.000
R-squared	=	0.4990					
Adj R squared	=	0.4916					

Source: Authors' calculations, STATA

The third relationship modeled using panel regression examines the connection between the dependent variable, the Development Index, and the level of total debt. According to the results, there is a positive and statistically significant relationship at the 0.01 significance level. The estimated beta coefficient is positive, indicating that an increase in total debt positively affects the Development Index. Specifically, an increase in total debt by 1 million BAM leads, on average, to an increase in the Development Index of 0.00395 units, assuming all other factors remain constant. On a more realistic scale, an increase in total debt of 100 million BAM corresponds to an increase in the Development Index of approximately 0.395. The model's F-statistic confirms that the model is statistically significant, while the coefficient of determination of 0.4990 indicates high explanatory power. In other words, 49.90% of the variation in the Development Index can be explained by changes in the level of cantonal total public debt.

The following table presents the results of the POLS model for the independent variable, relative public debt of the cantons, measured as the ratio of total public debt to budget revenues of each canton.

Table 5. POLS model results for independent variable relative public debt of cantons

Number of obs	=	70	Development index	β-coef.	Std. err.	T	P > t
F (1, 68)	=	26.51	Debt/revenue ratio	2.6861	0.521659	5.15	0.000
Prob > F	=	0.0000	const.	.43858	.093479	4.69	0.000
R-squared	=	0.2805					
Adj R squared	=	0.2700					

Source: Authors' calculations, STATA

The final relationship modeled using panel regression examines the connection between the dependent variable, the Development Index, and the level of relative debt. According to the results, there is a positive and statistically significant relationship at the 0.01 significance level. The estimated beta coefficient is positive, indicating that an increase in relative debt positively affects the Development Index. Specifically, an increase in the debt-to-revenue ratio of 0.01 (one percentage point) leads, on average, to an increase in the Development Index of approximately 0.0269 units, assuming all other factors remain constant. On a more realistic scale, an increase in the debt-to-revenue ratio of 0.10 (ten percentage points) corresponds to an increase in the Development Index of approximately 0.269 units. The model's F-statistic confirms that the model is statistically significant, while the coefficient of determination of 0.2805 indicates that the model has low explanatory power. In other words, 28.05% of the variation in the Development Index can be explained by changes in the level of cantonal relative public debt.

When comparing the results obtained from the regression analysis, which examines the individual impact of canton debt indicators on the Development Index, it can be concluded that all indicators have a positive and statistically significant effect on the dependent variable, although this effect is not equal across all variables. The strongest impact on the Development Index is observed for total debt, with the highest coefficient of determination, indicating the model's best explanatory power. A very strong effect is also present for the remaining absolute debt indicators, and these two models also demonstrate satisfactory explanatory power, whereas this is not the case for relative debt. Although the highest beta coefficient is observed for this variable according to the results, it is important to emphasize that this is a theoretical case and a consequence of the variable's interpretation. On the other hand, the coefficient of determination for this model is the lowest and lies at the boundary of an acceptable level. Taking all the above into account, the hypothesis that cantonal public debt positively and statistically significantly affects the Development Index of cantons in the Federation of Bosnia and Herzegovina cannot be rejected.

The second part of the analysis involves conducting a correlation analysis within each of the three categories of cantons based on their level of development. According to this index,

cantons can be classified into three categories (Group I – index > 1.25, Group II – index 0.6–1.25, and Group III – index < 0.6). By clustering the cantons into these three groups, the relationship between public debt and the Development Index will be examined for each group separately, in order to determine whether differences exist in this relationship across the groups. The following section presents the results of the correlation analysis between the dependent and independent variables individually for each of the three categories of cantons according to their level of development.

Table 6. Correlation analysis

Independent variable	Dependent variable: Development level of the cantons		
	Cantons according the development group		
	I	II	III
External debt – correl. (sig)	-0.9924 (0.0784)	0.1902 (0.2277)	0.9025 (0.0000)
Internal debt – correl. (sig)	-0.8423 (0.0174)	-0.1207 (0.4465)	0.8432 (0.0000)
Total public debt – correl. (sig)	-0.9607 (0.0006)	-0.0267 (0.8668)	0.8862 (0.0000)
Relative public debt – correl. (sig)	-0.8873 (0.0077)	0.5938 (0.0000)	0.7998 (0.0000)

Source: Authors' calculations, STATA

When the relationship between debt indicators and the Development Index is examined individually within each of the three categories of cantons by level of development, it can be concluded that the results differ across groups. In cantons from the first category, the correlation between debt indicators and the Development Index is negative and highly statistically significant. In the second category, which includes cantons with a medium level of development, no significant relationship can be observed between absolute debt indicators and the Development Index, while the correlation between relative debt and the Development Index is positive and statistically significant. A positive and statistically significant correlation is also observed between debt indicators and the Development Index in cantons of the third category, which comprises the least developed cantons. Based on these results, it can be concluded that the relationship between debt indicators and the Development Index varies depending on the level of development of the canton. The correlation is positive in cantons with lower levels of development and negative in cantons with higher levels of debt, which leads to the rejection of the hypothesis that the relationship between public debt and the Development Index is stronger in cantons with higher levels of development.

The obtained results show a positive impact of public debt on the Development Index of cantons in the FB&H, which is consistent with the findings of Julius and Odom (2024) and Ogbonna et al. (2023), who indicate that total public debt, as a combination of internal and external debt, can contribute to economic development when directed toward productive investments. It is particularly notable that internal public debt can have a constructive effect, as its use within domestic financial channels often allows for a more stable and sustainable contribution to economic development, as supported by studies such as Sheikh et al. (2010) and Abbas and Christensen (2010). These results confirm that, in the context of FB&H,

managing debt in a way that enables sustainable investments can contribute to improving the quality of life and socioeconomic indicators in the cantons. On the other hand, the results do not fully align with the findings of Saini and Muniyoor (2022), which show that in India, the accumulation of public debt may be associated with a reduction in economic development. These contrasting observations suggest that the effect of public debt on development largely depends on the level of development, the institutional framework, and the debt structure. Therefore, the positive impacts observed in FB&H may be the result of specific fiscal policies and the allocation of funds within the cantons, highlighting the importance of strategic debt management for achieving sustainable development.

5. CONCLUSION

In the analysis of the impact of public debt on the (under)development of cantons in the FB&H, the Development Index was used as the dependent variable, while the independent variable indicators included internal, external, total, and relative cantons' public debt. The results show that all analyzed variables have a statistically significant and positive impact on the Development Index, confirming that public debt, in the case of the cantons of the Federation of B&H, acts as a factor that increases the level of development. However, the intensity of this impact varies depending on the type of public debt indicator. Additionally, it was examined whether the relationship between public debt and development differs depending on the canton category according to the level of development. Based on the results of the correlation analysis, it was determined that there is a positive relationship for all categories of public debt: total, internal, external, and relative debt, which is more pronounced in less developed cantons, whereas in cantons with the highest level of development, this relationship is negative. In cantons with a medium level of development, no statistically significant relationship exists between absolute debt indicators and the Development Index, while relative debt shows a positive and statistically significant association with canton development.

The obtained results clearly show that the effect of public debt on the development of cantons is not uniform, but depends on their level of development. In the most developed cantons, increased borrowing is associated with a decrease in the Development Index. This indicates that funds obtained through public debt in these regions were not used in a way that contributes to further growth and improvement of the economic and social environment, but were likely allocated more toward current expenditures. As a result, the developmental function of public debt is lost, and it becomes a fiscal burden. Conversely, in the least developed cantons, borrowing had a positive and statistically significant impact on the Development Index. This suggests that in regions where basic needs are insufficiently met, additional funds obtained through borrowing contribute to development through investment in infrastructure, public services, and other projects that directly enhance the quality of life of the population and economic capacities. In cantons with medium levels of development, the absolute value of public debt did not show a significant impact, while the relative debt value was positively associated with the Development Index.

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QUANTITATIVE ECONOMICS

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FEATURE SELECTION FOR CASCO INSURANCE PRICING IN BOSNIA AND HERZEGOVINA: A MACHINE LEARNING APPROACH WITH XGBOOST

ABSTRACT

Digitalization has expanded insurers' databases, making machine learning (ML) a valuable tool for identifying key rsik factors in casco insurance pricing. While Generalized Linear Models (GLM) remain the standard, modelling claims frequency and severity separately is essential for accurately assessing the impact of each feature. Extreme gradient boosting (XGBoost), an ensemble ML method, can complement traditional GLM by improving predictive accuracy through feature selection. This study investigates a proposed hybrid XGBoost-GLM approach using a real-world dataset of 116.205 casco policies from a Bosnian insurer covering the period 2011-2023. The results show that XGBoost-based feature selection did not outperform the baseline GLM, which included all initial features without any selection. Deviance analysis confirmed that the baseline GLM with the full initial set of features achieved lower deviance and represented the optimal specification for the frequency-severity models. The modelling process was conducted in the R software environment (R Core Team, 2025).

Keywords: *casco insurance pricing, GLM, feature selection, machine learning, XGBoost.*
JEL: G22, C45, C52

1. INTRODUCTION

The growing adoption of machine learning (ML) in the insurance sector is enhancing risk evaluation and improving pricing accuracy. This trend reflects the industry's shift toward more advanced and adaptable approaches to risk assessment, pricing, and feature selection. In motor insurance pricing, multivariate tariff models require actuaries to define tariff classes and apply statistical models to predict potential losses (Paefgen et al., 2013). Traditionally, insurers have relied on a set of well-established risk factors (features) such as vehicle value, engine volume, and driver age. However, as the number of features increases, the dimensionality of the pricing framework expands, making the selection of appropriate variables a critical step in model development. As of 2024, casco insurance accounted for 10,79% of total premiums in Bosnia and Herzegovina, ranking second among non-life

segments after mandatory Motor Third Party Liability (MTPL) insurance (48,86%). This highlights the strategic importance of accurate pricing in maintaining insurers' profitability and competitiveness. Traditionally, Generalized Linear Models (GLM) have been regarded as the global standard for non-life insurance pricing, valued for their interpretability and transparency. However, with the growing availability of detailed data on insured risks, insurers now face the challenge of identifying the most relevant features even within the GLM framework. Recent advances in ML offer complementary approaches that can enhance traditional pricing models. Among these, XGBoost, a Gradient Boosting algorithm based on Decision Trees, has shown strong potential in non-life insurance pricing for identifying influential features and improving predictive accuracy. This study explores whether applying XGBoost-based feature selection can enhance GLM performance for casco pricing in Bosnia and Herzegovina. The extant literature provides a lot of work on using ML methods in non-life insurance pricing, particularly in motor insurance, both casco and MTPL. Various ML algorithms are used in modelling auto insurance premium, where authors make a comparison between performances of several algorithms deployed (Brati et al., 2025; So, 2024; Clemente et al., 2023). Also, there are studies that explore XGBoost method in particular and its applications in motor insurance pricing (e.g., Pesantez-Narvaez et al., 2019; Khusna & Murfi, 2020; Kollongei & Onyango, 2024; Fauzan & Murfi, 2018). On the other hand, with regard to studies conducted in the South-Eastern European (SEE) region and other emerging markets using ML methods for feature selection, only a few studies exist. It refers to the study by Omerašević & Selimović (2020), which presents results from Bosnia and Herzegovina using data-mining techniques. Apart from that, no existing studies elaborate this matter in the region.

This paper investigates the potential to enhance the performance of GLM for casco insurance pricing by incorporating XGBoost for feature selection. In this research, XGBoost is applied as a complementary tool as a GLM enhancer, to strengthen the GLM framework. The proposed hybrid XGBoost-GLM approach uses XGBoost to identify the most relevant predictors, which are subsequently included in the GLM estimation. The motivation lies in addressing the limitations of traditional GLM assumptions by leveraging the strengths of ML algorithms, aiming to preserve the interpretability and transparency of GLM while improving their predictive accuracy. This framework is designed to be applicable both to the Bosnian market and the broader South-East European (SEE) region. The standard frequency-severity modelling approach is employed. First, GLM for claim Frequency and claim Severity are estimated using all available features, without prior feature selection. Subsequently, alternative GLM are fitted using subsets of features selected via XGBoost. Model performance is assessed using the analysis of deviance. Since this study focuses on feature selection within the GLM framework as part of the pricing process, other tariff components such as overhead costs and non-risk-related adjustments are excluded from the analysis.

This study contributes to the literature in two main ways. First, it fills a research gap by applying ML-based feature selection in casco insurance pricing for small and emerging markets, being the first to evaluate a hybrid XGBoost-GLM framework in the Bosnian and SEE context. Second, it demonstrates that conventional GLM remain a valuable framework for insurance pricing, and their performance and interpretability can be enhanced through automated feature selection. The structure of this paper is as follows: Section 2 reviews the relevant literature, Section 3 outlines the research methodology, Section 4 presents the

empirical results, Section 5 provides a discussion, and the paper concludes with final remarks.

2. LITERATURE REVIEW

Standard frequency–severity GLM exhibit several methodological limitations. They assume a linear relationship between predictors and the response, independence between claim Frequency and Severity, and full credibility of observed data (Su & Bai, 2020; Clemente et al., 2023). These assumptions are often violated in practice, motivating the use of ML algorithms to enhance or extend GLM through automated feature selection. Positioned at the intersection of statistics and computer science, ML plays a central role in artificial intelligence and has demonstrated superior predictive performance across numerous applications. However, this performance gain often comes at the cost of reduced model interpretability. In insurance, ML methods, such as Decision Trees, Random Forests, Neural Networks, and Gradient Boosting techniques (e.g., XGBoost, LightGBM, CatBoost), are increasingly applied to pricing, reserving, and fraud detection. Feature selection in motor insurance pricing remains particularly challenging due to the complexity of modern datasets. Despite the rising prominence of ML, it remains essential to benchmark its performance against traditional GLM. Hellestøl and Eriksen (2022) compared four ML algorithms: CART, Random Forest, XGBoost, and Neural Networks with a benchmark GLM for claim Frequency among corporate insurance customers, finding that all ML methods outperformed the GLM. However, other studies have reported opposite results. Tuininga (2022), using vehicle insurance data, found that several ML techniques, including Gradient Boosting, XGBoost, Random Forests, and Neural Networks, did not outperform the GLM. Similarly, Clemente et al. (2023) obtained mixed results: Gradient Boosting outperformed the GLM in modelling claim Frequency, whereas the GLM yielded superior results for claim Severity. These contrasting findings suggest that the comparative performance of GLM and ML models in insurance pricing remains context-dependent, reinforcing the need for continued empirical evaluation. The optimal choice ultimately depends on whether the emphasis is placed on interpretability and transparency or on predictive accuracy and complexity.

The application of ML methods in actuarial research has increasingly focused on identifying relevant features in insurance pricing, with numerous studies demonstrating their effectiveness. Chen and Guestrin (2016) introduced the XGBoost algorithm, a Tree-based ensemble learning technique that has since become one of the most prominent approaches in non-life insurance pricing. As a Gradient Boosting framework, XGBoost efficiently handles both regression and classification tasks and is particularly well-suited for modelling complex feature interactions in insurance claim prediction. First, XGBoost and other ML techniques have been increasingly applied for feature selection in motor insurance pricing, while researchers often retain the GLM framework due to regulatory and interpretability requirements. Henckaerts et al. (2021) demonstrated that Gradient Boosting can effectively identify relevant predictors and interactions for GLM deployment, emphasizing transparency as a key consideration. Studies incorporating telematics data (Paefgen et al., 2013) compared "black box" ML models with Logistic regression, confirming that Neural Networks may improve accuracy. Further applications of Tree-based methods and XGBoost for variable selection and dimensionality reduction (Khusna & Murfi, 2020) highlight its computational efficiency and potential to maintain predictive performance with fewer features. To enhance GLM performance, Omerašević and Selimović (2020) employed

Forward Stepwise regression, Decision Trees, and Neural Networks for feature selection within the GLM framework, aiming to improve the accuracy of non-life insurance premium ratemaking.

Second, XGBoost has gained increasing attention in actuarial applications, particularly for modelling claim Frequency and Severity. Blier-Wong et al. (2021) identified Gradient Boosting and XGBoost as the most frequently applied ML methods in property and casualty insurance pricing and reserving. Pesantez-Narvaez et al. (2019) showed that XGBoost outperformed Logistic regression in predicting claim Frequency using telematics data, albeit with greater interpretability challenges. Similarly, Ibrahim et al. (2024) found that XGBoost and Gradient Boosting achieved comparable results for claim Frequency, while XGBoost outperformed Gradient Boosting for Severity prediction. Hanafy and Ming (2021) reported that Random Forests and C5.0 Decision Trees outperformed XGBoost and other methods for claim Frequency prediction. In contrast, several studies found XGBoost to achieve top performance or comparable results with other ML techniques across different insurance datasets (Fauzan & Murfi, 2018), while Brati et al. (2025) observed Random Forests slightly outperforming XGBoost in predicting high claims. These mixed findings highlight that the relative performance of XGBoost depends on data characteristics, target variables, and evaluation criteria. Previous research (Krùpovà et al., 2025; Brati et al., 2025; Khusna & Murfi, 2020; Kollongei & Onyango, 2024) has shown that the XGBoost model is widely used among ML algorithms for non-life insurance pricing and demonstrates superior performance in predicting claim occurrences, even on relatively small datasets (Pesantez-Narvaez et al., 2019). These findings served as the main motivation for selecting XGBoost in this study. XGBoost is a state-of-the-art ensemble method based on Gradient Boosting and has achieved notable success in multiple Kaggle ML challenges. Based on the literature review, we selected the XGBoost algorithm to enhance GLM for casco insurance pricing in Bosnia and Herzegovina.

3. RESEARCH METHODOLOGY

3.1. Dataset and features

This study uses a comprehensive, real-world casco insurance dataset from a Bosnian insurer, covering 2011-2023 and spanning both entities, the Federation of Bosnia and Herzegovina and the Republic of Srpska. All data have been anonymized to ensure confidentiality and compliance with privacy regulations. The dataset includes two categories of features: policyholder characteristics (Branch office, Client type, Gender, Driver´s age and Region) and vehicle characteristics (Document type, Car type, Vehicle´s age, Vehicle value, Engine power, Engine volume, Load capacity and Number of seats). The same set of features is used for both Frequency and Severity GLM, with claim count and claim severity as dependent variables, respectively. Final models are selected based on analysis of deviance. The modelling process was conducted on a machine running Microsoft Windows 11 Pro with an Intel Core i5-120U processor (10 cores, 12 logical processors, 1.40 GHz) and 16 GB of RAM. Analyses were performed in R (v. 4.4.3) using the following packages available on the CRAN: xgboost for feature importance; caret for data splitting (Kuhn, 2008); dplyr for data manipulation; ggplot2 for visualization; and Metrics for computing Root Mean Squared Error (RMSE) and Mean Squared Error (MSE).

3.2. Research design

The proposed modelling procedure is illustrated in Figure 1. The analysis begins with data preprocessing, followed by partitioning into training and test sets. Model tuning is performed using grid search and 5-fold cross-validation within the XGBoost algorithm, after which feature selection is conducted based on XGBoost variable importance. XGBoost is an embedded feature selection technique that incorporates variable selection directly into the model training process. Subsequently, GLM are fitted separately for claim Frequency and Severity. First, a baseline GLM is fitted using all features, and then a GLM is fitted using the XGBoost-selected features. According to the results of analysis of deviance, the final GLM are selected based on this criterion for potential deployment.

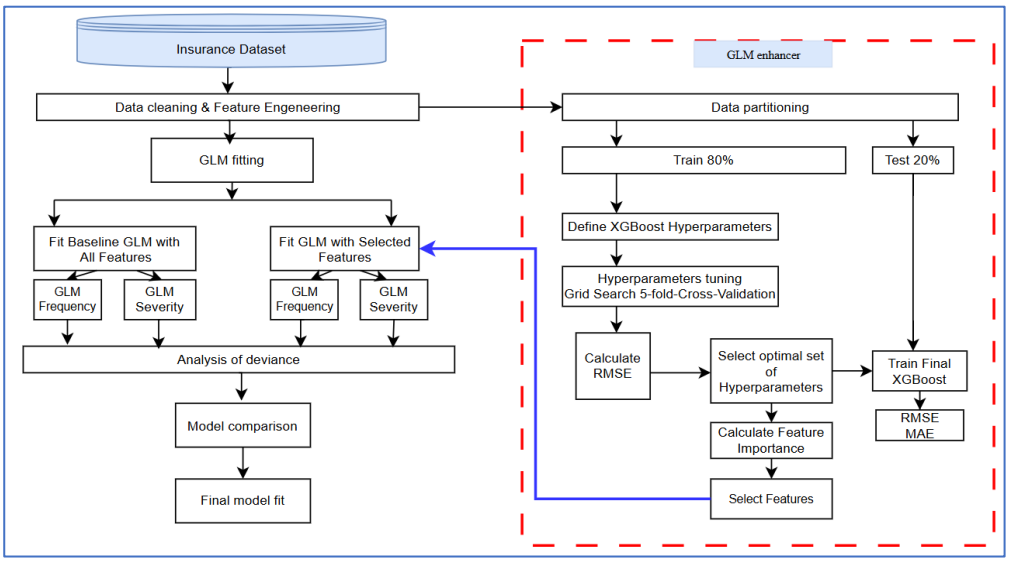


Fig. 1. Flowchart of proposed hybrid XGBoost-GLM model

4. RESULTS

4.1. Data preprocessing

The first step of the analysis involved data cleaning, feature engineering, handling missing values, and the discretization or binning of numerical and categorical variables. This stage is crucial, as insurance claims data are often noisy and prone to errors, which can compromise model reliability. The original dataset comprised two sources: the policy database (168.076 records) and the claims database (38.535 records), which were merged using unique ID variables to form a combined dataset of 116.205 motor insurance policies with 13 risk factors. Numerical features, such as vehicle age and engine power, were discretized based on expert judgment, while categorical features, such as region, were encoded with the reference level defined as the one with the highest exposure.

For the feature selection process using the XGBoost algorithm, the dataset was partitioned into training and testing subsets, with 80% of the data used for model training and the remaining 20% reserved for evaluating the model's generalization performance. To ensure reproducibility, a fixed pseudo-random number generator [*set.seed()* in R] was applied,

ensuring that the training and test splits remained consistent across all modelling procedures and scripts. A correlation analysis at the 1% significance level was conducted to identify redundant features, resulting in the exclusion of Gender, Branch office, and Driver's age due to strong correlations with other features. Subsequent analyses were performed using the remaining 10 features and an intercept. The features encompass policyholder characteristics (Client type and Region) and vehicle characteristics (Document type, Car type, Vehicle age, Vehicle value, Engine power, Engine volume, Load capacity, and Number of seats). The key variables in this study include the number of claims per policy (2011–2023), claim severity expressed as the total claim amount per policy (in BAM), and the premium charged per policy (in BAM). In addition, several derived variables were created through feature engineering: exposure (policy duration in days divided by 365), claim frequency (number of claims divided by exposure), and the average claim amount (total claims divided by the number of claims). Although the dataset is relatively small for ML models, it is of high quality, with complete and reliable real-world data, providing a solid basis for modelling. The descriptive statistics of the dataset provide an overview of the distribution of claims and claim amounts across the portfolio. As is typical in casco insurance, a high proportion of policies had no reported claims, with 76,42% of policies being zero-claim policies. Among policies with reported claims, the majority experienced only a single claim, representing 19,43% of the portfolio. Regarding claim severity, the average claim amount across the portfolio is 585 BAM.

4.2. XGBoost for feature selection

The XGBoost algorithm requires hyperparameter optimisation, which in this study was conducted using a grid search procedure combined with 5-fold cross-validation to identify the optimal parameter configuration. The default XGBoost parameter values are presented in Table 1. Hyperparameter optimisation for the XGBoost models was conducted via grid search over a range of values for each parameter, rather than using the default settings. These ranges were determined based on the official XGBoost documentation (XGBoost developers, n.d.) and relevant scientific literature. The optimal configuration obtained was used to train the final models, which were subsequently evaluated on the test dataset using RMSE and MSE.

Table 1. Parameters tuning for the claim Frequency and Severity XGBoost models

Hyperparameter	Default	Grid	Optimal - Frequency	Optimal - Severity
Eta	0,3	[0,1; 0,3; 0,7]	0,1	0,7
max_depth	6	[6; 8; 10]	8	10
Subsample	1	[0,5; 0,7; 1]	0,7	1
colsample_bytree	1	[0,5; 0,7; 1]	0,5	1
Lambda	1	[1; 2]	2	2
Alpha	0	[0; 1]	0	1
gamma	0	[0; 0,05]	0	0,05
Number of trees			233	13
RMSE (test data)			1,2196	4392,958
MSE (test data)			1,127	2040,145

Figure 2. shows the features selected by XGBoost for the Frequency and Severity models.

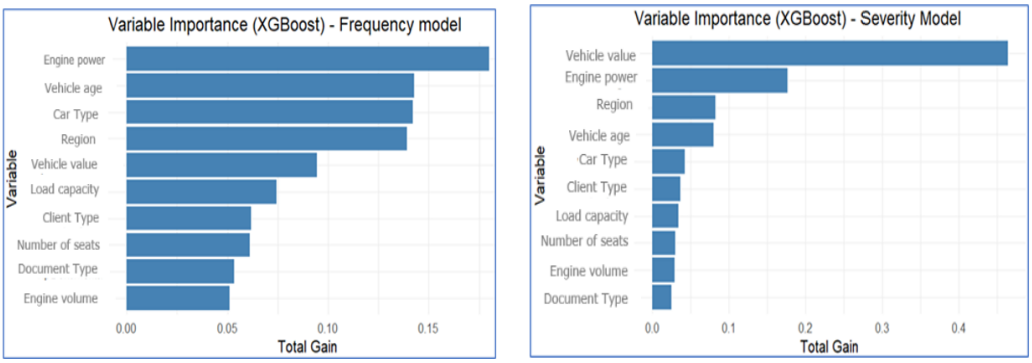


Fig 2. Features for claims Frequency (left) and Severity (right) selected with XGBoost

For the Frequency model, all features were considered important for a Gain threshold of > 0,05. When a more selective threshold of Gain > 0,1 is applied, only four features: Engine power, Vehicle age, Car type, and Region are retained. For the Severity model, at a Gain threshold > 0,05 four features are retained as important: Vehicle value, Engine power, Region, and Vehicle age.

At a higher threshold of Gain > 0,1 only two features are retained: Vehicle value and Engine power. Two model specifications were developed: one including all features using the lower threshold (Gain > 0,05), and a more selective specification including only the most influential features using the higher threshold (Gain > 0,1). Nevertheless, in practical actuarial applications, an actuary may choose to retain all features, considering them practically significant due to their potential interpretative value or business relevance.

4.3. Development and Evaluation of the Proposed Hybrid XGBoost-GLM

In this research, the frequency–severity modelling approach was adopted. By modelling the claim frequency (using a Poisson model with the logarithm of exposure as an offset) and claim severity (using a Gamma model with the logarithm of the number of claims as an offset) separately, this approach provides greater flexibility and interpretability in assessing how different risk factors contribute to the overall expected loss. The final GLM for claim Frequency and Severity are selected based on the analysis of deviance and the Likelihood Ratio Test (LRT), following Kafková and Křivánková (2014).

Deviance quantifies the difference in log-likelihood between the fitted and the saturated model. Models with different feature sets are compared using the analysis of deviance and, for confirmation, the Akaike Information Criterion (AIC). Specifically, the baseline GLM including all features are compared to reduced GLM containing a subset of features selected through feature selection. As nested models, this comparison enables testing the null hypothesis that the excluded features do not significantly improve model fit. The difference in deviance (ΔDev) between the two models follows a χ^2 distribution with degrees of freedom equal to the difference in the number of estimated parameters (Δdf) (Kafková & Křivánková, 2014).

a) Claim Frequency

Table 2 presents the results of model evaluation. The columns display the model's degrees of freedom (df), residual deviance, change in deviance (ΔDev) and degrees of freedom (Δdf) compared to the baseline model, the Akaike Information Criterion (AIC), and the results of the Likelihood Ratio Test (χ^2 test) with the corresponding p-values. The baseline GLM for claim Frequency, including all ten features, achieved a residual deviance of 93.819 with 116.167 degrees of freedom. GLM fitted with XGBoost-selected features were compared:

1. Gain > 0,05: All features retained; performance identical to the baseline GLM.
2. Gain > 0,1: Four features retained (Engine power, Vehicle age, Car type, Region); residual deviance increased to 94.439 (df = 116.179), a deterioration in model fit.

The LRT (and the corresponding significance level) confirmed that the excluded features significantly improved the model fit, as shown in the last two columns of Table 2. The test statistic far exceeds the critical value of the chi-square distribution; therefore, the null hypothesis is rejected. This finding, corroborated by the AIC, indicates that the baseline model is superior over the four feature model. Consequently, the baseline GLM including all ten features was selected as the final frequency model.

Table 2. Comparison of GLM Frequency Models: Baseline vs. XGBoost Selected Features

				FREQUENCY						
Fitted models			Included features	df	Resid. deviance*	ΔDev	Δdf	AIC	LRT (χ^2 test)	p value
1	Baseline GLM (all 10 features)		Car type, Vehicle age, Client type, Engine power, Region, Load capacity, Number of seats, Vehicle value, Document type, Engine volume	116.17	93.82	-	-	152.04	-	-
2	GLM with XGBoost feature selection	Gain > 0,05	10 features: Car type, Vehicle age, Client type, Engine power, Region, Load capacity, Number of seats, Vehicle value, Document type, Engine volume	116.17	93.82	0	0	152.04	Model identical as Baseline	-

	Gain > 0,1	4 features: Engine power, Vehicle age, Car type, Region	116.18	94.4	620	12	152.64	$\Delta Dev = 620 > \chi^2_{(\alpha = 0,05,\ df = 12)} = 21,026$	0,000***

*For the Poisson distribution, the dispersion parameter is equal to 1. ***Significance level 0,001.

b) Claim Severity

c)

The results of the model evaluation and the selection of the final model specification are presented in Table 3.

Table 3. Comparison of GLM Severity Models: Baseline vs. XGBoost Selected Features

			SEVERITY						
Fitted models		Included features	df	Resid. deviance*	ΔDev	Δdf	AIC	LRT (χ^2 test)	p value
1	Baseline GLM (all 10 features)	Car type, Vehicle age, Client type, Engine power, Region, Load capacity, Number of seats, Vehicle value, Document type, Engine volume	27.36	35.28	-	-	477.87	-	-
2	GLM with XGBoost feature selection	Gain > 0,05: 4 features: Vehicle value, Engine power, Region, Vehicle age	27.38	35.82	541	16	478.33	$\Delta Dev = 541 > \chi^2_{(\alpha = 0,05;\ df = 16)} = 26,30$	0,000***
		Gain > 0,1: 2 features: Engine power, Vehicle value	27.39	36.19	923	28	478.66	$\Delta Dev = 923 > \chi^2_{(\alpha = 0,05;\ df = 28)} = 41,34$	0,000***

* Not divided by the estimated dispersion parameter.

***Significance level 0,001.

The baseline GLM for claim Severity, including all ten features, achieved a residual deviance of 35.276 with 27.362 degrees of freedom. GLM with XGBoost-selected features were compared:

1. Gain > 0,05: the GLM fitted with XGBoost-selected features, retains 4 features (Vehicle value, Engine power, Region and Vehicle age), with a slight increase in

residual deviance to 35.817 and df to 27.378. This indicates a minor deterioration in model fit compared to the baseline.

2. Gain > 0,1: only 2 features remain important (Engine power and Vehicle value), with the residual deviance increasing further to 36.199 and df to 27.390, suggesting a greater deterioration in fit.

To assess whether the reduction in predictors significantly affects model fit, the LRT was performed. The difference in deviance (ΔDev) is assumed to follow a chi-square distribution with Δdf equal to the difference in the number of parameters between the baseline and reduced models. For both Gains (>0,05 and > 0,1) the null hypothesis is rejected. These results indicate that the excluded features do not significantly improve model fit at these thresholds. Nevertheless, the baseline GLM with all ten features is retained as the final Severity model. AIC values further confirm that reducing the model to four or two features (478.333 and 478.657, respectively) results in inferior performance. However, actuaries may choose between the full and reduced specifications depending on whether model complexity or parsimony is prioritised. The final Severity GLM includes all ten features.

5. DISCUSSION

In this analysis, the full GLM including all available predictors generally outperformed the models with XGBoost-selected features. The application of ML-based feature selection did not result in improved model fit or predictive performance. Nevertheless, for the Severity model, the GLM including only four predictors selected via XGBoost (Gain > 0,05) achieved a comparable fit, with only a marginal increase in residual deviance. This finding indicates that while a larger number of features may enhance explanatory power, a more parsimonious specification can adequately capture the underlying structure of claim Severity, providing an effective balance between model simplicity and interpretability. Despite being an advanced ML approach for feature selection, XGBoost did not demonstrate superior performance in this small transitional market setting compared to models without feature selection. These findings should be interpreted in light of the study's limitations. The relatively small number of features reflects the limited data availability typical of transitional insurance markets operating within complex political and legal environments. Moreover, the modest sample size may have constrained the performance of the XGBoost model, as ML algorithms typically require large datasets to fully exploit their predictive capacity.

In addition, the data cleaning and preprocessing phase was highly time-consuming and demanding due to the poor quality of the raw data, representing a major challenge for actuaries. These constraints highlight the practical challenges of applying data-driven techniques in smaller markets, where data limitations may offset the theoretical advantages of ML approaches. Since XGBoost performs iterative Gradient Boosting across multiple decision trees, it requires considerable computational resources and memory. Although model training can be intensive and time-consuming, this tailored configuration of model parameters represents a clear advantage, as it reflects the specific characteristics of insurance data instead of relying on default parameter choices. This approach can allow for more refined parameter tuning, leading to improved model accuracy and more precise insurance pricing.

The analysis of separate Frequency and Severity models highlighted the number of features selected for the Severity model compared to the Frequency model, and the influence of the distinct nature of the dependent variable: smaller sample size, greater heterogeneity, and the presence of outliers reduce the relative contribution of some predictors in predicting claim amounts. These findings align with previous studies (Clemente et al., 2023; Henckaerts et al., 2021) and suggest that ML methods can complement traditional GLM frameworks in actuarial pricing and risk management, even if improvements in predictive performance are limited in small datasets. For transitional markets, strengthening data quality and collection processes should precede the full adoption of complex ML techniques.

6. CONCLUSION

This study investigated whether incorporating XGBoost-based feature selection could enhance GLM performance for Bosnian casco insurance pricing. While XGBoost efficiently identified influential predictors, reduced-feature GLM did not outperform baseline models in terms of deviance and AIC. Both Frequency and Severity models achieved optimal fit when all ten predictors were retained, highlighting the importance of including all relevant risk factors in the pricing framework. The findings suggest that, in small and underdeveloped insurance portfolios, traditional GLMs remain robust and interpretable, whereas the use of ML-based feature selection may not necessarily yield superior results.

XGBoost can complement traditional GLM by providing insights into variable importance, but in this dataset, full GLM specifications remain preferable for predictive accuracy. However, while the existing literature often argues that ML methods outperform traditional approaches, caution is warranted, as their effectiveness may be context-dependent, particularly in small markets.

In contrast to GLM, which relies on a fixed parametric structure, XGBoost requires careful hyperparameter tuning and may overfit if model complexity is not adequately controlled. In addition, this study develops a methodological framework for a hybrid GLM-ML approach, demonstrating how ML can guide feature selection and hyperparameter optimization while retaining the interpretability of classical actuarial models. Future research could expand the dataset to include additional risk factors, such as driver-related, behavioural, and macroeconomic variables and incorporate data from different markets, which could enhance the explanatory power of the models and improve the generalisability of the results.

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THE WILLINGNESS OF INSURANCE COMPANIES IN BOSNIA AND HERZEGOVINA TO INTRODUCE INDEX-BASED INSURANCE OF AGRICULTURAL PRODUCTION

ABSTRACT

Agricultural production is the sector most affected by extreme weather conditions. Insurance, as the risk management tool, should provide an adequate response to the challenges that economies and households will increasingly face in the future. Given the importance of agricultural production for Bosnia and Herzegovina, a study was initiated to examine the interest of insurance companies to introduce index-based agricultural insurance products into their portfolios. Index-based (parametric) insurance is a model in which compensation payments are triggered by a reference index, in contrast to traditional insurance models that provide indemnification based on the actual loss incurred.

The main objective of the research was to determine how insurance companies perceive the agricultural insurance segment, specifically to identify the key factors influencing their attitudes toward index-based agricultural insurance. Secondary data sources included official publications and reports from state insurance agency. Primary data were collected through a survey conducted among insurance companies in Bosnia and Herzegovina registered for non-life insurance. The degree of agreement with statements in the questionnaire was assessed using a five-point Likert scale. The collected data were analyzed using methods of descriptive and inferential statistics.

The research revealed that insurance companies are indifferent on this matter. Their focus on the development of other insurance products and skepticism about the profitability of agricultural and index-based insurance products negatively affect their interest in introducing index-based agricultural insurance products. The companies agree that premium subsidies for agricultural insurance are essential, but they show a low level of initiative for negotiating with government authorities on this issue. The legal framework is an area that needs improvement in order to make significant progress in the wider application of insurance in agricultural production. Efforts should also be directed towards continuous education in the field of insurance and the development of new insurance products.

Keywords: *index insurance, agricultural insurance, Bosnia and Herzegovina, innovative insurance products.*
JEL: G22, O13

1. INTRODUCTION

The need for risk management in agricultural production has emerged due to the significant role agriculture plays in every society. The fact that agricultural production accounts for 4.65% of Bosnia and Herzegovina's Gross Domestic Product (GDP) in 2023 (Agency for Statistics of Bosnia and Herzegovina, 2025), ranking as the sixth largest sector in the overall GDP structure, highlights the importance of this economic activity for our society. In Bosnia and Herzegovina, insurance companies are the primary providers of property insurance products, while the state has the role of market regulator. Currently, insurance companies in the country offer agricultural insurance services primarily through traditional models that cover individual or grouped risks for related crops, based on indemnity payments for incurred losses. Index-based insurance, on the other hand, is a relatively new insurance model that relies on a reference index as a trigger for compensation payouts. In the context of agricultural insurance, the index may be based on the monitoring of specific weather (climatic) events, such as temperature levels, precipitation amounts, or soil moisture content, economic parameters such as agricultural yield per square meter, satellite-based crop monitoring, or any other parameter that can be accurately tracked over an extended period.

Given that agricultural insurance is underdeveloped in Bosnia and Herzegovina, there is a clear need to explore the root causes of this issue and to propose new models that could improve the state of the market. The central premise of this research is that, for index-based insurance to be utilized as an effective risk management tool in agricultural production, there must first be a concrete supply of such products on the market. This premise arises from the straightforward conclusion that agricultural producers, along with other stakeholders (e.g., the state and various levels of government), lack adequate knowledge of modern risk management techniques and innovations in risk transfer mechanisms. As a result, they are unable to generate initial demand for such protection tools. Since no index-based agricultural insurance products currently exist on the domestic market, this study focuses on examining the attitudes of insurance companies in Bosnia and Herzegovina regarding their interest in introducing index-based insurance products for agricultural production into their offering portfolios.

2. PREVIOUS RESEARCH

When discussing risks in agricultural production, the focus is primarily on their negative consequences, such as reduced yields and decreased financial income. On the other hand, taking on greater risk can potentially lead to higher yields and increased financial returns. Agricultural producers are therefore continuously engaged in the process of selecting the optimal business strategy. In 2020, Komarek, De Pinto, and Smith presented the results of a comprehensive review of the published literature on agricultural risks. The literature they examined included 3,283 peer-reviewed studies published between 1979 and 2019. Their analysis concluded that the vast majority of studies focused on production risks (Komarek et al., 2020, p. 2). Production risks arise from the inherent uncertainty of the biological growth processes of crops and livestock, with typical sources of such risks being related to weather conditions, climate impacts, pests, and diseases.

Risk management strategies in agriculture can generally be classified into risk mitigation strategies, risk transfer strategies, risk diversification, and retained risk management (Yang,

2010, p. 100). Alternative strategies include reliance on government disaster relief programs or increasing income from non-agricultural activities. In practice, production risk in agriculture is most commonly managed in two ways: through production diversification and risk transfer — by insurance. Production diversification has certain limitations: it is not spatially applicable everywhere (e.g., due to soil type, parcel size, climatic conditions), it is materially constrained (e.g., specific production equipment and available infrastructure), and it often leads to reduced production efficiency. Insurance, on the other hand, does not face these limitations. The use of insurance to manage losses caused by natural disasters varies significantly across the world. The forms and types of insurance products, as well as their market penetration, depend on risk factors, cultural context, regulatory requirements, and the economic environment. The application of insurance in agricultural production is primarily reflected in its stabilizing function at both the macro and micro levels. At the macro level, the national budget experiences less pressure from emergency expenditures in cases of unforeseen weather-related events. At the micro level, it enables agricultural producers to recover from damages and continue regular operations. Additionally, possessing an insurance policy also improves a farmer's creditworthiness.

Index-based insurance has been the focus of numerous academic studies, particularly in the context of agricultural production. One of the most prominent scholars associated with the concept of index-based agricultural insurance is Miranda, who in his 1991 study provided theoretical foundations and mathematical proofs supporting the applicability of this insurance model (Miranda, 1991, p. 233). A significant body of literature has focused on the implementation of index insurance in agricultural production in developing countries. Moreover, numerous studies have examined the willingness of agricultural producers to purchase insurance policies, both globally (Pérez-Blanco & Gómez, 2015, p. 1; Aina et al., 2018, p. 1; Gairola & Dey, 2023, p. 1) and in the regional context (Kozarević et al., 2019, p. 303; Kozarević & Ćetković, 2022, p. 15). The primary advantage of index-based insurance is in its significant reduction of moral hazard and adverse selection. Compensation is triggered by an index that is transparent, precisely defined, and therefore not susceptible to manipulation by either the insured or the insurer. Another advantage of this model is its low operational costs, including costs associated with underwriting, monitoring contracts, assessing losses, and processing claims. The main drawback of index-based insurance is basis risk. This arises from the inconsistency between the payout determined by the defined index and the actual loss experienced by the insured event.

Prabhakar and Solomon (2015, p. 20) conducted a review of available methodologies for evaluating the effectiveness of insurance and proposed indicators for assessing the efficiency of agricultural insurance in terms of climate change adaptation and natural disaster risk reduction. Cole and Xiong (2017, p. 236) reviewed studies on agricultural insurance in developing countries with the aim of examining its relationship with economic development. Li et al. (2022, p. 10) investigated how climate forecasts and agricultural production functions influence the effectiveness of government policies and agricultural insurance. Furthermore, the use of digital technologies in agriculture not only increases the efficiency of agricultural production but also contributes to reducing the risk associated with agricultural operations, which in turn leads to lower insurance premiums (Yekimov et al., 2023, p. 5).

3. METHODOLOGY

The subject of this study was to examine the interest of insurance companies in Bosnia and Herzegovina in introducing index-based agricultural insurance into their product offerings, and whether such interest is associated with their current offering of agricultural insurance products. In order to obtain a comprehensive understanding of the research topic, it was necessary to address the following questions: Do insurance companies recognize potential for the development of index-based agricultural insurance in Bosnia and Herzegovina? Is there a relationship between the level of satisfaction of insurance companies with the current legal framework regarding the introduction of index insurance and the perceived need for its improvement? Do the characteristics of insurance companies determine their interest in introducing innovative insurance products into their offering? Do insurance companies in Bosnia and Herzegovina consider flooding to be the most significant threat in agricultural production? Do insurance companies view the lack of interest among agricultural producers in purchasing agricultural insurance policies as the greatest obstacle to the introduction of index-based agricultural insurance? Do insurance companies consider government subsidies for agricultural insurance premiums to be essential?

Primary data were collected using a survey method. The instrument used for collecting primary data was a survey questionnaire, consisting of a total of 50 questions. The survey was conducted among insurance companies in Bosnia and Herzegovina registered for non-life insurance. A total of 18 completed questionnaires were analyzed. The level of agreement with the statements in the questionnaire was measured using a five-point Likert scale. The collected data were analyzed using descriptive statistical methods, including absolute and relative frequencies, measures of central tendency (mean), and measures of dispersion. To compare the mean values of defined variables between two independent groups, the independent samples t-test and its non-parametric alternative, the Mann-Whitney U test, were applied. Differences in interest in introducing innovative insurance products, depending on specific characteristics of insurance companies, were examined using analysis of variance (ANOVA) and the Kruskal-Wallis test. The analysis was processed using Microsoft Excel and IBM SPSS Statistics software packages.

4. RESEARCH RESULTS

The focus of the research was to explore the attitudes of insurance companies regarding index insurance for agricultural production. Therefore, the target group consisted of individuals within each company who were most knowledgeable about this topic. The first part of the questionnaire contained questions related to general information about the respondents and their respective insurance companies. The majority of responses were provided by company management (55,56%), followed by operational staff (27,78%). Three respondents (16,67%) held other positions. Most respondents held a higher education degree (66,67%), while a significant proportion held master's or doctoral degrees (27,78%). Only one respondent had completed secondary education (5,56%). Ten respondents (55,56%) reported having between 10 and 20 years of work experience in the insurance sector, while a substantial proportion (33,33%) had over 20 years of experience. One respondent had up to 5 years of experience, and one had between 5 and 10 years, each representing 5,56% of the sample. Insurance companies headquartered in the Federation of Bosnia and Herzegovina and supervised by the Insurance Supervisory Agency of the Federation of

Bosnia and Herzegovina accounted for 50% of the responses, while 50% came from companies based in the Republic of Srpska and Brčko District of Bosnia and Herzegovina and supervised by Insurance Agency of Republic of Srpska. The distribution of responses was balanced and did not significantly deviate from the spatial distribution of insurance companies across the country. Ten surveyed companies were predominantly foreign-owned (55,56%), while eight were predominantly domestically owned (44,44%).

4.1. Examining the attitudes of insurance companies regarding the potential for the development of index insurance in agricultural production

In order to determine whether insurance companies perceive potential for the development of index insurance for agricultural production in our country, it was necessary to examine their views regarding the current state of development of agricultural insurance, the potential for further development, the profitability of existing agricultural insurance products, the potential profitability of index-based insurance products for agriculture, as well as their opinions on the existence of potential for the development of index insurance for agricultural production in Bosnia and Herzegovina.

Table 1. Descriptive parameters of attitudes about the potential for the development of index insurance of agricultural production

Statement	N	Min.	Max.	Avg.	Std. Dev.	Mode	Median
Agricultural insurance in our country is poorly developed.	18	2	5	4,22	1,060	5	5,00
Agricultural insurance in our country could be more developed.	18	3	5	4,06	0,873	5	4,00
Agricultural insurance offers profitable potential for insurance companies.	18	1	5	2,17	1,249	1	2,00
Index (parametric) insurance of agricultural production offers profitable potential for insurance companies.	18	1	5	2,61	1,195	3	3,00
There is potential for the development of index (parametric) insurance of agricultural production in our country.	18	2	5	3,17	0,985	4	3,00

Source: Authors

Analyzing the answers, the hypothesis that insurance companies see the potential for the development of index insurance of agricultural production in our country cannot be confirmed.

4.2. Examining the level of satisfaction of insurance companies with the existing legal framework regarding the introduction of index insurance

The insurance market in our country follows the administrative organization of the state. The fragmentation of the legal and institutional framework and its incompatibility with European standards imposes the need to pay special attention to the analysis of the legal framework with the purpose of examining its suitability for the introduction of innovative products and following modern trends in the insurance field.

Table 2. Descriptive parameters of views on the adequacy of the legal framework

Statement	N	Min.	Max.	Avg.	Std. Dev.	Mode	Median
Statement_1	18	1	5	3,39	1,092	3	3,00
Statement_2	18	1	5	3,61	1,092	3	3,00

Statement_1 = The currently valid entity laws, primarily the FBiH Law on Insurance and the RS Law on Insurance Companies, are not suitable for the introduction of index insurance products for agricultural production. Statement_2 = Paragraph (2) of Article 925 of the Law on Obligations of the FBiH and RS, which states: "The amount of compensation cannot be greater than the damage suffered by the insured person due to the occurrence of the insured event," prevents the introduction of index insurance products for agricultural production in our country.

Source: Authors

In order to examine the connection between the level of satisfaction of insurance companies with the currently applicable legal framework regarding the introduction of index insurance and the need for its improvement, a survey questionnaire was used to investigate whether the company had discussed this issue with government representatives.

Table 3. Descriptive parameters of responses about discussions with state authorities regarding legal framework and views on the adequacy of current laws

Resposne	Statement	N	Min.	Max.	Avg.	Std. Dev.	Mode	Median
Yes, it is	Statement_1	1	3	3	3,00	-	3	3,00
	Statement_2	1	4	4	4,00	-	4	4,00
No, it's not	Statement_1	13	1	5	3,23	1,092	3	3,00
	Statement_2	13	1	5	3,46	1,127	3	3,00
No, but intends to	Statement_1	2	3	3	3,00	0,000	3	3,00
	Statement_2	2	3	3	3,00	0,000	3	3,00
No, and don't have intention	Statement_1	2	5	5	5,00	0,000	5	5,00
	Statement_2	2	5	5	5,00	0,000	5	5,00

Source: Authors

The majority of companies expressed a neutral stance regarding the legal framework, as well as on willingness to engage in negotiations with government representatives on this issue.

4.3. Examining the impact of selected characteristics of insurance companies on the interest in introducing innovative insurance products

The next step in the research was to determine whether certain characteristics of insurance companies, such as the number of employees, the level of education of employees, ownership structure, company headquarters, amount of capital and revenue, have an impact on their interest in introducing innovative insurance products into their offering. Only the results of those characteristics where an correlation was determined are presented.

There is a statistically significant difference between the mean values of the opinions of companies based in the Federation of Bosnia and Herzegovina and under the supervision of the Insurance Supervisory Agency of the Federation of Bosnia and Herzegovina and companies based in the Republic of Srpska and the Brčko District of Bosnia and Herzegovina and under the supervision of the Insurance Agency of the Republic of Srpska

in the tested statement “The financial costs required to introduce innovative insurance products are low”.

Eta square is 0,254, and according to Cohen's criteria (0,01 = small effect, 0,06 = medium effect, 0,14 = large effect), this would be considered as large effect.

Table 4. Results of the independent samples t-test according to the company’s headquarters and supervisory agency criterion

Statements		**Levene's Test for Equality of Variances**		**t-test for Equality of Means**						
		F	Sig.	t	df	Sig. 2-tailed	Mean Diff	Std. Err Diff	95% Confidence Interval of the Difference	
									Lower	Upper
1	Equal variances assumed	0,604	0,448	1,372	16	0,189	0,889	0,648	-0,485	2,262
	Equal variances not assumed	-	-	1,372	15,914	0,189	0,889	0,648	-0,485	2,263
2	Equal variances assumed	1,226	0,284	0,753	16	0,463	0,444	0,591	-0,807	1,696
	Equal variances not assumed	-	-	0,753	14,743	0,464	0,444	0,591	-0,816	1,705
3	Equal variances assumed	0,057	0,814	0,712	16	0,487	0,333	0,468	-0,659	1,326
	Equal variances not assumed	-	-	0,712	15,971	0,487	0,333	0,468	-0,659	1,326
4	Equal variances assumed	0,011	0,917	0,270	16	0,791	0,111	0,412	-0,762	0,985
	Equal variances not assumed	-	-	0,270	15,995	0,791	0,111	0,412	-0,762	0,985
5	Equal variances assumed	0,236	0,634	2,334	16	0,033	0,889	0,381	0,081	1,696
	Equal variances not assumed	-	-	2,334	15,935	0,033	0,889	0,381	0,081	1,697
6	Equal variances assumed	2,352	0,145	1,565	16	0,137	0,778	0,497	-0,276	1,831
	Equal variances not assumed	-	-	1,565	13,306	0,141	0,778	0,497	-0,293	1,849

Statement_1 = We are interested in introducing innovative insurance products into our offering. Statement_2 = The introduction of innovative insurance products would lead to significant time savings in contract monitoring, damage assessment, and claim settlement compared to the current product offerings. Statement_3 = By introducing innovative insurance products, we would more efficiently utilize available financial capital. Statement_4 = By introducing innovative insurance products, we would engage available human resources more efficiently. Statement_5 = The financial costs required to introduce innovative insurance products are low. Statement_6 = Market research for the purposes of introducing innovative insurance products is not demanding.

Source: Authors

Table 5. Ranks of the Mann-Whitney U test according to the criterion of the company's headquarters and supervisory agency criterion

Statement	*Company's headquarters and supervisory agency*	*N*	*Mean Rank*	*Sum od Ranks*
Statement_5	Federation of BiH - Insurance Supervisory Agency of the FBiH	9	11,89	107,00
	Republic of Srpska and Brčko District - Insurance Agency of the Republic of Srpska	9	7,11	64,00

Source: Authors

Mann-Whitney U test confirmed previous results that there is a statistically significant difference between companies headquartered in the Federation of Bosnia and Herzegovina and those based in the Republic of Srpska and the Brčko District of Bosnia and Herzegovina regarding their view that the financial costs required to introduce innovative insurance products are low. In our case, the *Z*-value is -2,015 (N=18), resulting in r = -0,475

Table 6. Results of the Mann-Whitney U test according to the criterion of the company's headquarters and supervisory agency criterion

Statement	**Mann-Whitney U test**	**Z**	**Asymp. Sig. (2-tailed)**
Statement_5	19,000	-2,015	0,044

Source: Authors

According to Cohen's criteria (0,1 = small effect, 0,3 = medium effect, 0,5 = large effect), this would be considered as large effect. Greater agreement with the statement that the financial costs required for introducing innovative products are low is found among companies headquartered in the Federation of Bosnia And Herzegovina (11,89) than among companies from the Republika Srpska and the Brčko District of Bosnia and Herzegovina (7,11), U=19,000, Z = -2,015, p = 0,044, r = -0,475.

Companies with predominantly more highly educated employees expressed a higher level of interest in introducing innovative products into their offerings (mean value=4,67) compared to those with predominantly less educated employees (mean value=3,50).

Table 7. Results of the independent samples t-test according to the employee education level criterion

Statements		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. 2-tailed	Mean Diff	Std. Err Diff	95% Confidence Interval of the Difference	
									Lower	Upper
1	Equal variances assumed	8,696	0,009	-1,753	16	0,099	-1,167	0,665	-2,577	0,244
	Equal variances not assumed	-	-	-2,338	14,766	0,034	-1,167	0,499	-2,232	-0,102
2	Equal variances assumed	0,078	0,783	-0,394	16	0,699	-0,250	0,634	-1,595	1,095
	Equal variances not assumed	-	-	-0,401	10,588	0,696	-0,250	0,623	-1,628	1,128
3	Equal variances assumed	0,219	0,646	-0,844	16	0,411	-0,417	0,493	-1,463	0,629
	Equal variances not assumed	-	-	-0,824	9,498	0,430	-0,417	0,505	-1,551	0,718
4	Equal variances assumed	0,046	0,832	-0,775	16	0,450	-0,333	0,430	-1,245	0,578
	Equal variances not assumed	-	-	-0,720	8,419	0,491	-0,333	0,463	-1,391	0,725
5	Equal variances assumed	4,000	0,063	-1,109	16	0,284	-0,500	0,451	-1,455	0,455
	Equal variances not assumed	-	-	-1,291	14,801	0,217	-0,500	0,387	-1,326	0,326
6	Equal variances assumed	0,265	0,614	0,444	16	0,663	0,250	0,563	-0,942	1,442
	Equal variances not assumed	-	-	0,427	9,139	0,679	0,250	0,585	-1,070	1,570

Statement_1 = We are interested in introducing innovative insurance products into our offering. Statement_2 = The introduction of innovative insurance products would lead to significant time savings in contract monitoring, damage assessment, and claim settlement compared to the current product offerings. Statement_3 = By introducing innovative insurance products, we would more efficiently utilize available financial capital. Statement_4 = By introducing innovative insurance products, we would engage available human resources more efficiently. Statement_5 = The financial costs required to introduce innovative insurance products are low. Statement_6 = Market research for the purposes of introducing innovative insurance products is not demanding.

Source: Authors

Table 8. Results of the Mann-Whitney U test according to the ownership structure of the company

Statement	Mann-Whitney U test	Z	Asymp. Sig. (2-tailed)
Statement_1	30,000	-0,950	0,342
Statement_2	31,500	-0,776	0,438
Statement_3	29,500	-1,038	0,299
Statement_4	34,000	-0,637	0,524
Statement_5	16,500	-2,216	0,027
Statement_6	39,000	-0,093	0,926

Source: Authors

Companies with majority foreign ownership expressed a higher level of agreement with the statement that the financial costs required for introducing innovative insurance products are low (mean=3,10, median=3,00) compared to those with predominantly domestic ownership (mean=2,13, median=2,00) (U=16,500, Z=-2,216, p=0,027, r=-0,522).

4.4. Examining attitudes toward the greatest sources of risk in agricultural production

Taking into account the specific characteristics of the production environment in our country, it was necessary to examine insurance companies' perceptions of the risk level associated with selected weather (climatic) events.

Table 9. Descriptive parameters and risk ranking in agricultural production

Risk description	N	Min.	Max.	Avg.	Std. Dev.	Mode	Median	Rank
Hail	18	3	5	4,28	0,752	5	4,00	1
Drought and insufficient rainfall	18	2	5	4,22	0,943	5	4,50	2
Storm and strong wind	18	2	5	4,06	0,639	4	4,00	3
Flood and flash flood	18	2	5	3,78	0,878	4	4,00	4
Excessive precipitation	18	2	5	3,67	0,970	4	4,00	5
Frost and low temperatures	18	3	5	3,61	0,698	3	3,50	6
Fire	18	1	4	2,56	0,984	3	3,00	7
Earthquake and landslide	18	1	4	2,11	0,963	2	2,00	8

Source: Authors

The highest average score was recorded for the risk of hail, amounting to 4,28. The lowest average score was recorded for the risks of earthquakes and landslides, at 2,11.

4.5. Examining the attitudes toward the most significant barriers to the introduction of index insurance in agricultural production

The responses to the question regarding the greatest barriers to the introduction of index insurance products in agricultural production were analyzed.

The highest average score was recorded for the statement: "There are other insurance products we are focused on" (4,56). The lowest average score was recorded for the statement: "We do not have an adequate amount of capital" (2,17).

Table 10. Descriptive parameters and ranking of barriers to the introduction of index insurance of agricultural production

Statement	N	Min.	Max.	Avg.	Std. Dev.	Mode	Median	Rank
Statement_1	18	4	5	4,56	0,511	5	5,00	1
Statement_2	18	1	5	3,83	1,249	5	4,00	2
Statement_3	18	1	5	3,78	1,060	4	4,00	3
Statement_4	18	1	5	3,72	1,074	4	4,00	4
Statement_5	18	1	5	3,33	1,328	4	4,00	5
Statement_6	18	1	5	3,28	1,074	3*	3,00	6
Statement_7	18	1	5	3,22	1,003	4	3,00	7
Statement_8	18	1	5	3,17	1,200	2*	3,00	8
Statement_9	18	2	4	3,11	0,676	3	3,00	9
Statement_10	18	2	4	3,11	0,471	3	3,00	9
Statement_11	18	1	5	3,06	1,392	4	3,50	10
Statement_12	18	1	5	2,89	1,278	4	3,00	11
Statement_13	18	1	4	2,17	1,150	1	2,00	12

Statement_1 = There are other insurance products we are focused on.
Statement_2 = Agricultural producers are uninformed about the availability and features of agricultural insurance products.
Statement_3 = We do not have precise data on the frequency of natural disasters in a particular area.
Statement_4 = We do not possess precise instruments for determining the parameters related to the magnitude and effects of natural disasters required for the application of index insurance in a given area (e.g., temperature levels, precipitation amounts, river water levels, etc.).
Statement_5 = We do not have accurate data on the extent of damage caused by natural disasters in agricultural production. Statement_6 = Available data on the average yield and size of agricultural holdings are scarce.
Statement_7 = Available data on the number and structure of agricultural holdings are scarce.
Statement_8 = We are not familiar with the index (parametric) insurance model.
Statement_9 = The costs of creating index insurance products are high.
Statement_10 = The premium for insurance policies based on index model would be too high.
Statement_11 = We do not have a sufficient number of qualified workers.
Statement_12 = Agricultural producers are uninterested in contracting agricultural insurance policies.
Statement_13 = We do not have an adequate amount of capital.
* Multiple modes exist. The smallest value is shown.

Source: Authors

4.6. Examining the attitudes toward government subsidies in the agricultural sector

Given that government subsidies for agricultural insurance premiums have been of great importance for the success of many pilot projects introducing index insurance programs, it was necessary to examine the attitudes of insurance companies in our country on this issue. Additionally, a question was included regarding whether insurance companies have engaged in discussions with representatives of local and/or national authorities about the subsidization of agricultural insurance premiums.

Table 11. Descriptive parameters of responses to discussions with authorities about insurance premium subsidies and attitudes towards state subsidies in agriculture

Response	Statement	N	Min.	Max.	Avg.	Std. Dev.	Mode	Median
Yes, it is	1	3	4	5	4,67	0,577	5	5,00
	2	3	1	3	2,33	1,155	3	3,00
	3	3	3	4	3,67	0,577	4	4,00
No, it's not	1	11	3	5	4,09	0,701	4	4,00
	2	11	1	4	2,82	0,874	3	3,00
	3	11	3	5	4,00	0,894	3*	4,00
No, but intends to	1	4	4	5	4,50	0,577	4*	4,50
	2	4	1	4	2,00	1,414	1	1,50
	3	4	3	4	3,75	0,500	4	4,00

Statement_1 = Government subsidization of agricultural insurance policy premiums is necessary.
Statement_2 = Government financing of protective measures in agriculture (such as income support for farmers, production incentives, or capital investments) reduces the importance of agricultural insurance for agricultural producers.
Statement_3 = Local and state governments should enable the payment of production subsidies and other forms of support only to those farmers who have a contracted agricultural insurance policy.
* Multiple modes exist. The smallest value is shown.

Source: Authors

Companies that expressed a greater willingness for negotiations with representatives of authorities regarding the subsidization of agricultural insurance premiums also showed a higher level of agreement with the statement that government subsidies for agricultural insurance premiums are necessary. On the other hand, it is important to emphasize that no companies expressed a lack of need for such negotiations.

4.7. Assessment of insurance companies' interest in the introduction of index-based insurance products of agricultural production

It was necessary to collect data on whether and to what extent companies currently offer products from group 9.11 Crop and plantation insurance and/or group 9.12 Livestock insurance, and to compare this with responses regarding interest in introducing index (parametric) insurance products for agricultural production into their portfolio.

Table 12. Descriptive parameters of responses on the current offer of agricultural insurance products and attitudes on interest in introducing index (parametric) insurance products

Response	Statement	N	Min.	Max.	Avg.	Std. Dev.	Mode	Median
We offer product(s) from group 9.11.	Statement	1	3	3	3,00	-	3	3,00
We offer product(s) from groups 9.11 and 9.12	Statement	11	2	4	2,91	0,701	3	3,00
We do not offer products from the aforementioned groups	Statement	6	1	4	2,50	1,378	1*	2,50

Statement = We are interested in introducing index (parametric) agricultural production insurance products into our offer.
* Multiple modes exist. The smallest value is shown.

Source: Authors

Most companies express a neutral stance regarding their interest in introducing index insurance products for agricultural production into their offerings, regardless of their current portfolio of agricultural insurance products.

5. DISCUSSION AND CONCLUSION

Risk management in agricultural production involves the use of a strategy that financially protects the agricultural producer from the negative effects of risks that arise during the production process. When making a decision about purchasing an insurance policy, agicultural producers should consider two key factors: the magnitude of a potential catastrophic event and the financial capacity of their agricultural holding, or alternatively, the availability of external financing. In cases of potentially significant losses that exceed the agricultural holding's financial capacity, or when borrowing is either undesirable or unavailable, producers should consider obtaining an insurance policy. Experience has shown that, in our region, agricultural producers often rely on available government aid programs after natural disasters.

Index insurance can be applied as a new method of risk management in agricultural production in Bosnia and Herzegovina, but only under certain conditions. First, it is necessary to harmonize the legal framework governing this area. Dialogue between insurance companies and government authorities on this issue needs to be intensified. Second, the level of interest among companies in introducing index insurance, and to a certain extent other innovative products, is not satisfactory. This research has identified several reasons for the low level of interest, one of which is the prevailing view among companies that both traditional agricultural insurance and index-based agricultural insurance are not sufficiently profitable. Furthermore, companies have demonstrated a strong commitment to the development of other (traditional) insurance products. There is a need for continuous education of employees in the insurance sector, as well as the general public, regarding modern advancements in insurance and the development of new products. This recommendation is supported by the finding that companies with better-educated employees showed greater interest in adopting innovative products. Insurance companies also emphasized the necessity of premium subsidies for agricultural insurance. Therefore, attention should also be directed toward proposing the allocation of a portion of available public funds to support preventive measures in agricultural risk management in Bosnia and Herzegovina.

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A MODERATED MODEL OF UNIVERSITY STUDENTS' FINANCIAL LITERACY: THE EFFECTS OF GENDER AND FINANCIAL KNOWLEDGE ON THE RELATIONSHIP BETWEEN FINANCIAL ATTITUDES AND FINANCIAL BEHAVIOR

ABSTRACT

The subject of this study concerns the moderating effect of students' gender and financial knowledge on the relationship between their financial attitudes and financial behaviour.
The sample includes 1,044 students who, at the time of the study, were enrolled at public universities in Bosnia and Herzegovina. A dual moderation analysis was conducted to investigate whether the effects of financial attitudes on financial behaviour vary by gender and financial knowledge of students.
Results show that financial knowledge influences the relationship between financial attitudes and behaviour, while gender does not have a significant moderating effect. This indicates that students with higher financial knowledge are better at converting their positive financial attitudes into actual financial behaviour. The conditional effects confirmed that financial attitudes significantly predicted financial behavior at all examined levels of financial knowledge and for both genders, with stronger effects observed among students with higher financial knowledge. These findings imply that financial knowledge is the primary factor enabling students to act on their financial attitudes, whereas gender differences are minimal.

Practically, this suggests that interventions focused on enhancing financial knowledge can help students better translate their positive financial attitudes into responsible financial behaviour, regardless of gender.

Keywords: *financial literacy, students, moderation.*
JEL: G53, D03, C5

1. INTRODUCTION

Financial literacy represents a key component of both individual financial well-being and broader economic stability. It is particularly critical for young people who are increasingly required to make financial decisions with long-term implications. Although extensive research has examined financial literacy across various population groups, much of the existing empirical and theoretical work has focused on developing countries or advanced economies, with comparatively limited attention given to youth in transition economies. This gap is particularly notable considering that young adults are at a critical stage of developing financial habits, forming attitudes, and acquiring the knowledge necessary for responsible financial decision-making.

Motivated by this gap, the goal of this study is to explain how university students' gender and financial knowledge moderate the relationship between their financial attitudes and financial behaviour. Understanding how these components interact is essential, as prior research indicates that attitudes may not always translate into behaviour unless supported by adequate knowledge or contextual enablers.

To examine these dynamics more systematically, this research is guided by the following objectives:

RO1: To examine the relationship between financial attitudes and financial behaviour among university students.
RO2: To investigate whether gender moderates the relationship between financial attitudes and financial behaviour among university students.
RO3: To assess the moderating role of financial knowledge in the relationship between financial attitudes and financial behaviour among university students.
RO4: To explore the combined moderating effect of gender and financial knowledge on the relationship between financial attitudes and financial behaviour among university students.

The paper is organized as follows. Following the introduction, part two offers a summary of the literature review that is important to the paper's main objective. Part three discusses the methods of data and analysis. The core of the paper is part four, which involves a review and discussion of the initial empirical findings. Some final remarks and conclusions are found in the last chapter.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

In this research, we adopt the definition provided by OECD INFE (2011) and Atkinson and Messy (2012), which describe financial literacy as a blend of awareness, knowledge, skills, attitudes, and behaviours required for sound financial decision-making and the achievement of personal financial well-being. This definition forms the basis for the financial literacy measurement instrument, which includes financial knowledge, behaviour, and attitudes (Atkinson & Messy, 2012).

A considerable body of research has demonstrated that financial literacy is not evenly distributed across population groups, with many studies reporting a persistent gender gap in this domain. Evidence from Berlinger et al. (2025), Adiandari (2023), Zaimović et al. (2023), Blaschke (2022), Okičić et al. (2021), Yu et al. (2015), Falahati and Paim (2011), Bucher-Koenen et al. (2014), Erner et al. (2016), Tavares et al. (2019), Garg and Singh (2018), Lusardi et al. (2010), Chen and Volpe (1998), Fonseca et al. (2012), Iqbal and Ahmad (2014), Okičić and Kakeš (2019), Greimel-Fuhrmann and Silgoner (2018), Oseifuah et al. (2018), Agnew et al. (2018), Barboza et al. (2016), and Hasler and Lusardi (2017), among others, consistently indicate that there is a potential gender gap in terms of financial literacy.

Besides, when it comes to a particular relationship between three dimensions of financial literacy, evidence of the effect of financial knowledge and attitude on financial behaviour can be found in the recent literature (Atkinson & Messy, 2012; Felipe et al., 2017; Hayhoe et al., 2005; Okičić et al., 2021; Potrich et al., 2016).

From a behavioural perspective, attitudes guide individuals' intentions toward financial actions, while financial knowledge equips them with the capability to implement those intentions effectively. This conceptual reasoning further supports the importance of examining how attitudes and knowledge interact in shaping financial behaviour. Building on the presented evidence, the present study focuses on university students to examine how financial attitudes relate to financial behaviour and how this relationship may be influenced by gender and knowledge levels.

Specifically, the research proposes four hypotheses:

H1: Financial attitudes positively predict financial behavior among university students.
H2: Gender moderates the relationship between financial attitudes and financial behaviour, such that the effect differs for male and female students.
H3: Financial knowledge moderates the relationship between financial attitudes and financial behaviour, such that the effect is stronger for students with higher financial knowledge.
H4: Gender and financial knowledge jointly moderate the relationship between financial attitudes and financial behaviour.

3. METHODOLOGY

3.1. Data source and sample

Using a purposive sampling approach, data were collected online as part of a project conducted by Okičić et al. (2021) and supported by the Federal Ministry of Education and Science, Bosnia and Herzegovina, resulting in 1,044 valid responses from undergraduate students enrolled at one of eight public universities in the country: University of Tuzla, University of Sarajevo, University of Zenica, University of Banja Luka, University of Bihać, University of Mostar, University Džemal Bijedić of Mostar and University of East Sarajevo.

Table 1. Overview of basic characteristics of the sample

Characteristic		Frequency	Per cent
Gender	Male	722	69.2
	Female	322	30.8
	Total	1044	100.0
Living environment	Urban	700	67.0
	Rural	344	33.0
	Total	1044	100.0
University	University of Tuzla	284	27.7
	University of Sarajevo	148	14.4
	University of Zenica	94	9.2
	University of Banja Luka	337	32.8
	University of Bihać	17	1.7
	University of Mostar	12	1.2
	University Džemal Bijedić of Mostar	51	5.0
	University of East Sarajevo	84	8.2
	Total	1027	100.0

Source: Authors' research

Table 1 gives a brief overview of the basic characteristics of the sample. The data collection instrument was a structured questionnaire with closed questions, divided into several sections. The first section addresses the financial attitudes, financial behaviour and financial knowledge, whereas the second section considers specific socio-economic characteristics of the respondents. The questionnaire was primarily based on the OECD (2018) and some previous work of Atkinson and Messy (2012) as well as Lusardi and Mitchell (2011).

3.2. Variables and methods

Financial literacy is operationalised through variables capturing its key components: financial knowledge, financial behaviour, and financial attitude. Financial knowledge was assessed using two sets of multiple-choice questions. The first set, representing basic knowledge, consists of seven questions on exchange rates, loan interest, and the time value of money. The second set, representing advanced knowledge, includes six questions examining understanding of simple and compound interest, inflation, and risk diversification. A financial knowledge score was derived from the number of correct responses. The remaining two components, financial behaviour and financial attitude, were measured using a 5-point Likert scale ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree").

To examine the dimensionality of the measurement items and identify coherent latent constructs, an exploratory factor analysis (EFA) was conducted. EFA ensured that the resulting factors demonstrated conceptual clarity and satisfactory psychometric properties. After establishing the factor structure, composite scores were generated and subsequently used in hypothesis testing.

Furthermore, to examine the moderating effects of gender and financial knowledge, the study employed the following dual moderation model:

$$FB = b_0 + b_1 FA + b_2 Gender + b_3 FKS + b_4 (FA \times Gender) + b_5 (FA \times FKS) + \epsilon \qquad (1)$$

where *FB* denotes *Financial Behaviour* (dependent variable), *FA* represents *Financial Attitudes* (independent variable), *Gender* is the student's gender (moderator W; coded 0 = male, 1 = female), FKS is the *Financial Knowledge Score* (moderator Z), *FA* × *Gender* is the interaction term testing moderation by gender and *FA* × *FKS* is the interaction term testing moderation by financial knowledge.

4. RESULTS AND DISCUSSION

In this study, the variables for financial attitude and financial behavior used in the moderated regression analysis were derived from the exploratory factor analysis conducted on 15 items, measuring financial attitude and behaviour, in the work of Okičić et al. (2021). Using principal component analysis with Varimax rotation, two conceptually clear factors emerged, i.e. Financial attitude and Financial behavior with the factor solution demonstrating good sampling adequacy (KMO = .807), a significant Bartlett's test, and acceptable internal consistency for both scales (Cronbach's α = .730 for Financial attitude and α = .763 for Financial behavior). These validated factor-based composite variables were subsequently used in the moderated regression model presented in Table 2.

Table 2. Moderated Regression Results

Predictor	B	SE	t	p	95% CI (LLCI, ULCI)
Constant	24.538	1.584	15.493	.000	21.439, 27.645
Financial attitude	0.205	0.118	1.738	.083	-0.027, 0.437
Gender	-1.728	1.118	-1.546	.122	-3.921, 0.465
Financial attitude × Gender	0.063	0.080	0.784	.433	-0.094, 0.220
Financial knowledge	-0.181	0.154	-1.181	.238	-0.483, 0.120
Financial attitude × Financial knowledge	0.026	0.011	2.332	.020	0.004, 0.049

Source: Authors' research

The overall model was significant, $F(5, 1038) = 44.88$, $p < .001$, explaining approximately 17.8% of the variance in financial behavior ($R^2 = .1778$). The direct effect of financial attitudes on financial behavior was positive but not statistically significant, $b = 0.205$, $t(1038) = 1.738$, $p = .083$. Gender did not significantly moderate this relationship ($b = 0.063$, $p = .433$), whereas financial knowledge significantly moderated the effect of attitudes on behavior ($b = 0.026$, $p = .020$), indicating that students with higher financial knowledge were better able to translate their attitudes into behavior.

Table 3. Conditional Effects of Financial Attitudes on Financial Behavior by Gender and Financial Knowledge

Gender	FKS (Percentile)	Effect (B)	SE	t	p	LLCI	ULCI
Male	7	0.390	0.053	7.337	.000	0.286	0.494
Male	10	0.469	0.043	10.849	.000	0.384	0.553
Male	13	0.548	0.057	9.672	.000	0.437	0.659
Female	7	0.453	0.080	5.686	.000	0.296	0.608
Female	10	0.532	0.067	7.919	.000	0.400	0.664
Female	13	0.611	0.071	8.659	.000	0.472	0.749

Source: Authors' research

Table 3 presents the conditional effects of financial attitudes on financial behavior at varying levels of financial knowledge and gender. The effect of attitudes is stronger among students with higher financial knowledge, for both male and female students, suggesting that knowledge is a key factor enabling the translation of attitudes into behaviour. Gender differences are minimal, as the pattern is consistent across male and female students.

Table 4 presents the results of the interaction tests for the dual moderation model. The interaction between financial attitudes and gender was not statistically significant ($\Delta R^2 = .0005$, $F(1,1038) = 0.614$, $p = .433$), indicating that gender does not significantly moderate the relationship between attitudes and behavior. The interaction between financial attitudes and financial knowledge was significant ($\Delta R^2 = .0043$, $F(1,1038) = 5.437$, $p = .020$), indicating that the effect of attitudes on behavior increases as financial knowledge increases. The joint interaction of gender and financial knowledge was also significant ($\Delta R^2 = .0054$, $F(2,1038) = 3.408$, $p = .034$), reflecting that the moderation effect is primarily driven by financial knowledge rather than gender.

Table 4. Interaction tests

Interaction	ΔR^2	F	df	p
Financial attitude × Gender	0.0005	0.614	1	.433
Financial attitude × Financial knowledge	0.0043	5.437	1	.020
Financial attitude × Gender × Financial knowledge	0.0054	3.408	2	.034

Source: Authors' research

The findings of this study provide important insights into the mechanisms linking financial attitudes and financial behavior among undergraduate students, with particular attention to the moderating roles of gender and financial knowledge. Consistent with previous research highlighting the multidimensional nature of financial literacy (Atkinson & Messy, 2012; OECD INFE, 2011), this study confirmed that financial attitudes and behaviors represent distinct yet related constructs, supported by satisfactory psychometric properties. These results align with Okičić et al. (2021), who also identified clear and reliable attitudinal and behavioral dimensions in the context of undergraduate students in Bosnia and Herzegovina.

The key finding of this study is that financial attitudes, although positively associated with financial behavior, did not show a statistically significant direct effect. This result contrasts with several studies that report a positive and significant association between attitudes and behavior (Bhushan & Medury, 2014; Garg & Singh, 2018). One possible explanation is that attitudes alone may be insufficient to drive behavioral change among students when not accompanied by adequate knowledge or confidence. Similar dynamics were observed in research showing that behavioral translation often depends on enabling resources, cognitive capacity, or contextual supports (Lusardi & Mitchell, 2011; Erner *et al*., 2016). For many undergraduates, particularly in emerging economies, structural constraints such as limited financial autonomy or lack of real-life financial responsibilities may weaken the attitude – behaviour link.

A central contribution of this study is the identification of financial knowledge as a significant moderator of the relationship between financial attitudes and financial behavior. Students with higher levels of financial knowledge demonstrated a stronger ability to translate positive attitudes into concrete behavioral practices. This finding is consistent with the view that knowledge acts as a behavioural catalyst, enabling individuals to operationalize their attitudes (Chen & Volpe, 1998; Lusardi et al., 2010). The pattern observed across financial knowledge percentiles for both male and female students further highlights that knowledge amplifies the behavioural impact of attitudes, regardless of gender.

In contrast, gender did not emerge as a significant moderator. This finding is supported by Berlinger et al. (2025), who reported no gender gap in financial knowledge and attitudes among finance undergraduates, although a gender gap was observed in financial behavior. This result stands in partial contrast to a substantial body of literature documenting gender differences in financial literacy and financial behavior (Adiandari, 2023; Agnew et al., 2018; Barboza et al., 2016; Berlinger et al., 2025; Blaschke, 2022; Bucher-Koenen et al., 2014; Chen & Volpe, 1998; Erner et al., 2016; Falahati & Paim, 2011; Fonseca et al., 2012; Garg & Singh, 2018; Greimel-Fuhrmann & Silgoner, 2018; Hasler & Lusardi, 2017; Iqbal & Ahmad, 2014; Lusardi et al., 2010; Okičić & Kakeš, 2019; Okičić et al., 2021; Oseifuah et al., 2018; Tavares et al., 2019; Yu et al., 2015; Zaimović et al., 2023).

The non-significant interaction in the present study supports this emerging perspective. It also aligns with research suggesting that gender differences in financial literacy may be driven more by confidence, socialisation patterns, and structural barriers than by inherent differences in attitudes or behavioural tendencies (Agnew *et al*., 2018; Blaschke, 2022). When financial knowledge is accounted for, as in the dual moderation model, gender appears to play a minimal role, indicating that knowledge, rather than gender, is the primary driver of behavioral outcomes.

Overall, the study advances understanding in two meaningful ways. First, it demonstrates that the translation of financial attitudes into behavioural outcomes is conditional rather than universal, reinforcing the importance of developing comprehensive financial literacy initiatives that combine knowledge acquisition with attitude formation. Second, it provides evidence that financial knowledge, rather than gender, is the critical moderating factor shaping financial behavior in the student population. This insight is particularly relevant for designing targeted educational programmes that aim to strengthen financial capability in higher education settings.

Although the presented results are insightful, they should be interpreted in light of several limitations. First, the cross-sectional design restricts causal inference, so the observed associations cannot confirm cause-and-effect relationships. Second, data were collected via self-reported online surveys, which may introduce social desirability or recall biases. Third, the sample, though diverse across eight public universities in Bosnia and Herzegovina, may not fully represent all university students or young adults in other contexts, limiting generalizability. Finally, only two moderators, gender and financial knowledge, were examined, while other relevant factors, such as socioeconomic background, socialisation, or personality traits, were not included. Therefore, future studies could employ longitudinal designs, broader and more representative samples, and investigate additional individual or contextual factors to provide a more comprehensive understanding of financial literacy and behavior among university students

5. CONCLUSION

This study examined the relationship between financial attitudes and financial behavior among undergraduate students, with a particular focus on the moderating roles of gender and financial knowledge. Using validated factor-derived measures and a dual moderation framework, the findings highlight several important insights for understanding financial literacy of university students. *First*, although financial attitudes exhibited a positive association with financial behavior, the direct effect was not statistically significant. This suggests that attitudes alone may be insufficient to generate consistent behavioral outcomes among university students, particularly in contexts where financial responsibilities and real-world decision-making experience are limited. *Second*, financial knowledge emerged as a significant moderator, strengthening the link between attitudes and behavior. Students with higher knowledge levels were more capable of translating positive attitudes into practical financial actions. This finding reinforces the critical role of financial knowledge as an enabling resource and aligns with contemporary evidence suggesting that knowledge enhances decision-making confidence and behavioral consistency. *Third*, gender did not significantly moderate the relationship between attitudes and behavior. This contrasts with

much of the earlier literature documenting gender disparities in financial literacy but supports emerging studies showing that such differences may be attenuated within more homogeneous educational settings. When both moderators were considered jointly, the moderating effect was driven primarily by financial knowledge rather than gender. Overall, the study provides empirical support for the view that financial literacy is multidimensional and that the interaction between its components can shape behavioural outcomes.

In practical terms, the findings highlight the importance of university-level financial education programs that prioritize strengthening financial knowledge. For policymakers and educators in Bosnia and Herzegovina and similar contexts, these results suggest that interventions aimed at enhancing financial knowledge can benefit students across genders and promote more responsible and informed financial behavior among young adults.

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