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Notes from of Editor-in-Chief

Editor-in-Chief

International Review is an international scientific journal in all its characteristics, from the participation of eminent experts in the field of economic sciences in the processes of designing and functioning of the journal, to the reviewer list, which includes scientists from many countries and who give special importance to the authenticity and originality of the published works.

Since its foundation in 2012, International Review has met all regulatory standards of the Republic of Serbia. Also, the appearance and technical equipment represent a significant quality of this magazine.

The multidisciplinarity of business economics is part of the very conceptual essence of the International Review, which means that the need for a scientific review of other scientific fields, especially those related to entrepreneurship, cannot be left out during an objective scientific review of certain issues in this field. At the same time, the publication of papers in this journal is possible only if they meet full scientific standards in terms of originality, a high level of scientific methodological approach and creativity.

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December 22.7.2026

Prof. Zoran Radulovic, PhD

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PART I.

CONTEMPORARY TRENDS IN EDUCATION, LEARNING AND TALENT MANAGEMENT

ORIGINAL SCIETNTIFIC PAPER

STRATEGIES FOR ADAPTING ONLINE TEACHING TO DIFFERENT LEARNING STYLES: AN ANALYSIS THROUGH THE COMMUNITY OF INQUIRY MODEL

ARSENIJEVIĆ Jasmina[1], KASTRATOVIĆ Edita[2], ARSENIJEVIĆ Olja[3], ŠPRAJC Polona[4]

[1] Preschool Teachers' Training College in Kikinda (Serbia) ORCID 0000-0003-2347-6573
[2] Faculty of Business Economics and Entrepreneurship, Belgrade (Serbia) ORCID 0009-0003-0808-1220
[3] Institute for Serbian Culture Pristina – Leposavic (Serbia) ORCID 0000-0002-0465-0508
[4] Faculty of Organizational Studies, University of Maribor, Kranj (Slovenia) ORCID 0000-0003-1356-3438

E-mail: arsenijevicjasmina@gmail.com, edita.kastratovic@vspep.edu.rs, arsenijevicolja@gmail.com, polona.sprajc@um.si

ABSTRACT

Due to the changes caused by the intensification of online teaching during the pandemic, the aim of this research was to examine the differences in students' perceptions of university online teaching in relation to their learning styles. Online university teaching is investigated in this paper based on the theoretical model known as the Community of Inquiry (CoI), developed in 2000 by Garrison, Anderson, and Archer. As the theoretical framework for learning styles, the paper used Honey and Mumford's model, which identifies four learning styles: Activist, Reflector, Theorist, and Pragmatist. This paper presents the results of an international study carried out in the academic year 2022/2023 among students (N = 808) from Serbia, Bosnia and Herzegovina, Croatia, Slovenia, Romania, and Russia. A modified version of the Community of Inquiry survey instrument was applied and tested, demonstrating high reliability (α = 0.94). The results showed that students with different learning styles perceive the Community of Inquiry framework in online learning differently. Across all CoI elements (Teaching, Social, and Cognitive Presence), students with a reflector learning style gave the highest evaluations, followed by theorists, then activists, while pragmatists gave the lowest evaluations. These findings indicate that it is necessary to improve the application of educational technology in a way that suits all students' learning styles and preferences.

***Keywords**: Community of Inquiry, online teaching, learning styles, higher education.*

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INTRODUCTION

The structural and transitional changes caused by the spread of the COVID-19 pandemic worldwide in 2020 have led to a considerable amount of research around the world on online teaching and the success of higher education in meeting these challenges. The organization of online teaching in higher education is a complex and interdisciplinary endeavor (Rapanta et al., 2020). Although some systems and institutions of higher education had more experience, as they had already introduced distance learning before the outbreak of the global pandemic, this task was particularly difficult for the vast majority of them. Teaching staff had to be trained to use digital tools for online teaching and to develop online learning materials simultaneously. In the short term, universities faced an increased demand for IT specialists, digital infrastructure, and appropriate software and hardware resources. Recent studies emphasize that the successful adoption of digital technologies significantly improves organizational performance and facilitates adaptation to rapidly changing environments (Zhou et al., 2026). Furthermore, the integration of artificial intelligence into educational and organizational processes is increasingly recognized as a driver of innovation, efficiency, and sustainable development (Sun & Zhu, 2026).

Effective online teaching is by no means something that can be organized on the fly through improvisation; it requires a different design from the traditional model. The growing importance of e-learning has also highlighted the need for the development of digital competencies among students and teachers. As noted by Vučeković, Medić, and Marković (2020), digital skills have become a prerequisite for effective participation in contemporary educational and professional environments, making the quality and adaptability of online learning systems increasingly important.

Developing online teaching that achieves good results and the desired effects does not mean transferring teaching that has been carried out in vivo to the online environment (Huang et al., 2020; Rapanta et al., 2020). The digitalization of existing teaching processes is necessary, but it is also important to develop a new process that was not possible in face-to-face teaching. "Instead of the translation of the old pedagogical practices into the new online environment, there needs to be a real adaptation of teachers to the opportunities and constraints of the online environment" (Arsenijević et al., 2022: 53).

In order for online classes to be designed in a manner that suits all students equally, it is necessary to consider the individual differences among students. Designing an effective and adaptive e-learning system represents a challenging task, as it needs to adjust to the diverse needs of learners (Alshammari, 2016). Individual differences have been identified as a key factor in numerous models predicting students' behavior in e-learning systems. Previous studies have demonstrated that factors such as age, gender, experience, and education significantly influence the implementation of e-learning systems (Baharudin, Sahabudin & Kamaludin, 2017). Educational environments that effectively integrate digital technologies can also contribute to the development of entrepreneurial and innovative competencies among students, thereby strengthening their adaptability to the contemporary labor market (Subotic et al., 2026).

In this context, learning styles are particularly important as individual characteristics of students. A learning style is the way in which an individual organizes, processes, presents, and combines information, stores it in his or her cognitive system, and then retrieves information and experiences in a style that reflects his or her communication technique (Fleming & Baume, 2006; Pashler et al., 2008; Jaleel & Thomas, 2019). Learning styles can also be described as methods and strategies by which students individually respond to the set requirements and curricula of higher education in accordance with their intellectual autonomy, independent thinking, and the way they approach learning and problem solving.

Previous studies have shown that little attention has been paid to students' individual needs and preferences in the design of online courses and that students have generally been treated equally (Shi et al., 2008; Lee & Kim, 2012; Alshammari & Qtaish, 2019; Yalcinalp & Avcı, 2019). Since students differ in their approaches to acquiring and processing knowledge, educational strategies should be sufficiently flexible to support the development of competencies among learners with different preferences and learning styles. This need becomes even more important in digitally mediated environments where adaptability and continuous learning represent essential components of individual competitiveness (Radović-Marković et al., 2019).

More research needs to be conducted on how educational technologies can affect the development of skills and the performance of different learners (El-Sabagh, 2021). Studies examining the extent to which online teaching meets different learning styles, which represent a broader dimension and cross-section of

learning styles in higher education during the pandemic, when education was urgently shifted to the online environment (especially in developing countries), are still relatively rare. A comparative study conducted before the pandemic showed that students with a particular learning style exhibit different behaviours and perform differently in traditional and online courses (Downing & Chim, 2004). This paper aims to do just that by presenting the results of an investigation of differences in the Community of Inquiry framework in online higher education during the 2021/2022 academic year, according to students' learning styles.

The theoretical basis for the learning styles used in this paper is Honey and Mumford's model, which is a modified version of Kolb's Learning Style Inventory (Kolb, 1984), conceptualized under the influence of John Dewey, Piaget (1950, 1952), and Lewin (1951, 1957). According to this model, learning styles are divided into four categories: Activist, Reflector, Theorist, and Pragmatist (Honey & Mumford, 1992). An activist learns best through activity, seeking practical solutions and enjoying new experiences and opportunities that enable active engagement and collaboration with others in the learning process. Activists learn best through short, interactive tasks. A reflector learns best by gathering and evaluating new information, tending to observe information and reflect on it before acting. Reflectors learn best by observing others and need sufficient time for careful reflection. Theorists learn best by reasoning and constructing logical models, asking questions, examining things from different perspectives, studying meticulously, thinking incrementally, and seeking logical explanations. Theorists are analytical, learn like reflectors, and like to apply their own concepts. A pragmatist learns best through hands-on activities and experiments, especially when faced with a difficult problem. Pragmatists learn similarly to activists but prefer having a practical goal and tend to interact with others while learning. While reflectors and theorists are oriented towards thinking and independent learning, activists and pragmatists learn by doing and interacting with others.

The Community of Inquiry (CoI) framework was used in this research because it is the most widely accepted theoretical framework in professional and academic circles dealing with online teaching. It was developed in 2000 by Garrison, Anderson, and Archer (Garrison, Anderson & Archer, 2003) and is based on John Dewey's progressive understanding of education (Dewey, 1933, 1938, 1959), which relates to the very process of knowledge formation and creation. According to the CoI model, online teaching supports an inquiry-based learning community that enables learning through interactive and meaningful inquiry and knowledge sharing while integrating a collaborative and constructivist approach to learning. The model includes three types of presence: teaching, social, and cognitive presence, and their interaction provides the structure needed for a dynamic online environment conducive to learning and experience. Teaching presence includes a wide range of pedagogical activities, roles, forms, and interventions that teachers undertake to facilitate interaction with students in an online environment. It involves designing the teaching process and learning environment while directing cognitive and social processes in order to achieve learning outcomes. Social presence is the extent to which students feel socially and emotionally connected to others and to the online learning environment, that is, their ability to communicate purposefully and develop interpersonal relationships by projecting themselves socially and emotionally into the learning community through the medium used in online teaching (Garrison, 2009). Cognitive presence represents the process of students' interaction with the learning content, that is, the extent to which students are able to construct meaning through reflection and communication. Its foundation lies in reflection, which leads to inquiry and the practical application of knowledge, according to the teachings of John Dewey (Dewey, 1933).

MATERIALS AND METHODS

The aim of this research is to examine whether there are differences in the perception of the *Community of Inquiry* and its elements in relation to the students' learning styles (*activist, reflector, theorist, and pragmatist*). The research hypothesis is that there are statistically significant differences in the assessment of the CoI model and its elements in relation to the students' learning styles.

The SPSS 20.0 software package was used for data entry and processing. To investigate the differences in the assessments of the Community of Inquiry in relation to the students' learning styles, within the framework of comparative statistics, a one-way analysis of variance (ANOVA) was used.

THE RESEARCH INSTRUMENT

The research instrument used in this paper is an adapted version of the *Community of Inquiry Questionnaire* (Arbaugh et al., 2008). A detailed description of the instrument, an analysis of the main components, and a reliability analysis are presented in another paper by the same authors (Arsenijević & Andevski, 2022). The instrument has high reliability, as Cronbach's alpha coefficient was $\alpha = 0.941$.

In order to describe the latent structure of the measurement space, factor analysis was used. Three factors meeting the Kaiser-Guttman criterion of having an eigenvalue greater than 1 were identified, explaining 64.78% of the total variance. All three factors fully correspond to the CoI elements. The first factor is composed of items related to *teaching presence*; the second factor refers to *cognitive presence*; and the third factor refers to *social presence*.

In addition to the modified CoI instrument, a shorter questionnaire constructed for the purposes of this research was used to obtain basic data about the sample (country, field of education, level of representation of online teaching), including a question regarding the respondents' dominant learning style. It is a closed-ended question with four possible answers, and each answer directly describes one learning style from Kolb's theoretical model (1984).

THE RESEARCH SAMPLE

The research was conducted from October 2022 to January 2023 at universities in six countries: Serbia, Bosnia and Herzegovina, Croatia, Slovenia, Romania, and Russia. A convenience sampling method was used.

Table 1. A comparative view of respondents by country

Country	Frequency	Percent
Serbia	249	30.8
Bosnia and Herzegovina	69	8.5
Croatia	72	8.9
Slovenia	38	4.7
Romania	176	21.8
Russia	204	25.2
Total	808	100.0

The largest number of students included in the research were from Serbia, followed by Russia and Romania, while the smallest number were from Slovenia (Table 1).

Table 2. Fields of education of students included in the research

Field of education	Frequency	Percent
Social Science & Humanities	438	54.2
Engineering & Technology	210	26.0
Natural Sciences	35	4.3
Medical and Health Science	71	8.8
Creative Arts and Interdisciplinary Fields	24	3.0
Missing	30	3.7
Total	808	100.0

When it comes to the field of education, the sample consists of students from all fields of education (Table 2). More than half of the students who participated in the research studied Social Sciences and Humanities, while more than one-quarter studied Engineering and Technology. Medical and Health Sciences and Natural Sciences followed. Respondents studying Creative Arts and Interdisciplinary Fields represented the smallest share of the total sample.

Table 3. Presence of online teaching in the observed sample

Mode of teaching	Frequency	Percent
Completely	420	52.0
To a greater extent	203	25.1
As much as in vivo	106	13.1
To a lesser extent	75	9.3
Missing	4	0.5
Total	808	100.0

Teaching had been organized completely online for more than half of the respondents, while it was organized predominantly online for approximately one-quarter of the respondents. About 13% of respondents attended classes online to the same extent as in vivo, while only 9.3% stated that they attended their classes predominantly in vivo (Table 3).

Table 4. Students' learning styles

Learning style	Frequency	Percent
Activist	183	22.6
Reflector	219	27.1
Theorist	235	29.1
Pragmatist	171	21.2
Total	808	100.0

Among the students who participated in the research, the largest group consisted of those whose learning style was *theorist*, followed by *reflectors* and *activists*, while *pragmatists* were the least represented (Table 4). Bearing in mind the structure of the respondents in relation to the field of education, the distribution of learning styles is expected because the majority of students study Social Sciences and Humanities, which correspond to the learning styles of *theorists* and *reflectors*—characterized by methodical thinking and analysis—rather than the more practical, experimental, and active approach to learning that is characteristic of the *activist* and *pragmatist* learning styles.

RESULTS

The students' perceptions of the presence of the *Community of Inquiry* in online teaching and its elements are shown in Table 5.

Table 5. Community of Inquiry in online teaching

CoI element	Mean	Standard deviation
Teaching Presence	3.69	0.96
Social Presence	3.64	0.93
Cognitive Presence	3.45	0.98
Total CoI	3.59	0.86

The *Community of Inquiry* is moderately well expressed in the entire sample. Of all the elements, *teaching presence* was rated the best, followed by *social presence*, while *cognitive presence* was rated the lowest.

A one-way analysis of variance (ANOVA) was used to examine the assessments that students of different learning styles gave to the *Community of Inquiry*. Table 6 shows the F-test values and the level of significance, as well as arithmetic means and standard deviations.

Table 6. Significance of the model and arithmetic means with standard deviations

Domains		AS	SD	F	df1(df2)	*p-level*
Teaching Presence	Pragmatist	3.55	0.99	7.411	600(3)	.000
	Theorist	3.67	0.94			
	Activist	3.46	0.99			
	Reflector	3.93	0.86			
Social Presence	Pragmatist	3.52	0.90	4.390	600(3)	.005
	Theorist	3.51	0.99			
	Activist	3.51	0.90			
	Reflector	3.84	0.90			
Cognitive Presence	Pragmatist	3.21	0.93	6.260	600(3)	.000
	Theorist	3.40	1.02			
	Activist	3.22	0.98			
	Reflector	3.64	0.92			
Community of Inquiry	Pragmatist	3.43	0.83	7.273	600(3)	.000
	Theorist	3.53	0.89			
	Activist	3.40	0.83			
	Reflector	3.81	0.81			

Students with different learning styles evaluate the *Community of Inquiry* in online teaching differently. In other words, there are statistically significant differences in all three elements and in the CoI model as a whole in relation to students' learning styles, which confirms the research hypothesis. *Reflectors* consistently evaluate the presence of the *Community of Inquiry* more positively than students with other learning styles. *Theorists* follow *reflectors*, then *activists*, while *pragmatists* give the lowest assessments of the *Community of Inquiry* (Table 6). This pattern is evident in all CoI elements.

Table 7. Post hoc tests between individual groups (LSD)

			Average difference (I-J)	Standard error	*p-level*
Teaching Presence	Pragmatist	Theorist	-0.127	0.121	0.294
		Activist	0.090	0.106	0.392
		Reflector	-0.388*	0.118	0.001
	Theorist	Pragmatist	0.127	0.121	0.294
		Activist	0.217*	0.108	0.044
		Reflector	-0.261*	0.120	0.029
	Activist	Pragmatist	-0.090	0.106	0.392
		Theorist	-0.217*	0.108	0.044
		Reflector	-0.478*	0.104	0.000
	Reflector	Pragmatist	0.388*	0.118	0.001
		Theorist	0.261*	0.120	0.029
		Activist	0.478*	0.104	0.000
Social Presence	Pragmatist	Theorist	0.010	0.117	0.933
		Activist	0.007	0.102	0.943
		Reflector	-0.323*	0.114	0.005
	Theorist	Pragmatist	-0.010	0.117	0.933
		Activist	-0.002	0.104	0.981
		Reflector	-0.332*	0.116	0.004
	Activist	Pragmatist	-0.007	0.102	0.943
		Theorist	0.002	0.104	0.981

	Reflector	Reflector	-0.330*	0.101	0.001
		Pragmatist	0.323*	0.114	0.005
		Theorist	0.332*	0.116	0.004
		Activist	0.330*	0.101	0.001
Cognitive Presence	Pragmatist	Theorist	-0.183	0.122	0.135
		Activist	-0.007	0.107	0.948
		Reflector	-0.426*	0.119	0.000
	Theorist	Pragmatist	0.183	0.122	0.135
		Activist	0.176	0.109	0.107
		Reflector	-0.243*	0.121	0.046
	Activist	Pragmatist	0.007	0.107	0.948
		Theorist	-0.176	0.109	0.107
		Reflector	-0.419*	0.106	0.000
	Reflector	Pragmatist	0.426*	0.119	0.000
		Theorist	0.243*	0.121	0.046
		Activist	0.419*	0.106	0.000
Community of Inquiry	Pragmatist	Theorist	-0.100	0.106	0.347
		Activist	0.030	0.093	0.745
		Reflector	-0.379*	0.104	0.000
	Theorist	Pragmatist	0.100	0.106	0.347
		Activist	0.130	0.095	0.170
		Reflector	-0.279*	0.105	0.008
	Activist	Pragmatist	-0.030	0.093	0.745
		Theorist	-0.130	0.095	0.170
		Reflector	-0.409*	0.092	0.000
	Reflector	Pragmatist	0.379*	0.104	0.000
		Theorist	0.279*	0.105	0.008
		Activist	0.409*	0.092	0.000

A more detailed comparison using the post hoc LSD test (Table 7) showed that there were statistically significant differences between *reflectors'* assessments of the *Community of Inquiry* and those of students with other learning styles. This applied both to the individual CoI elements and to the overall scale. Apart from this consistent difference across all CoI domains, a statistically significant difference between *theorists'* and *activists'* assessments of *teaching presence* was also observed.

DISCUSSION

Before starting the analysis of the differences in the way students with different learning styles evaluated the Community of Inquiry, it is necessary to clarify to what extent the CoI model was generally represented in online university teaching. The results of the descriptive statistics showed that, according to the responses of the students who participated in the research, the Community of Inquiry was moderately high, but that there was room for improvement (Table 5). Teaching presence was represented to the greatest extent (moderately high presence), followed by social presence (also moderately high), while cognitive presence was represented the least (partial presence). In the observed international sample, in online university teaching during the COVID-19 pandemic, teachers undertook a moderately high degree of pedagogical interventions to design an online teaching process so that students' cognitive processes were encouraged and guided: they set clear deadlines and responsibilities, formulated learning objectives, directed students to create learning tasks, emphasized and led discussions about the material, encouraged students to independently research the learning content, and provided feedback to students about their progress. Social presence was also moderately high, but slightly lower than teaching presence, and there

was a moderately high level of mutual, free, and independent communication and interaction among students. This communication and interaction contributed to students feeling emotionally and socially connected to the online community, which in turn contributed to their learning and allowed them to gain new insights and ideas through interaction with others and to check and improve their knowledge. According to the students' responses, they expressed their opinions to a moderately high extent, listened to the reactions and objections of others, jointly shaped and refined ideas, made comments, and found arguments in the joint search for knowledge. Cognitive presence was rated the lowest, which means that students' interaction with the learning content was only partially present and that students were only partially able to construct meaning through research and reflection, by combining prior and new knowledge, and through communication with others. There is the greatest room for improvement within this CoI element.

The results show that there is a statistically significant difference in how students with different learning styles perceive the Community of Inquiry and its elements in the realized online university teaching (Table 6). It is evident that reflectors, followed by theorists, rate the Community of Inquiry the highest, while activists rate it lower, and pragmatists the lowest. This pattern is evident across all CoI elements as well. We can search for an explanation in the way online classes were organized during the period covered by this research, but also in the very nature of the students' learning styles.

Reflectors tend to have divergent thinking, and theorists are inclined to cognitive assimilation, so they are most suited to classes in which they can combine observation, experience, reflection, and analysis. Reflectors are inclined to inductive reasoning and theorists to deductive reasoning, but both of them prefer the teacher in the role of a knowledge source and teaching that emphasizes observation and independent learning. The fact that reflectors and theorists are most satisfied with the CoI elements (Table 6) clearly explains what kind of online teaching was implemented at the observed faculties during the pandemic. The results regarding the representation of the CoI model also support this, according to which Teaching Presence was the most strongly represented of all elements.

Reflectors and theorists are more inclined toward traditional learning with clearly defined goals, an emphasis on learning content, and the presence of systematic instructions. They are more suited to online teaching that focuses on literature, logical tasks, and case studies and offers opportunities for individual and collective analysis and reflection on the learning content, with periodic knowledge tests (Kanninen, 2009). The online teaching that was realized during the pandemic partially follows the needs of students, and reflectors and theorists give higher scores both on the entire Community of Inquiry scale and on the CoI elements. In contrast, activists and pragmatists, whose learning style is dominated by action, interaction, and the application of knowledge, have a greater need for experimentation and the practical application of their own ideas, as well as for more liberal and less conventional forms of learning and thinking. Students who are pragmatists and activists are most focused on action and interaction in the learning process. Analogy and deduction are present in their thinking process, and they are more suited to a teacher who acts as an observer and coach, guiding them through the practical application of knowledge and providing the necessary feedback (Honey & Mumford, 1992). According to the research presented in this paper, activists, followed by pragmatists, give lower assessments of the Community of Inquiry in online teaching and all its elements, in which they clearly do not find the desired challenges.

Reflectors and theorists are more inclined toward reflection, while activists and pragmatists focus on practice and experience. For activists and pragmatists, group and interactive work, interaction, and conversation are important (Honey & Mumford, 1992). It is possible that the lack of interactivity, in addition to the lack of activity and the practical application of knowledge, contributed to the consistently low scores given by activists and pragmatists to the CoI scale and all three of its elements. The online teaching realized by the observed faculties obviously did not meet the needs arising from their learning styles.

Therefore, in online teaching, teachers mostly used activities and traditional methods from the analogue learning environment. Traditional ex cathedra teaching patterns with clearly defined goals and deadlines, systematic teacher instructions, and a focus on learning content were predominantly represented (teaching presence), while interaction among students (social presence) and students' interaction with the learning content (cognitive presence) were represented to a lesser extent. It is obvious that the application of knowledge, practical lessons, experimentation, and interactive and project-based learning were the weak points, while teaching instruction was the strongest point. Therefore, under such conditions, in which self-directed and independent learning was the most reliable, it is logical that reflectors and theorists evaluate

online teaching better than pragmatists and activists. It is known that "students appreciate direct online communication with the teacher, expressed in direct guidance and instructions, correspondence, feedback, assessments, monitoring, and including even comments, humour, and other forms of active and immediate interaction" (Arsenijević et al., 2023: 11). The online teaching investigated in this paper does not respect the individual learning styles of students and does not sufficiently apply didactic, methodological, and organizational strategies and methods that would contribute to greater efficiency of online learning while respecting the dominant learning styles of individuals.

These results confirm the findings of some earlier studies, although they were conducted before the pandemic and used a different methodology. According to one comparative study conducted before the pandemic, it was shown that reflectors were the most successful in online education programmes, unlike in traditional programmes, thanks to the fact that online programmes provided them with sufficient opportunity and time to think (Downing & Chim, 2004). The fact that online teaching favours a reflective learning style was also shown in a study by another group of authors. Namely, a study on the correlation between students' learning styles and behaviour in e-learning showed that reflectors demonstrated the greatest interest in the e-learning system, followed by theorists, while activists showed less interest and pragmatists the least interest (Baharudin, Sahabudin & Kamaludin, 2017). Moreover, Mestre pointed out that most online situations best serve students who can learn in a text-based, logical, and passive environment (Mestre, 2006).

When considering the diversity of students' needs in online learning environments, it is important to note that in recent years efforts have been made to adapt online teaching methods and content to students' learning styles and other preferences in so-called adaptive learning environments (Normadhi et al., 2019). Modern AI-based tools adjust and personalize learning content and the pace of learning based on students' interests, capacities, and even learning styles. A personalized learning approach focuses on providing an effective, customized, and efficient learning path so that each student can participate in the learning process (Hussein & Al-Chalabi, 2020).

The potential of digital work is therefore primarily seen in optimizing the use of online learning technology that follows and respects individual learning styles, as well as in teachers' pedagogical competencies to differentiate teaching strategies and activities according to the different needs of students. In this sense, educational technology is understood as an infusion, a catalyst for analogue learning practices (Taisir Subhi Yamin, 2014; Maksimović et al., 2021).

In order to be more effective in online teaching and learning, reflectors and theorists should be encouraged and given more time to think, question ideas, analyse phenomena, and use rationality and logic. Reflectors benefit the most from studying online learning materials, listening to online lectures, and participating in forum discussions, while theorists benefit from well-prepared classes that analyse case studies and connect cause and effect, with occasional knowledge tests (Kanninen, 2009). Pragmatists and activists should be allowed to make a correlation between the problems they investigate and real life and practice, to be placed at the centre of problem solving, and to try out their own ideas. They need teachers in the role of coaches to give them feedback and encourage their group activities in solving problems. Pragmatists need practical exercises, opportunities for experimentation, and real-time conversation, while activists need practical problem-solving and interactive activities such as role-playing. Both activists and pragmatists need engagement in project work and real-time interaction and conversation (Kanninen, 2009). In order to engage activists and pragmatists, it is therefore important that teachers involve students in as wide a range of different learning activities as possible, such as "online projects in teams, small groups and pairs, assign tasks in which students need to apply theoretical knowledge in solving practical and professional problems ... these can be projects, case studies, discussions, forums, debates, and other forms of online communication that create conditions for active interaction" (Arsenijević et al., 2023: 11; Arsenijević et al., 2023: 114).

CONCLUSION

In this study, the Community of Inquiry in online university teaching during the pandemic was examined. The research was conducted among students from different educational fields in developing countries who had no previous experience with online higher education and were adapting to the transition to digital teaching. The results indicate that the online teaching implemented during the pandemic did not align with students' preferences and learning styles.

The results lead to the conclusion that, during the pandemic, online teaching in higher education was approached with the dominance of didactic materialism, characteristic of the analogue learning environment. This is inferred from the low scores for the Community of Inquiry given by students who are activists and pragmatists, as they are the ones who are inclined to combine action, experiential learning, and interaction in their learning. Obviously, online teaching at universities did not provide opportunities for this type of learning. In contrast, reflectors and, to a lesser extent, theorists, who learn passively through observation and reflection, rated the Community of Inquiry in online teaching the highest. It is clear that online university teaching was designed to accommodate the learning styles of reflectors and theorists. This indirectly indicates that higher education in the observed countries is not adapted to the student and that online education, as a major socio-technological experiment worldwide, fits into this context.

There is a widespread belief that online learning in higher education will continue to expand in the post-pandemic era, which consequently means that it will involve an increasing number of users. The development of technology towards so-called adaptive learning environments allows the adaptation of online teaching, methods, and content to different preferences and learning styles of students (Normadhi et al., 2019), and modern artificial intelligence-based tools adjust the content and the pace of learning based on students' interests and cognitive abilities. This means that the future will undoubtedly be marked by the technologically based individualization of learning. However, for this to happen, not only is technological development important, but also the support of higher education as a system, as well as the support of people, especially teachers. This research has shown that, at least in the initial stage of implementing online education, this was not the case. It is important to design online learning environments that are tailored to the needs of all learning styles, that use diverse teaching strategies and techniques, that incorporate different teaching materials, and that adapt technological solutions so that each student can participate equally.

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ORIGINAL SCIETNTIFIC PAPER

BRANDING THE SERBIAN ARMED FORCES AS AN EMPLOYER TO ATTRACT AND RETAIN TOP TALENT

VUJOVIĆ Tanja[1], NEŠEVSKI Aleksandar[2], KNEŽEVIĆ Milena[3]

[1] *Faculty of Economics, Kosovska Mitrovica (SERBIA), ORCID: 0000-0001-7103-0934*
[2] *University of Defence, Belgrade (SERBIA), ORCID: 0009-0008-4071-7539*
[3] *Military Academy, Belgrade (SERBIA), ORCID: 0000-0003-2814-7453*

E-mail: tanja.vujovic@pr.ac.rs, anesevski@gmail.com, milena.knezevic@mod.gov.rs

ABSTRACT

This paper is based on research examining the possibilities of attracting and retaining the best talents through the employer branding process of the Serbian Armed Forces. The aim of the research was to determine whether, and if so, to what extent, there was a relationship between the branding process of the Serbian Armed Forces and the work environment, through the level of job satisfaction, possibility for advancement, and leadership style within the defence system of the Republic of Serbia. The main motive for writing this paper was to examine whether the branding process of the Serbian Armed Forces affects the attraction of new talents and the retention of existing high-performing personnel. The paper also presents the opportunities that the Serbian Armed Forces, as an employer, can utilize in order to attract potential new employees.

***Keywords**: branding, Serbian Armed Forces, employer, work environment.*
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INTRODUCTION

Viewed through the lens of marketing, the Serbian Armed Forces represent one of the oldest Serbian brands, with enormous historical and traditional value.

Previous empirical studies have confirmed that companies have intensified the competition for employees with professional and managerial skills in recent years. Therefore, attracting new employees and retaining existing ones has become a matter of great importance for organizational management. The Serbian Armed Forces, as one of the employers on the labour market, must respond to new demands and take measures to present themselves, particularly to younger generations, as an attractive and secure employer, while preserving their organizational and traditional values.

This paper highlights, through conducted research, the opportunities offered by the branding process to help the Serbian Armed Forces attract new employees and retain the best talents. The following hypotheses were tested:

$\boldsymbol{H_1}$: There is a statistically significant relationship between the variables "Job Satisfaction" and "Army as a Brand";

$\boldsymbol{H_2}$: There is a statistically significant relationship between the variables "Possibility for Advancement" and "Army as a Brand";

$\boldsymbol{H_3}$: There is a statistically significant relationship between the variables "Work–Life Balance" and "Army as a Brand";

$\boldsymbol{H_4}$: There is a statistically significant relationship between the variables "Leadership Style" and "Army as a Brand".

LITERATURE REVIEW

The Serbian Armed Forces are a brand that is well known throughout the country and represent one of the oldest national brands, with exceptional social influence and importance [1]. Despite all the tragic events of the 1990s, they remain a brand that evokes positive emotions and is firmly rooted in the public consciousness [2].

When discussing the branding of the military as an employer, it should be noted that Ambler and Barrow first coined the term employer branding by combining the concepts of human resource management and marketing. They defined the term as "a package of functional, economic and psychological benefits provided by employment and identified with the company" [3]. In the literature, employer branding is often described as a three-step process [4]. First, the employer develops a distinct value proposition for both potential and current employees. The second step is external marketing, which serves to attract the target group, while the third step consists of internal marketing, which includes fulfilling the "promise" made to the target group [5].

The trend of a shortage of human capital in the labour market has intensified competition among companies for employees in recent years. As a result, attracting and retaining qualified employees has become a global challenge, the solution to which requires a well-designed strategic approach [6]. In such business conditions, most companies have begun to recognize the importance of an effective employer branding strategy in order to attract a higher-quality workforce [7]. Therefore, it has become imperative for organizations to understand the expectations of both potential and current employees and to develop an employer branding strategy that will attract and retain talent [8].

In his study, Kumar notes that candidates consider a company's reputation when applying for a job. He also states that a positive company image and reputation help attract and retain employees [9]. Retaining valuable employees is a major challenge for modern organizations, and a company's brand image is a key factor in attracting and retaining employees [10]. In this context, it has been suggested that successful employer branding facilitates recruitment and employee engagement, increases creativity and job satisfaction, and consequently improves employee retention. Therefore, employer branding has effectively become a tool for retaining employees [11].

RESEARCH METHODOLOGY

For the purpose of conducting empirical research on the possibilities of attracting and retaining the best talents through the branding process of the Serbian Armed Forces, a survey method was used, specifically a questionnaire distributed via Google Forms. The participants in the survey were employees within the defence system of the Republic of Serbia, ranging from personnel engaged in technical and operational duties, through employees performing highly specialized tasks in institutions of the Ministry of Defence and units of the Serbian Armed Forces, to managers in the sectors and administrations of the Ministry and the Armed Forces, as well as in the Rectorate of the University of Defence.

The first part of the questionnaire contained socio-demographic characteristics of the respondents, including questions related to gender, marital status, level of education, length of service, type of work performed, monthly income, and lifestyle.

The second part of the questionnaire consisted of questions concerning the importance and influence of the Serbian Armed Forces as a brand, their current reputation, and their presence in the public sphere and the media, particularly on social networks.

The third part of the questionnaire included questions related to the respondents' work environment, including the degree of job satisfaction, opportunities for further training and development, the establishment of a balance between work and private life, and assessments of leadership and management practices by superiors.

The survey was conducted by distributing the questionnaire to the e-mail addresses of 103 members of the Ministry of Defence and the Serbian Armed Forces, of whom 92 participated in the survey. Consequently, the survey conducted in March 2024 achieved a response rate of 89.32%.

RESULTS AND DISCUSSION

A total of 92 respondents participated in the study, with slightly more men, 52 (55.4%), than women, 40 (44.6%). Regarding the level of education, most respondents held a master's degree, 39 (41.7%). Furthermore, 17 (18.7%) respondents had completed undergraduate studies, 27 (29.7%) had secondary or vocational education below the seventh qualification level, while 9 (9.9%) respondents held a PhD degree.

With regard to length of service, more than two-thirds of the respondents, 70 (75.8%), had over 15 years of service. A total of 14 (15.4%) respondents had less than 5 years of service, while only 8 (8.8%) participants had between 5 and 15 years of work experience.

The structure of the sample according to the type of job was relatively balanced. The largest group consisted of respondents in management positions, 27 (29.6%), followed by those in administrative positions, 24 (25.3%), and highly professional positions, 21 (23.1%). The smallest number of respondents were employed in technical-operational positions, 13 (14.3%), and other jobs, 7 (7.7%).

Regarding marital status, the majority of respondents were married, 63 (68.1%), while only 2 (2.2%) respondents were in an extramarital union. The criterion "monthly income level" indicates that more than half of the respondents, 52 (55.0%), had a monthly income exceeding RSD 100,000, which corresponds to the educational structure of the sample, where more than 70% of respondents had higher education qualifications. Only 9 (9.9%) respondents reported a monthly income below RSD 70,000.

Table 1. Socio-demographic profile of respondents (N = 92)

Variables	N	%	Cumulative %
Gender			
Female	40	44,6	44,6
Male	52	55,4	100
Educational level			
Secondary school	14	15,4	15,4
Vocational studies	13	14,3	29,7
University (basic studies)	17	18,7	48,4
Master's degree	39	41,7	91,1
PhD	9	9,9	100

Length of Service			
Up to 5 years	14	15,4	15,4
From 5 to 15 years	8	8,8	24,2
From 15 to 25 years	37	39,5	63,7
Over 25 years	33	36,3	100
Type of job			
Management	27	29,6	29,6
Highly professional jobs	21	23,1	52,7
Administrative jobs	24	25,3	78,0
Technical-operational jobs	13	14,3	92,3
Other jobs	7	7,7	100
Marital status			
Single	19	20,9	20,9
Married	63	68,1	89,0
Extramarital union	2	2,2	91,2
Widowed	2	2,2	93,4
Divorced	6	6,6	100
Monthly Income Level			
Up to RSD 70.000	9	9,9	9,9
From RSD 70.000 to RSD 100.000	31	34,1	45,0
From RSD 100.000 to RSD 130.000	16	17,6	62,6
Above RSD 130.000	36	38,4	100
Total	92	100	

Source: Authors' calculations

Within the questionnaire, each variable was assessed using a five-point Likert scale, where 1 indicated "completely incorrect" and 5 indicated "completely correct". In order to determine the existence and strength of the relationships among the five variables, namely "Army as a Brand", "Job Satisfaction", "Possibility for Advancement", "Work–Life Balance", and "Leadership Style", a descriptive analysis of the observed variables was first conducted (Table 2).

Table 2. Descriptive statistics of variables

Variables	N	min	max	M	SD
Army as a Brand	92	1	5	3,99	0,625
Job Satisfaction	92	1	5	3,16	0,663
Possibility for Advancement	92	1	5	3,23	0,823
Work–Life Balance	92	1	5	3,95	0,666
Leadership Style	92	1	5	3,78	0,756

Source: Authors' calculations

The descriptive statistics of the analyzed variable "Army as a Brand" clearly reflect the respondents' attitudes, given that the mean values of all observed variables are above average. The highest-rated variables were "Use of social networks in promotion" (M = 4.38, SD = 0.90), "Use of social networks in the representation of the Ministry of Defence and the Serbian Armed Forces" (M = 4.32, SD = 0.97), and "Introduction of compulsory military service" (M = 4.29, SD = 1.08).

It can be stated with confidence that the contemporary era is characterized by the widespread use of the Internet and social networks, which is confirmed by the survey results, where more than 85% of respondents indicated that the use of social networks is important for promoting and presenting the Ministry of Defence and the Serbian Armed Forces. In recent months, the possibility of reintroducing compulsory military service has increasingly been discussed by the state and military leadership. As many as 80% of respondents believe that the reintroduction of compulsory military service would contribute to strengthening the brand of the Serbian Armed Forces. Until 2011, all able-bodied men of legal age were obliged to perform military service. Subsequently, continuity was maintained through reserve units, military exercises, tactical-technical gatherings, and similar activities [12]. However, as the current situation has not produced noticeable results, the reintroduction of compulsory military service is increasingly viewed as the most viable option.

Regarding the variable "Job Satisfaction", the respondents evaluated the individual items somewhat unevenly. Among the highest-rated items were "Performing different types of work" (M = 4.12, SD = 1.15) and "Attractiveness of the workplace" (M = 3.93, SD = 1.02). The lowest-rated item was "Possibility of working from home" (M = 1.42, SD = 0.88). This confirms the specific nature of military work, where very few duties can be performed remotely. In addition, military service is generally not characterized by frequent business travel, which was confirmed by more than 40% of respondents.

For the variable "Possibility for Advancement", all analyzed items received relatively positive evaluations. The highest-rated item was "Openness to acquiring other professional skills" with a mean score of M = 3.95 (SD = 1.12). This result indicates a clear willingness among respondents to improve various professional competencies. However, only 24% of respondents stated that they had opportunities to do so. This finding may negatively affect the attractiveness of the Serbian Armed Forces as an employer. Therefore, managers throughout the defence system should ensure equal opportunities for professional development and specialization for all employees.

The range of average scores for the variable "Work–Life Balance", from M = 3.33 (SD = 1.32) to M = 4.59 (SD = 0.78), indicates generally positive attitudes among respondents. The highest-rated items were "Possibility of leaving work earlier" (M = 4.59, SD = 0.78) and "Communication with colleagues" (M = 4.23, SD = 0.81). These findings reflect the specific nature of military service, where team spirit and strong interpersonal relationships are particularly important, given the considerable amount of time spent together outside regular workplaces, during field exercises, training activities, shooting practice, and similar settings. In his research, Kovačević states that good interpersonal relations are the factor that most strongly influences the motivation of professional members of the Serbian Armed Forces, while working conditions and leisure time are ranked somewhat lower [13].

When analyzing the variable "Leadership Style", a relatively wide range of scores was observed. The lowest-rated item was "Tasks outside the job description" (M = 3.00, SD = 1.40), while the highest-rated item was "Manager's attitude toward employees" (M = 4.40, SD = 0.77). The remaining ratings also indicate a high level of trust that employees place in their managers and superiors, as well as confidence in their competencies and leadership style. Research conducted among Swedish soldiers confirmed that constructive leadership has a significant positive effect on job satisfaction, whereas destructive leadership has the opposite effect [14].

The statistical technique selected for hypothesis testing was correlation analysis. Before conducting the analysis, several preparatory steps were undertaken. First, reverse coding was applied to items containing negatively worded statements or negative connotations. This procedure was applied to certain items within the variables "Army as a Brand", "Job Satisfaction", and "Leadership Style". The recoding process was performed using the Transform and Recode functions in the SPSS software package.

Subsequently, average scores were calculated for each of the five scales used in the study. The next step involved calculating Cronbach's alpha (α), which provides information regarding the reliability of the measurement scales. Furthermore, the internal consistency of the items within each scale was assessed through factor analysis using principal component analysis. Finally, the assumptions required for conducting correlation analysis were examined, including linearity and homogeneity of variance.

The obtained mean values for the scales, Cronbach's alpha coefficients, and the results of the factor analysis are presented in Table 3.

Table 3. Mean scale scores, Cronbach's alpha coefficients, and factor analysis results

Questionnaire Scale	M	A	FA			Number of Extracted Factors	% of Explained Variance
			KMO	BT	Sig.		
Army as a Brand	3,9856	0,791	0,754	387,296	0,000	1	40,151
Job Satisfaction	3,1619	0,784	0,718	356,137	0,000	1	46,376
Possibility for Advancement	3,2276	0,775	0,732	244,489	0,000	1	46,533
Work–Life Balance	3,9452	0,762	0,752	194,983	0,000	1	57,359
Leadership Style	3,7778	0,807	0,846	293,939	0,000	1	48,721

Note: α = Cronbach's alpha coefficient; FA = factor analysis; KMO = Kaiser–Meyer–Olkin measure of sampling adequacy; BT = Bartlett's test of sphericity; Sig. = level of statistical significance.

The mean scores obtained for each scale ranged from M = 3.2276 to M = 3.9856, indicating that the majority of respondents expressed positive attitudes toward the issues examined in the questionnaire. All obtained Cronbach's alpha coefficients exceeded 0.700, leading to the conclusion that the scales used in the study demonstrated an acceptable level of reliability.

The calculated values of the Kaiser–Meyer–Olkin measure of sampling adequacy for each scale were greater than 0.700, while the values of Bartlett's test of sphericity were statistically significant, indicating that the data were suitable for factor analysis. The factor analysis results revealed a single extracted factor for each scale, with percentages of explained variance exceeding 40%, suggesting satisfactory internal consistency among the items within each scale used in the study.

The assumptions required for conducting the correlation analysis, namely linearity and homogeneity of variance, were examined using scatterplots, which did not reveal any non-linear relationships or significant outliers. Given that respondents evaluated the items using a five-point scale, the four hypotheses proposed in this study were tested using Spearman's rank correlation coefficient (rho). The results of the correlation analysis are presented in Table 4.

Table 4. Results of the Correlation Analysis

	(1)	(2)	(3)	(4)	(5)
Army as a Brand (1)	-	0,475**	0,548**	0,460**	0,467**
Job Satisfaction (2)		-	0,764**	0,552**	0,442**
Possibility for Advancement (3)			-	0,585**	0,448**
Work–Life Balance (4)				-	0,340**
Leadership Style (5)					-

Note: * Correlation is statistically significant at $p < 0.05$; ** Correlation is statistically significant at $p < 0.01$.

Based on the results of the correlation analysis, the relationship between "Army as a Brand" and "Job Satisfaction" was positive and statistically significant (rho = 0.475, $p < 0.005$). According to Cohen's criteria, the strength of this relationship can be characterized as moderate. The calculated coefficient of determination indicates that these two groups of variables share 22.56% of the common variance. This relationship is also supported by the findings presented earlier, where certain items within the "Job Satisfaction" variable received particularly high ratings, namely "Performing Different Types of Work" (M = 4.12) and "Attractiveness of the Workplace" (M = 3.93). Therefore, hypothesis H_1 was confirmed.

The results of the correlation analysis regarding the relationship between "Army as a Brand" and "Possibility for Advancement" were also positive and statistically significant (rho = 0.548, $p < 0.005$). According to Cohen's criteria, the strength of this relationship can be considered strong. The calculated coefficient of determination indicates that these two groups of variables share 30.03% of the common variance. The specific nature of the military profession requires continuous professional development and advancement, which is also reflected in respondents' evaluations of this variable (M = 3.23). Based on these findings, hypothesis H_2 was confirmed.

The variables "Army as a Brand" and "Work–Life Balance" also demonstrated a positive and statistically significant relationship (rho = 0.460, $p < 0.005$). The calculated coefficient of determination indicates that these two groups of variables share 21.16% of the common variance. According to Cohen's criteria, the strength of this relationship can be classified as moderate. As previously noted, military service is characterized by strong team spirit and collegial relationships, which is reflected in the observed relationship between these variables. Consequently, hypothesis H_3 was confirmed.

The relationship between the variables "Army as a Brand" and "Leadership Style" was likewise positive and statistically significant (rho = 0.467, $p < 0.005$). According to Cohen's criteria, the strength of this relationship can be described as moderate. The calculated coefficient of determination indicates that these two groups of variables share 21.80% of the common variance. Therefore, the statistical results also confirmed hypothesis H_4.

CONCLUSION

The research conducted in this paper aimed to examine the possibilities available to the Serbian Armed Forces, as an employer, to attract new talents and retain existing employees through the promotion, greater utilization, and further development of their employer brand.

The results of the study indicated a positive and statistically significant correlation between the variables "Army as a Brand" and "Job Satisfaction". According to the results of the correlation analysis, the strength of this relationship was assessed as moderate, thereby confirming Hypothesis H_1.

Furthermore, the results of the correlation analysis between the variable "Army as a Brand" and the variables "Possibility for Advancement", "Work–Life Balance", and "Leadership Style" showed positive and statistically significant correlations in all cases. The relationships between the observed variables were assessed as strong or moderate, which provided grounds for confirming Hypotheses H_2, H_3, and H_4.

It can be concluded that the Serbian Armed Forces, as an employer brand, have much to offer in the labour market. The trust and reputation that the Armed Forces enjoy within society represent a solid foundation for attracting new talents and retaining existing employees. The implementation of new development and modernization programs, the provision of equal opportunities for all employees, and a more active presence on social networks would further enhance the attractiveness of the Serbian Armed Forces, particularly among younger generations, thereby contributing to the attraction of new talents.

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PART II.

FINANCE, BANKING, INSURANCE AND DIGITAL BUSINESS TRANSFORMATION

ORIGINAL SCIETNTIFIC PAPER

STRATEGIC APPRAISAL OF THE INTERDEPENDENCE OF DIGITAL TECHNOLOGIES IN EMERGING ENTREPRENEURIAL MODELS

ANĐELKOVIĆ Maja [1], ILIĆ Dejan [2], VEMIĆ Milan [3]

[1] Faculty of Information Technology and Engineering, University „Union - Nikola Tesla, Belgrade, Serbia, ORCID 0000-0002-5507-9831

[2] Faculty for Business Studies and Law, University „Union - Nikola Tesla“, Belgrade, Serbia, ORCID 0000-0001-8966-9955

[3] Faculty for Business Studies and Law, University „Union - Nikola Tesla“, Belgrade, Serbia, ORCID 0000-0002-6814-8031

E-mail: maja.andjelkovic@fiti.edu.rs, dejan.ilic@fpsp.edu.rs, : milan.vemic@fpsp.edu.rs

ABSTRACT

The purpose of this paper is to investigate some consequences of the assumption that digitalization can benefit small and medium-sized enterprises (SMEs). In the digital economy, SMEs are key players. For example, there are 33 million small businesses in the U.S. and 31 million SMEs in the EU. SMEs are important as the primary source of new job creation and the dissemination of new business practices, and they make a substantial contribution to GDP. If the e-economy is to make real progress, there must be active and substantial SME participation. This basic reality applies to SMEs worldwide. The potential offered by e-business to SMEs is considerable through enhanced productivity, reduced transaction costs, increased management efficiency, access to potential new markets, and better penetration of the existing customer base. The majority of these entrepreneurial firms base their sustainable competitive advantage on optimizing core competencies through the introduction and wider application of digital technologies. From an entrepreneurial perspective, and especially from a strategic point of view, the processes of creating new entrepreneurial firm models and reengineering existing ones should involve digitalization. In this paper, the authors examine and discuss three major competitive entrepreneurial models focused primarily on achieving strategic goals and reengineering the current "classical entrepreneurial firm structure" into a "virtual entrepreneurial firm structure". The authors consider improving sustainable competitive advantage by enhancing overall entrepreneurial firm performance through the design and implementation of different complementary and profitable digital technologies. Finally, conclusions are drawn, and recommendations are made based on the researched digitalization models and findings.

Keywords: *Digital economy, Digital entrepreneurship, Digital reengineering, Entrepreneurial firm models, SMEs, Digital technologies, Sustainable competitive advantage, Strategy*

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AN INTRODUCTION TO THE IMPACT OF DIGITALIZATION ON SMALL AND MEDIUM-SIZED ENTERPRISES AND ENTREPRENEURIAL FIRMS

Until the late 1970s, the use of telephones was considered a public service rather than a commercial activity. The telephone system was usually owned by the national postal service. However, technological developments were making the traditional public service status of the telephone system increasingly untenable.

The application of new digital technologies greatly increased the capacity of the telecommunications infrastructure. The introduction of mobile telephones in the late 1980s provided an alternative to fixed-line systems. The convergence of emerging computer technologies and telecommunications enabled data, as well as voice transmission, over telephone lines, giving rise to e-mail and the Internet as major means of communication. A new economic sector, Information and Communications Technology (ICT), was born.

Traditional government perceptions of telecommunications changed. National postal and telephone services were separated, and governments established commercial, publicly owned companies to operate their telecommunications systems. In most countries, the new national telecommunications companies were wholly or partly privatized. Most importantly, telecommunications are now regarded as a market in which competition should be encouraged rather than as a service provided by public institutions.

During the second half of the 1990s, there was an enormous increase in ICT activity, giving rise to new expressions such as "e-business", "e-commerce", "e-government", "Information Society", and the "Digital Age". Most governments now regard the development of their national ICT sectors as crucial to economic development and international competitiveness and adopt their policies accordingly. The implementation of these policies is already having a major impact on SME development.

There are three aspects of fundamental importance to SMEs arising from the Digital Age and the Information Society resulting from advances in Information and Communications Technology: (1) e-business, which is the use of ICT for business purposes; (2) e-commerce; and (3) e-government, which is the application of ICT to communication between, on the one hand, public administration and, on the other, citizens and enterprises. Simply put, the Internet is bringing about major changes in the ways SMEs conduct their operations, whether through marketing and promotion, direct transactions (e.g., booking airline tickets and hotel accommodation, Internet banking, online shopping, and many other activities), or electronic compliance with regulations and administrative formalities.

The Information Society and the Digital Age are of vital importance to both advanced and developing countries, which face major challenges in adopting the emerging business models discussed hereinafter.

EMERGING STRATEGIC DEVELOPMENT OBJECTIVES FOR REENGINEERING ENTREPRENEURIAL FIRMS THROUGH DIGITAL TECHNOLOGIES

The reengineering of the "industrial economy" into an "emerging digital economy" was mainly initiated and accelerated by the strategic reengineering of entrepreneurial firms, i.e., the emergence and reengineering of new entrepreneurial firm models contingent on the more dynamic development and application of digital technologies [Marković et al., 2020, pp. 505–518]. The strategic reengineering of entrepreneurial firms in the digital economy is significantly contingent on the broader application of digital technologies and is "essential for enhancing the ability of entrepreneurial firms to survive and thrive due to the challenges caused by rapid innovation in the environment". Indeed, it is not restricted to isolated or incremental innovation but introduces radical innovation through the reengineering and restructuring of entrepreneurial firm models [Radosavljević, 2022; Krasulja and Ilić, 2023, p. 223; Vemić, Grečiškina, and Samohovec, 2021]. According to Cruise (2023) and Krasulja and Ilić (2023, p. 223), strategic reengineering implies a radical and profound reshaping of the essence of the entrepreneurial firm, i.e., a reshaping of the entrepreneurial firm model. As Ilić (2021) indicated, the strategic reengineering of entrepreneurial firms, at its core, "implies reshaping the existing and introducing radically new management models aimed at fundamentally innovating and modernizing the ongoing performance and practices of entrepreneurial firms, thereby providing the capacity to adequately initiate and respond to developments and upcoming challenges in the Digital Economy". Similarly, Anthony (2016), together with Krasulja and Ilić (2023, p. 223), suggests that strategic reengineering enables the implementation of a dual reengineering process contingent on strengthening the current entrepreneurial firm model while efficiently developing its future core competencies.

Emerging entrepreneurial firm models, together with the strategic reengineering of existing enterprises, are contingent on the dynamic development and application of new digital technologies, which currently include Artificial Intelligence (AI), the Internet of Things (IoT), 3D printing, blockchain technology, and virtual (VR) and augmented reality (AR). These technologies are becoming the most important foundations for reengineering the global economy into a truly digital economy. The basic reengineering aspects of innovative digital technologies, as well as the influence of key business factors on the modern entrepreneurial firm, can generally be identified through the following segments [OpenText, 2016; Ilić, 2018, p. 55; Marković et al., 2020, pp. 505–518; Ilić, 2021]:

- New technologies;
- A shift in consumer behavior toward "digital consumption" (2010), i.e., the Digital Consumer/Customer;
- The reengineering of safety standards and procedures;
- The reengineering of the labor market and workforce qualifications;
- A shift in regulations toward innovative regulatory frameworks;
- The reengineering of entire supply chains into "digital supply chains".

Emerging entrepreneurial firm models involving radical reengineering of organizational structure, culture, business processes, and entire value chains are fundamentally contingent on digitalization and digital reengineering in the Fourth Industrial Revolution (Industry 4.0). Consequently, researchers distinguish between "digitalization" and "digital reengineering". Namely, digitalization requires the development and broader use of both new and existing technologies, as well as the dissemination of business information aimed at creating new and optimizing existing entrepreneurial firm business processes. This creates a more conducive environment for the digital entrepreneurial firm, in which high-quality information plays a central role [Startit.rs, 2020; Marković et al., 2020, pp. 505–518].

The term "*digital reengineering*", in relation to the "structuring of organizations" [Mintzberg, 1979] through digitalization, is broader and suggests "the incorporation of digital technologies into all structures of the entrepreneurial firm, producing radical innovation" [Vemić, Grečiškina, and Samohovec, 2021] and creating value for clients. Thus, the authors refer to the application of digital technologies that radically transform entrepreneurial firm models, generate new cash flows, and fundamentally restructure business processes [Startit.rs, 2020; Marković et al., 2020, pp. 505–518]. Digital reengineering introduces an action plan, together with guidance and processes for transforming existing entrepreneurial firm models into new ones. Here, the authors refer to "pathways for the ongoing transformation toward new forms of business life in the digital entrepreneurial firm". Such a firm is characterized by the deep integration of physical, logical, and business processes, resulting in a high degree of efficiency and optimized overall business performance. Digital reengineering requires the incorporation of new digital technologies to transform heterogeneous, independent, or loosely connected structures into more integrated value models, which are most often characterized by the following reengineering innovations [Marković, 2019; Marković et al., 2020, pp. 505–518]:

1. Optimizing customer satisfaction through deeper value creation;
2. A higher degree of customer integration into entrepreneurial firm business processes;
3. Establishing the broader application of new digital technologies, including new sales, financial, and production channels, as a new standard;
4. Optimizing the overall efficiency of the entrepreneurial firm;
5. Deepening the knowledge base and skills required in the digital economy;
6. Optimizing relationships within entrepreneurial value chain processes;
7. Transforming and optimizing firm outputs into "smart products and services".

ELEMENTS OF REENGINEERING A DIGITAL STRATEGY REQUIRED BY THE BUSINESS PROCESSES OF THE ENTREPRENEURIAL FIRM

An effective strategy for designing and implementing the digital reengineering of an entrepreneurial firm requires a structured management approach [Marković, 2019]. When defining business objectives, they should, of course, be realistic, well defined, and achievable within the specified time frame, while at the same time being set neither "too low" nor "too high" [Marković, 2019; Marković et al., 2020, pp. 505–518]. Addressing strategy, Jovanić (2007, p. 12), as well as Krasulja and Ilić (2023, p. 224), define it as "a plan of action that guides the entrepreneurial firm towards the achievement of future goals. This clearly directs the positioning and reengineering of the entrepreneurial firm in an emerging business environment." Similarly, Coulter (2010, p. 6), together with Krasulja and Ilić (2023, p. 224), defines strategy as "a set of viable decisions and processes within a particular entrepreneurial firm, integrating formal capabilities and organizational resources with external opportunities and threats." Figure 1 illustrates this approach by integrating the elements, steps, and activities required to achieve the defined objectives of digital reengineering and create a new entrepreneurial dynamic.

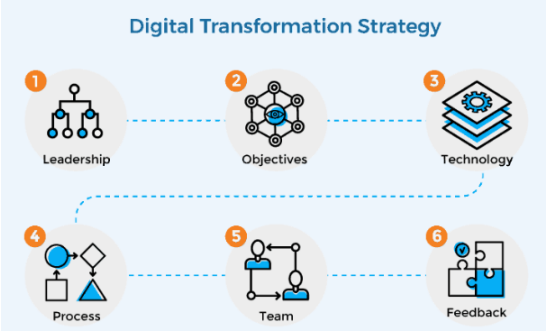

Figure 1. *Elements, activities, and basic steps in the process of formulating and implementing the digital reengineering strategy of the entrepreneurial firm.*
Adapted from: Plutora (2019). Digital Reengineering Strategy: Your 6 Steps for Success; Marković, B., Ilić, D., & Ivannikov, N. (2020). Strategic Development Objective for Digital Entrepreneurial Firm Reengineering in the New Economy, ANTIM 2020, 7th International Conference Application of New Technologies in Management, Proceedings, p. 511.

Similarly, for the purpose of designing and implementing the digital reengineering of an entrepreneurial firm, the authors proceed from the following interconnected "building blocks", as shown in Figure 2.

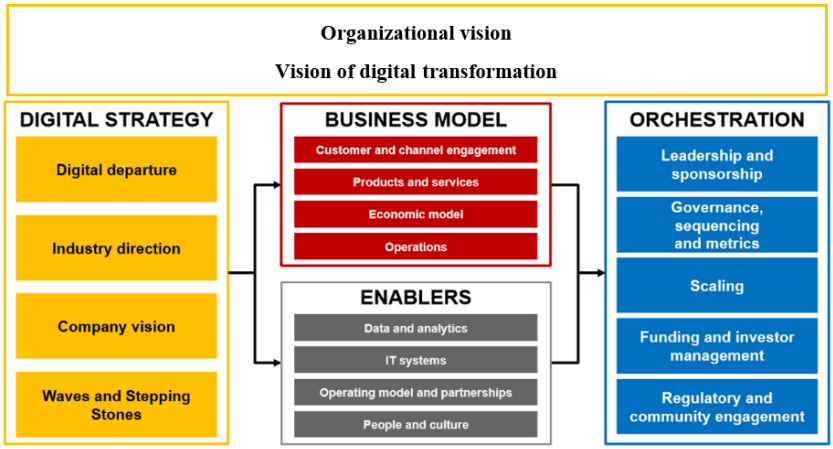

Figure 2. *Building blocks and their interdependence in the process of digital reengineering.*
Adapted from: World Economic Forum (2019). A Step-by-Step Guide to Digital Reengineering (online); adapted by the authors.

The roadmap of the major processes within the Digital Reengineering Strategy Development Objective is presented in Figure 3.

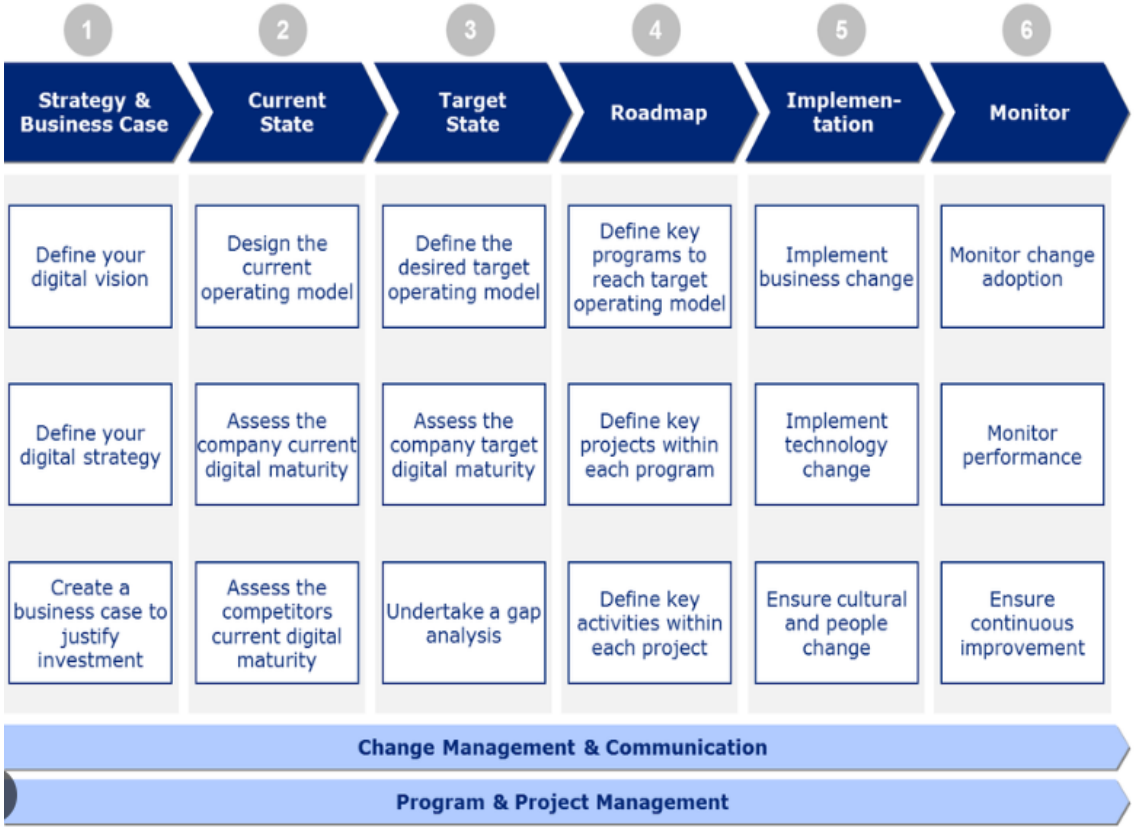

Figure 3. *Digital Reengineering Strategy Development Objective.*
Adapted from: Digital Reengineering Strategy Development Objective (2020) (online); Marković, B., Ilić, D., & Ivannikov, N. (2020). Strategic Development Objective for Digital Entrepreneurial Firm Reengineering in the New Economy, ANTIM 2020, Proceedings, p. 517.

Marković et al. (2020) compared different approaches in their research, and Figure 3 presents the initial step of *the Digital Reengineering Strategy Development Objective*. It requires creating a vision for digital reengineering, followed by the formulation of strategies and the implementation of the practical measures identified by Accenture, the Markle Foundation, and the UNDP (2001). The next step involves examining the operating model that leads to the digital maturity of the entrepreneurial firm, as well as those of its direct and indirect competitors within the value chain. The third step in this strategic reengineering process is the design of the target state, together with the desired future business performance of the entrepreneurial firm. This stage includes precisely determining the gap between the current and projected business model, as well as between the current and expected digital performance of the entrepreneurial firm. The fourth step involves designing the most important programs, projects, and activities related to process reengineering, while the fifth focuses on implementing the digital strategy. The sixth step includes monitoring, evaluating, and improving digital business processes through corrective measures, followed by the final step, which addresses the long-term development of business culture, as well as further research, development, and innovation.

In Figure 4, the authors illustrate an innovative, i.e., radically transformed entrepreneurial firm model required by Industry 4.0.

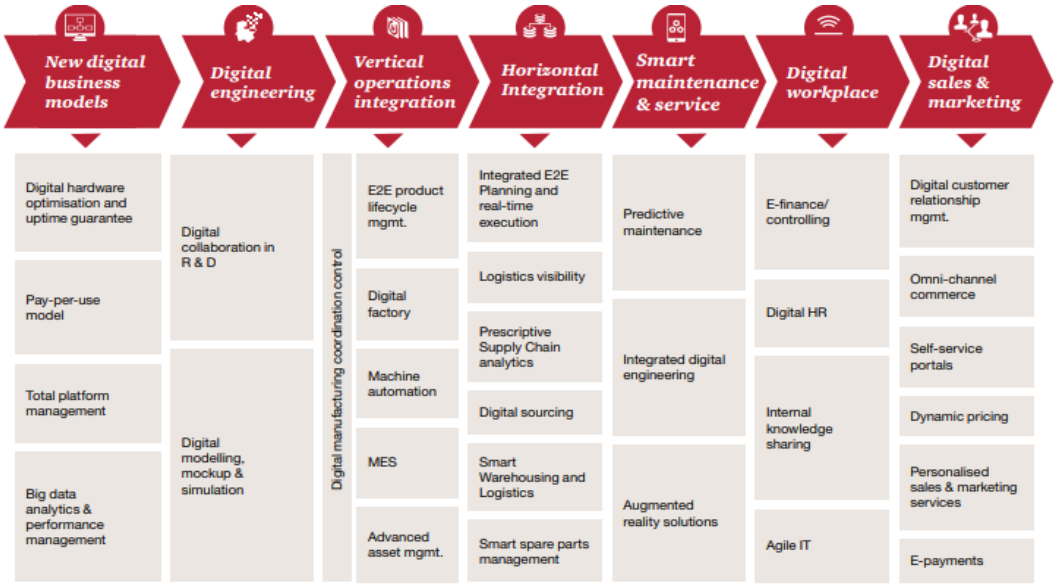

Figure 4. *A new entrepreneurial firm model after the implementation of digital reengineering. Source: PwC (2016). Industry 4.0: Building the Digital Enterprise, Global Industry Survey (online); Ilić, D., Marković, B., & Milošević, D. (2017). Strategic Entrepreneurial Firm Reengineering: An Industry 4.0 Perspective, International Journal of Economic & Law, 7(20), 49–59; Krasulja, N., & Ilić, D. (2023). The Impact of the Fourth Industrial Revolution and the Crisis on the Strategic Reengineering of Entrepreneurial Firms and Employees, Yearbook of the Faculty of Business Studies and Law, 1(1), 223–248.*

APPRAISAL OF THE INTERDEPENDENCE OF DIGITAL TECHNOLOGIES IN THE EMERGING ENTREPRENEURIAL FIRM MODEL

Digital reengineering of the entrepreneurial firm, as well as the evolution of a new entrepreneurial firm model, must not become an end in itself. Sustainable competitive advantage achieved through digital reengineering should become the primary goal of the new entrepreneurial firm model [Marković et al., 2020, p. 518]. In the digital economy and Industry 4.0, modern entrepreneurial firms are required to possess emerging knowledge and skills, coupled with the ability to continuously evaluate, select, and apply optimal and profitable digital technologies that are aligned with the new entrepreneurial firm model. Ilić et al. (2022, p. 129) proposed the strategic imperatives of the "new normal of the entrepreneurial firm", based on the appraisal and selection of optimal digital technologies aligned with the goals of digital reengineering and corporate strategies. Strategic management, as it evolves through such business processes, enables the achievement of strategic goals, such as optimizing customer satisfaction, optimizing value chains while creating and delivering added value, and optimizing the efficiency of new communication channels required to enhance entrepreneurial knowledge and sustainable competitive advantage in the digital economy [Ilić et al., 2022, p. 129]. Therefore, the appraisal and selection of the most compatible digital technologies have evolved into a "very prominent tool in itself" [Ilić et al., 2022, p. 129]. Digital, and especially disruptive, technologies in the open business models [Chesbrough, 2003] of Industry 4.0 have a significant reengineering impact on entrepreneurial business models. Although numerous technologies exist and cannot all be discussed here, some of the most important [Ilić et al., 2017a, pp. 169–172; Marković, 2019; Marković et al., 2020, pp. 505–518] include:

- Internet of Things (IoT);
- Artificial Intelligence (AI);
- Big Data;
- Digital twin;
- Low-code development platforms (LCDPs);
- Microservices;
- Social media.

Regarding the appraisal and selection of optimized digital technologies with the capacity to support the reengineering of the new entrepreneurial firm model, Ilić et al. (2022, pp. 129–142) suggest three models: the "Hierarchical Model" developed by Mei-Chen Lo et al. (2007, p. 1), the model and methodology presented by Aznar (2007), and the model presented on the Vera Solutions website (2019).

The results of this research indicate that the first model, entitled the "*Hierarchical Model*", was developed and published by a group of authors led by Mei-Chen Lo et al. (2007, p. 1). It is based on internal strengths and opportunities, external opportunities and risks, and the systemic characteristics of enterprise products and their technology life cycle. The "Hierarchical Model" is illustrated in Figure 5.

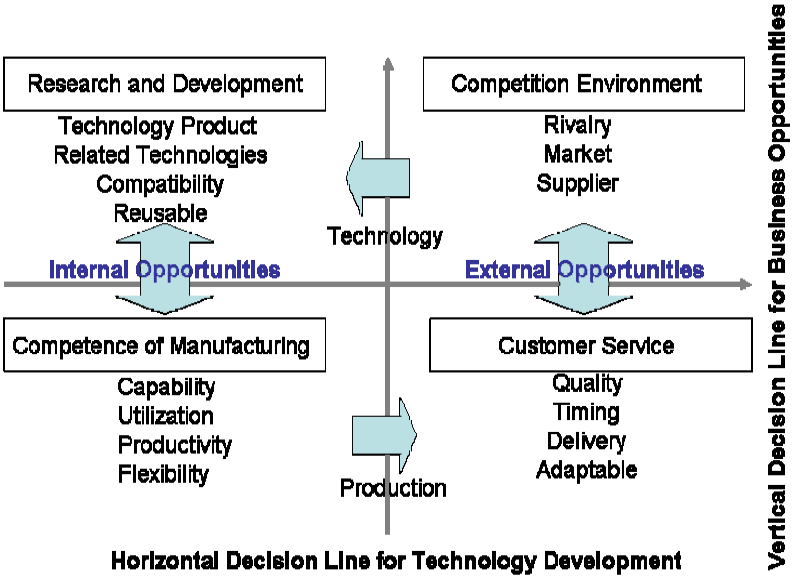

Figure 5. *Hierarchical model: Strategic Development Objective for the appraisal and selection of technologies (digital technologies).*
Source: Mei-Chen Lo, Jerzy Michnik, & Li-Ping Alfred Cheng (2007). Technology Assessment as a Guidance to Entrepreneurial Firm Management of New Technologies, 2007 IEEE International Conference on Industrial Engineering and Engineering Management, pp. 75–79; Ilić, I., Ilić, D., & Marković, B. (2022). Assessment of the Application of New Technologies in Entrepreneurial Firms. ANTIM 2022, 8th International Conference Application of New Technologies in Management and Economy, Proceedings, Vol. 1, Belgrade, Serbia, pp. 129–142.

As illustrated in Figure 5, the main advantages of the "Hierarchical Model" are based on the traditional SWOT/TOWS analysis (*Strengths, Weaknesses, Opportunities, and Threats*). External analysis (the analysis of opportunities and threats in the external environment) is followed by internal analysis (the analysis of core competencies and weaknesses originating within the organization). The model focuses on a systems approach characterized by complex thinking and the interconnection of horizontal and vertical decision-making processes. Systematic and hierarchical decision-making contributes to improving and optimizing the competitive environment, business process structure, organizational integrity, and the intensity of competition. Ultimately, this affects market size and potential, as well as enterprise supply chains developed on the basis of new digital technologies.

The second segment of the "Hierarchical Model" enables researchers to analyze the quality of products and services, the timing of market entry and exit, and the impact of digital technologies on business communication with customers and stakeholders. The model enables entrepreneurial firms to identify the gap between product and service performance and customer expectations. In addition, it facilitates the analysis of internal strengths, core competencies, and the work of the R&D sector in determining whether they contribute to the technological and digital maturity of entrepreneurial firm processes, products, and services. Finally, through the fourth segment, the entrepreneurial firm focuses on systems integration, flexibility, the impact of digital technologies on productivity optimization, and the sustainable strengthening of relationships with customers and other stakeholders.

Other authors, such as Pope et al. (2004), supported and further developed the "Hierarchical Model", demonstrating that "integrated assessment, i.e., the strategic assessment of digital technologies, is a useful

business process based on the analysis of technological development and its consequences, which positively affects the overall business performance of the entrepreneurial firm". Similarly, Ilić et al. (2022, pp. 129–142) observed that "analyzing implemented, as well as evaluating digital technologies, supports strategic and entrepreneurial decision-making. In this way, numerous opportunities and advantages can be exploited while reducing or even eliminating potential risks." The same authors, Ilić et al. (2022, pp. 129–142), proposed the following three key questions for analyzing the "Hierarchical Model":

a) Is the current strategic development objective sufficient to evaluate and select the digital technologies that are most compatible with the strategic vision of the new entrepreneurial firm model, or does it require reengineering?

b) Can the proposed hierarchical model adequately quantify the benefits of digital technologies in an entrepreneurial firm?

c) To what extent can the flexibility of this model contribute to assessing the compatibility of digital technologies with the new entrepreneurial firm model in Industry 4.0 and its overall performance?

The authors also present the "*ICE-9 Essential Questions of Digital Technologies Appraisal*" model. This approach represents a strategic development objective based on the methodology of nine fundamental questions proposed by Aznar (2007). Aznar (2007) identified the nine structural questions illustrated in Figure 6.

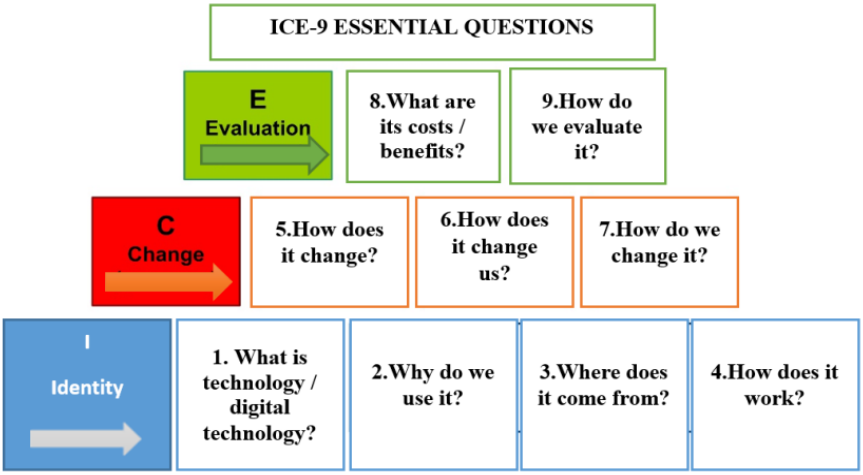

Figure 6. *ICE-9 Essential Questions of Digital Technologies Appraisal*

Source: Aznar, M. F. (2007). *Understanding and Evaluating Technology*. Knowledge Context, customized ed. (online); Ilić, I., Ilić, D., & Marković, B. (2022). *Assessment of the Application of New Technologies in an Entrepreneurial Firm*. ANTIM 2022, 8th International Conference *Application of New Technologies in Management and Economy*, Proceedings, Vol. 1, Belgrade, Serbia, pp. 129–142.

As illustrated in the framework presented in Figure 6, the advantages of the nine proposed questions are evident and numerous. However, certain limitations and weaknesses have also been identified. The main disadvantage, highlighted by critics of this methodology, relates to the risk of subjective analysis when answering Question No. 9: *How do we assess digital technologies in an entrepreneurial firm?* Furthermore, several authors critical of this model, such as Ilić et al. (2022, pp. 129–142), identified the following insufficiently defined aspects: "whether and in what way digital technologies evolve, as well as what their basic goals, development objectives, and evaluation criteria are". To address the identified shortcomings of the "ICE-9 Essential Questions of Digital Technologies Appraisal" model, additional answers are required in the following areas of analysis [Udell, 2019; ITONICS, 2022; Ilić et al., 2022, pp. 129–142]:

- To what extent does the current or proposed entrepreneurial firm model integrate the processes and contextual aspects of present and future entrepreneurial firms and their existing and emerging technologies (this may be referred to as Entrepreneurial Firm Model Fit);
- What is the future technological potential for improving the market position and development of the entrepreneurial firm (this may be referred to as Entrepreneurial Firm Potential);

- What is the cost structure associated with the development and transfer of digital technologies, requiring a cost-benefit analysis of their implementation and integration into the future entrepreneurial firm model (this may be referred to as Entrepreneurial Firm Cost-Benefit Analysis);
- Determine the disruptive innovation potential of digital technologies in existing and emerging markets (this may be referred to as Innovation Disruptive Potential);
- Assess the application and potential of digital technologies within the existing business domain (this may be referred to as Enterprise Application Scope);
- Assess the knowledge and skills generated through the application of digital technologies (this may be referred to as Enterprise Internal Know-How);
- Determine whether digital technologies positively influence user experience and customer satisfaction with the entrepreneurial firm's products and services [Udell, 2019];
- Assess the urgency of changing the business model through radical measures;
- Analyze and determine the gap between currently used technologies and emerging digital technologies (this may be referred to as the Enterprise Technology Gap);
- Analyze and determine the enterprise's integration capacity, i.e., the extent to which digital technologies can be flexibly integrated into the existing technical, organizational, or ICT system (this may be referred to as Enterprise Integration Capability);
- Review the legal and regulatory framework governing the potential use of digital technologies, including existing requirements and standardized development objectives for implementing new technologies;
- Analyze and assess the security risks associated with the application of new digital technologies (this may be referred to as Enterprise System Safety and Security);
- Analyze and assess the social and cultural dynamics of the enterprise resulting from the application of digital technologies (this may be referred to as Enterprise Social and Cultural Dynamics).

The third model examined in this paper was published on the Vera Solutions website (2019). Entitled "Ten Criteria for Digital Technologies Assessment", it is illustrated in Figure 7.

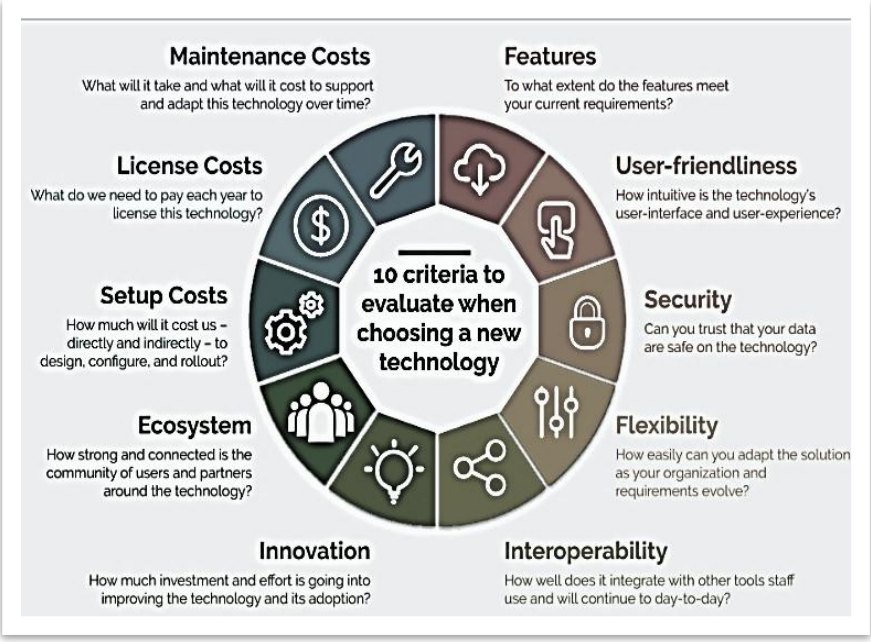

Figure 7: *Ten Criteria for Evaluating Digital Technologies.*
Source: Vera Solutions (2019). 10 Criteria to Evaluate When Choosing a New Technology. https://www.verasolutions.org/10-criteria-to-evaluate-when-choosing-a-new-technology/?locale=en; Ilić, I., Ilić, D., & Marković, B. (2022). Assessment of the Application of New Technologies in an Entrepreneurial Firm. ANTIM 2022, 8th International Conference Application of New Technologies in Management and Economy, Proceedings, Vol. 1, Belgrade, Serbia, pp. 129–142.

Figure 7 is based on three essential questions that entrepreneurial firms should consider when evaluating and selecting new digital technologies, each supported by a set of ten assessment criteria [Vera Solutions, 2019]. The three essential questions are:

1. "To what extent will this digital technology meet our needs today?"
2. "To what extent will this digital technology meet our future needs?"
3. "To what extent does this digital technology fit within your budget?"

It is crucial *to determine the extent to which a digital technology meets current organizational needs, as* this initiates the research and development of a particular technology, tool, or digital platform capable of creating and delivering new value in the short term. The following three criteria are proposed to answer the first question:

1. Question 1 / Criterion 1 – *Characteristics*: Do the key characteristics of the digital technology meet the requirements of the entrepreneurial firm and the new entrepreneurial firm model? If they do not fully or partially meet these requirements, can the identified gap be addressed through the reengineering of the selected digital technology?
2. Question 1 / Criterion 2 – *Ease of Use*: From the customer/user perspective, how intuitive, useful, and user-friendly are the digital technologies in terms of user interface and user experience?
3. Question 1 / Criterion 3 – *Data Security*: Have the digital technologies contributed to improving data security? These criteria are directly related to the GDPR (General Data Protection Regulation) and ISO/IEC 27001 information security standards.

A similar methodology is applied when addressing the second question, "To what extent will digital technologies meet our future needs?", for which the following four criteria are proposed:

1. Question 2 / Criterion 1 – *Flexibility*: How effective and user-friendly is the implementation of the technological solution used by the entrepreneurial firm, and what are its technological requirements? Does the technology create new opportunities and operating models, or does it merely respond to existing market trends?
2. Question 2 / Criterion 2 – *Interoperability*: What is the degree of innovation diffusion [Vemić, 2008]? How effectively and easily can digital technologies be integrated with the existing technologies of the entrepreneurial firm?
3. Question 2 / Criterion 3 – *Innovation*: To what extent, and with what level of investment and resources, is the diffusion [Vemić, 2008] and further development of digital technologies supported? How many complementary and innovative technologies emerge annually within the new entrepreneurial firm model, and what additional value do they generate?
4. Question 2 / Criterion 4 – *Ecosystem*: How developed and interconnected is the community of customers, users, and stakeholders involved in the application of digital technologies? To what extent is knowledge shared to solve business problems and improve the use of digital technologies?

The third question, concerning whether the selected technology fits within the available *budget, also includes several important criteria*:

1. Question 3 / Criterion 1 – *Adjustment Costs*: What is the composition and value of the costs, and what is the structure of the direct and indirect costs associated with developing and reengineering digital technologies?
2. Question 3 / Criterion 2 – *License Costs*: If the entrepreneurial firm is a licensee, what are the benefits and costs associated with the licensing agreements for the selected digital technology?
3. Question 3 / Criterion 3 – *Maintenance Costs*: What is the structure and value of the direct and indirect maintenance costs associated with the selected digital technologies?

CONCLUSION

Governments across the world are increasingly committed to steering development towards building a digital knowledge society, or Information Society. One of the essential prerequisites for achieving this ambitious goal is the widespread and successful implementation of ICT and e-business technologies. This is a priority for the general public and all business entities, but it is particularly beneficial to SMEs, as it helps them lower market entry barriers, especially in global markets. Given the sheer number of SMEs, it is clear that their successful adoption of digital e-business is essential to their success in the Knowledge Society.

The roadmap towards the Digital Society is no longer uncharted territory. With the rapid pace of technological and legal changes, considerable knowledge and experience have been accumulated. Based on scientific and professional literature, this paper selected and presented what are arguably the three most important models for the appraisal and selection of digital technologies that are most compatible with the objectives of digital reengineering and the new entrepreneurial firm model in the Digital Economy. The authors presented a structured collection of rules, guidelines, advice, warnings, and examples of both successful and unsuccessful implementation. Furthermore, the experience gained by SMEs and entrepreneurs who were early adopters can be effectively utilized by later adopters, helping them avoid common pitfalls.

The primary role of governments and public institutions is to create an environment that encourages the use of digital technologies. Specific interventions range from legislative initiatives to targeted programmes that directly support certain industries (for example, the software industry), create demand for new services, and at the same time assist less advantaged SMEs in adopting those services in a timely and efficient manner.

SMEs need people with vision and courage to make crucial decisions and support their implementation, as well as people with the necessary e-skills to integrate existing and emerging technologies into everyday business practice for the benefit of businesses and society as a whole. SMEs represent one of the most important sectors of the economy due to their large number, the number of people they employ, and the entrepreneurial spirit that drives them. The implementation of e-technologies in business and government processes, when carried out in a socially responsible manner, will remain one of the key factors contributing to a successful and competitive global economy.

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ORIGINAL SCIETNTIFIC PAPER

E-GOVERNMENT AS A CATALYST FOR EFFICIENT GOVERNANCE AND PUBLIC SERVICE DELIVERY: EVIDENCE FROM THE BALTIC STATES

DOMAZET Ivana[1], MARJANOVIĆ Darko[2], SUBIĆ Jonel[3]

[1] Institute of Economic Sciences, Belgrade (SERBIA), ORCID: 0000-0002-3493-4616
[2] Institute of Economic Sciences, Belgrade (SERBIA), ORCID: 0000-0001-7336-1964
[3] Institute of Agricultural Economics, Belgrade (SERBIA), ORCID: 0000-0003-1342-1325

E-mails: ivana.domazet@ien.bg.ac.rs, darko.marjanovic@ien.bg.ac.rs, jonel_s@iep.bg.ac.rs

ABSTRACT

This paper investigates the trajectory of e-government development in the Baltic states (Estonia, Latvia, and Lithuania) over the period 2010–2024, addressing two research questions: (RQ1) How have the three Baltic states differed in their e-government development trajectories, as measured by the EGDI and its sub-indices? (RQ2) What factors explain the observed divergences between Estonia, Latvia, and Lithuania? The study relies on secondary data from the UN E-Government Knowledgebase and applies a longitudinal comparative analysis of the E-Government Development Index (EGDI) and its three components—the Online Service Index (OSI), the Telecommunication Infrastructure Index (TII), and the Human Capital Index (HCI). The findings reveal that all three countries have progressed to the "very high" EGDI tier by 2024, yet their trajectories differ markedly: Estonia advanced from rank 20 in 2010 to rank 2 in 2024 (EGDI: 0.6965–0.9727), driven by its early institutional investment in digital identity and data-exchange infrastructure; Lithuania rose from rank 28 to rank 21 (EGDI: 0.6295–0.9110) through sustained online service expansion and broadband penetration; and Latvia, after stagnating in the "high" tier until 2018, accelerated to rank 29 in 2024 (EGDI: 0.5826–0.8852) following significant infrastructure investment. The results suggest that institutional commitment and policy continuity, rather than initial resource endowments, are the primary drivers of e-government advancement in this region.

Keywords: *e-Government, Public Services, Public Administration, Development, ICT, Baltic states.*

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INTRODUCTION

Digital transformation is more important than ever, as modernizing the public sector and aligning the private sector with global trends have made digitalization in all areas of society a necessity rather than a choice. This shift is being accelerated by recent advancements in connectivity, the development of digital skills, and increasing societal demands, especially with the rapid evolution of new technologies. Therefore, to meet citizens' expectations for efficiency, transparency, and accessibility, public administration reform must be a top priority in every country, including the Baltic states. The implementation of electronic services and the digital transformation of public administration are essential components of reform initiatives. Digital transformation refers to reorganizing and improving operational procedures by using all available digital tools and technologies, including online service delivery. A strong legal framework is crucial for these advancements: regulations that validate electronic documents, signatures, identity, delivery, and trust services are necessary to encourage wider e-commerce adoption and increase public trust in the exchange of digital data.

The strategic integration of ICT into public administration is essential for modern governance. E-government supports democratic participation, improves public service quality, and enhances administrative efficiency. By increasing accessibility, transparency, and effectiveness in government–citizen interactions, it contributes to economic and social development. It also reduces opportunities for corruption through more transparent and auditable processes, enabling faster government responses via digital services and communication channels. However, its success depends on overcoming challenges such as the digital divide, cybersecurity risks, and resistance to change.

E-government refers to the delivery of public services through digital technologies such as computers and the Internet. It improves citizens' access to services and enhances government efficiency. Successful implementation depends on adequate digital infrastructure, including telecommunications networks, internet connectivity, and digital skills among citizens and public employees. Many people are unable to use e-services effectively, while many public employees lack the skills or resources needed to implement them properly. Insufficient infrastructure, limited digital literacy, and shortcomings in human resources can hinder or slow the successful implementation of e-government initiatives. Comparative analyses of e-government practices across countries provide valuable insights into the strengths and weaknesses of existing information technologies, helping to identify strategies for improving and maximizing the efficiency of public administration [1].

Since 2001, the United Nations has published an E-Government Survey every two years to assess the level of digitalization in public administration among its member states. The survey includes the E-Government Development Index (EGDI), which comprises three equally weighted components: the Online Service Index, the Telecommunication Infrastructure Index, and the Human Capital Index. As the only comprehensive global assessment of e-government development, the survey serves as an important resource for policymakers, digital governance experts, public administration professionals, and stakeholders involved in information and communications technologies.

Against this backdrop, the present paper is guided by two explicit research questions: (RQ1) How have Estonia, Latvia, and Lithuania differed in their e-government development trajectories over the period 2010–2024, as reflected in the EGDI and its three sub-indices? (RQ2) What structural factors—related to digital infrastructure, human capital, and online service provision—explain the observed divergences among the three countries? Answering these questions contributes to the comparative e-government literature by offering an evidence-based account of why nominally similar post-Soviet EU states have achieved different levels of digital governance maturity. The remainder of the paper is organized as follows. Section 2 reviews the relevant theoretical and empirical literature. Section 3 describes the research methodology and data. Section 4 presents and interprets the results. Section 5 draws conclusions, discusses theoretical implications, and offers policy recommendations.

THEORETICAL BACKGROUND AND LITERATURE OVERVIEW

The potential and actual benefits of e-government, along with its drawbacks, have attracted significant interest from academics and professionals [2]. The e-government system is a crucial part of modern governance. With the e-government system, government services are now faster, more reliable, and free from the bureaucratic problems that typically affected the old system [3]. The term "e-government," which refers to the state's use of information and communication technology to deliver public services to its stakeholders, has a global connotation today. It refers to the public sector providing services online or through technology [4], [5]. One of the leading trends in the modernization of public administration in the EU is e-government. Due to the importance of e-government as a tool for advancing the modernization of public administration, Ardielli and Halásková [6] examine the evaluation of the state of e-government in their research.

The existing literature on e-government can be organized around three broad thematic clusters that are directly relevant to the present study. The first cluster concerns the conceptual and definitional foundations of e-government and its relationship to public administration efficiency. The second addresses the role of technological infrastructure, human capital, and institutional factors as enablers or inhibitors of e-government uptake. The third examines country-specific and comparative evidence, including the Baltic context.

One key initiative that could elevate the standard of public service from traditional to contemporary is the e-government system. Its implementation is linked to public administration reform policy [7]. According to Goloshchapova et al. [8], e-government refers to the use of digital technology to create electronic channels that improve public service efficiency, promote economic growth, and increase living standards. In their research, Huang et al. [9] and Setyawan [10] examined the contribution of e-government to improving the efficacy and efficiency of contemporary public administration. The results show that e-government plays a major role in reducing the possibility of corruption and abuse of power, improving transparency, and speeding up public service procedures. Sharmin and Chowdhury [11] state that automating procedures, reducing costs, and encouraging public participation significantly increase administrative efficiency in e-governance. Their research indicates that blockchain, artificial intelligence, and big data will shape the future of digital governance. However, legal and ethical frameworks must be strengthened to ensure safe, inclusive, and citizen-centered governance models.

Increasing public awareness, managing organizational change, strengthening cybersecurity, and improving IT infrastructure can all help public administrators and legislators implement more inclusive and successful e-government programs [12]. Mensah [13] examined the relationship between e-government service usage and government performance and competence. The results showed that both factors significantly influenced how helpful consumers perceived e-government services to be. The adoption of e-government promises the efficient delivery of government services to citizens across various economic sectors. With significant investments made to establish procedures that ensure transparency in much of the nation's operations, especially in the contracting and acquisition of public properties and services, e-government processes have become a key area of development [14], [15]. The quality of online government information, services, and transactions is expected to continue improving, according to e-governance evolution models [16], [17]. However, the potential advantages of continued government investment in e-Government technology are seriously questioned [18].

Many governments worldwide are increasingly adopting information and communication technologies (ICT) to modernize their service delivery systems, aiming to improve the efficiency, effectiveness, and responsiveness of public administration. By digitalizing government processes and services, ICT enables faster service provision, reduces administrative costs and paperwork, enhances transparency and accountability, and improves citizens' access to public services. Consequently, ICT-driven modernization has become a key component of public sector reform and digital transformation strategies in both developed and developing countries [19]. With the careful and thorough application of contemporary ICT, many nations have transformed their administrative structures in the public sector. Economic progress significantly affects the development of ICT, e-government, and the quality of a country's institutional framework. Governments in many developed countries support initiatives to improve public administration, most of which are fundamentally linked to the use of ICT to provide e-government services [20], [21]. Innovations in information and communication technology have changed how people work, communicate, behave, and what information they require.

In the digital age, e-government integration is widely recognized as a transformative tool for public administration reform, enabling governments to modernize their structures, processes, and service delivery through the effective use of information and communication technologies (ICT). By digitizing administrative procedures and facilitating online interactions among governments, citizens, and businesses, e-government enhances the efficiency, transparency, accountability, and accessibility of public services [22]. Given globalization and the digital age, the question of how the digital environment is evolving is particularly relevant [23]. Governments worldwide are increasingly implementing e-government solutions as digital technology advances to enhance public services, boost public confidence, and streamline administrative procedures [24]. The authors examine how e-government can enhance transparency and accountability in public administration in the digital age. Their findings highlight the importance of digital inclusion and the need for a comprehensive strategy to ensure equitable access to e-government services for all segments of society. According to Alakash et al. [25], new organizations and contemporary laws have emerged to regulate the interaction between e-government and public administration, as well as their interactions with individuals and businesses.

Every country's social and economic development depends on the digitization of government administration. In this regard, e-government is developing and expanding its methods of application, contributing significantly to the effectiveness of public administration, transparency, and the reduction of corruption in public institutions [26]. The modernization of public administration, especially the growth of e-government, was supported by digitalization [27]. By digitizing government services and procedures, e-government plays a critical role in improving accessibility, efficiency, and transparency [28]. With the advent of e-government, digital transformation has become a key factor in improving the quality of public service delivery. Digital technologies are considered essential for technical modernization in public administration, improving government agencies' operations and stakeholder interactions [29]. Compared with countries where public service digitization is less advanced, the analysis found that higher levels of population proficiency with online services significantly amplify government performance, effectively doubling the improvement in government efficiency. This suggests that when citizens are more digitally literate and able to confidently use online public services, governments can deliver services more quickly, reduce administrative burdens, and streamline internal processes more effectively. In contrast, in countries with lower digital skills among the population, the benefits of digital transformation are less pronounced, as limited user capability restricts the full utilization of e-government systems and reduces overall efficiency gains. Doran et al. [30] examined the influence of intensifying the digitization of public services on government efficiency in EU member states. The analysis found that, compared with countries with less advanced public service digitization, the population's proficiency with online services doubles the improvement in government efficiency.

Estonia is often cited as an innovative model for its use of information and communication technology (ICT) in the public sector. It is renowned for its highly advanced digitalization of public services. Despite being a leader in e-governance, the nation's public sector digital transformation plan must be regularly evaluated because of societal challenges and the rapidly evolving technological landscape [31]. Ikromov [32] critically examines how digital platforms are transforming public administration, focusing on Estonia, a globally recognized leader in e-government. He identifies strong government commitment, a supportive regulatory environment, the innovative use of technologies such as blockchain, and a consistent emphasis on cybersecurity and public trust as key factors contributing to Estonia’s success in digital governance. Sustained political leadership has ensured long-term investment in digital infrastructure and policy continuity, while enabling legislation has created a flexible, innovation-friendly framework for e-government development. The adoption of advanced technologies, including blockchain, has strengthened data integrity, security, and transparency in public services. Estonia’s focus on cybersecurity has protected sensitive information and maintained system resilience, while efforts to build and sustain public trust have encouraged widespread citizen adoption of digital services and reinforced the overall effectiveness of its digital transformation strategy.

Focusing on the Estonian context, Espinosa and Pino [33] examine how e-government (EG) promotes economic development and transition. They highlight two key institutions: secure property rights and governance regulations that emphasize openness, trust, and security. Björklund [34] discusses Estonian e-government, the digitalization of public administration and governance, and how it creates moral citizens. Centralization is a defining feature of the power-knowledge regime in Estonia. A strong national e-government policy requires centralization, within which the distinctive Estonian citizenry is portrayed. The

effectiveness of public service depends not only on the proposed solutions but also on the information accessible to citizens, who are the potential users. The e-service must be simple to use, easily available, and beneficial to the user; if these qualities are considered during the development phase, the service can also achieve other goals, such as cost savings and efficiency [35]. As a leader in government-business partnerships, Estonia consistently improves its standing under the European Union's Digital Single Market project and effectively deploys these services nationwide [36].

A thorough analysis of the complex effects of digitalization across various sectors of Latvian society underscores the strategic importance of fostering digital innovation and creating a supportive, transformation-friendly environment. In Latvia, ongoing digital development is closely tied to efforts to modernize public administration, enhance economic competitiveness, and reduce regional disparities in access to services and opportunities. Baskar [37] notes that cooperation among public institutions, the private sector, and research organizations, along with continuous innovation and sustained investment, are essential pillars for ensuring Latvia's long-term growth and prosperity in an increasingly digital economy. Latvia's progress particularly depends on expanding digital public services and improving digital infrastructure, especially in rural and less-developed regions where access and digital skills may still lag behind urban centers. Broader deployment of e-services and smart technologies can increase efficiency, improve social welfare delivery, and support more inclusive development at both regional and national levels. As digital competitiveness becomes an increasingly important measure of national performance, Latvia's ability to strengthen its innovation ecosystem and invest consistently in digital transformation will play a decisive role in shaping the country's future economic resilience and social well-being.

Vilkaite-Vaitone and Povilaitiene [38] studied the evolution of e-management in public sector organizations and potential solutions to e-management issues in Lithuania. They concluded that, before the COVID-19 pandemic, e-management in municipalities was used only in special circumstances due to workplace stationarity and legislation, based on interviews with managers at local public administration organizations in Lithuania. However, e-management is now seen as the only option available to municipality administrations, rather than as an alternative. Lithuania continues to face methodological, legal, and technical issues that prevent e-government from reaching its full potential. These obstacles are problematic because, as several national and international studies have shown, ineffective public administration significantly reduces a nation's ability to attract foreign investment and its appeal as a place to live [39]. Municipalities in Lithuania that already use ICT for everyday tasks are prepared to use e-leadership tools; however, they still need a clearer vision and guidelines to establish e-leadership as an organizational practice [40]. The Lithuanian case also reflects a broader regional trend in which the rapid shift toward digital governance has revealed both institutional strengths and structural weaknesses in public administration. The forced acceleration of e-management practices during and after the COVID-19 pandemic has highlighted the uneven readiness of municipalities to fully adopt digital leadership models. While some local administrations have successfully integrated ICT into daily operations, many still face fragmented digital systems, insufficient interoperability between platforms, and limited administrative capacity to manage complex e-government tools. As a result, the transition from traditional to digital governance has been inconsistent, creating disparities in service quality and organizational efficiency across municipalities. In addition, ongoing legal ambiguities and the absence of a coherent national framework for e-leadership hinder the institutionalization of digital governance practices in Lithuania. These challenges are intensified by the need for targeted training programs and clearer strategic guidance to support public sector managers in adapting to digitally driven decision-making processes. Without addressing these systemic issues, Lithuania risks limiting the full benefits of its digital transformation efforts, particularly in improving public sector performance, strengthening institutional trust, and enhancing the country's overall attractiveness for investment and skilled labor.

The EGDI, developed by the UN, is the most widely used indicator for evaluating the expansion of e-governance [41], [42], [43]. Yuliantini and Nurmandi [44] examined how the EGDI affected the Worldwide Governance Indicators (WGI) in EU Member States. Based on EGDI data from EU Member States, the results show that the implementation of e-government has no discernible impact on the six WGI indicators. Paul and Adams [45] investigate the relationship between e-government development indicators and the Corruption Perceptions Index using cross-sectional data from 2012 to 2020. According to the data, perceptions of corruption increase as OSI increases; the relationship between TII and perceptions of corruption is statistically significant but not inversely correlated; and perceptions of corruption decrease as HCI increases.

The reviewed literature reveals several tensions that motivate the present study. First, while much of the general e-government scholarship assumes a positive relationship between digital governance investment and administrative efficiency [8], [9], [10], MacLean and Titah [18] caution that empirical evidence of such benefits remains inconsistent, with many studies relying on anecdotal or single-country evidence. Second, Yuliantini and Nurmandi [44] found that EGDI improvements do not automatically translate into measurable improvements in broader governance quality indicators in the EU context, contrasting with the optimistic claims of Sharmin and Chowdhury [11]. Third, comparative Baltic literature highlights that even countries sharing similar post-Soviet institutional legacies and EU membership can diverge substantially in outcomes—as demonstrated by the gap between Estonia's sustained leadership and Latvia's mid-period stagnation [37], [38], [39], [40]. These contradictions underline the need for a longitudinal, sub-index-level comparative analysis that can isolate the specific dimensions driving divergence, which is the contribution of the present paper.

RESEARCH METHODOLOGY

This study is guided by two research questions: (RQ1) How have Estonia, Latvia, and Lithuania differed in their e-government development trajectories over the period 2010–2024, as measured by the EGDI and its sub-indices (OSI, TII, HCI)? (RQ2) What structural factors explain the observed divergences? Based on the literature reviewed in Section 2, two working propositions frame the analysis: (H1) Countries with earlier and more sustained institutional investment in digital identity infrastructure will exhibit higher EGDI growth rates over the observation period; (H2) Improvements in the Telecommunication Infrastructure Index will be the primary driver of EGDI gains in the Baltic states that were classified below the "very high" tier before 2020.

The study employs a longitudinal comparative case design using secondary data from the UN e-Government Knowledgebase and the biennial UN E-Government Surveys (2010–2024, eight measurement points). The analytical procedure comprises three steps: (1) descriptive profiling of EGDI scores and rankings for each Baltic state at each measurement point; (2) sub-index decomposition, comparing OSI, TII, and HCI trajectories across the three countries to identify which component drove overall EGDI change in each country and each period; and (3) comparative interpretation, explaining observed differences by cross-referencing sub-index trends with known policy developments documented in the country-specific literature (Sections 2 and 4). The Baltic states were selected because they constitute a theoretically coherent comparison group—three small post-Soviet EU members with broadly similar starting conditions in 2010—whose subsequent divergence in e-government outcomes makes them an ideal case for examining what differentiates high e-government performers from very high performers in a European context. The choice of the UN EGDI as the primary measure is justified by its unique global coverage, methodological consistency over time, and its disaggregation into three sub-indices that enable the analysis of enablers and barriers at the infrastructure, service, and human capital levels.

To compute the EGDI, each component is normalized—often using z-score standardization—so that its values range from 0 to 1, and then their arithmetic mean is calculated. The resulting score places each of the UN's 193 member states into one of four tiers: very high, high, medium, or low levels of e-government development. Beyond ranking, the EGDI helps identify strengths and weaknesses in a country's e-government ecosystem. For example, a country may score high in human capital but lag in infrastructure or online service delivery. The 2024 survey also noted global improvements: more states are reaching "high" or "very high" EGDI levels, and the share of the world's population lagging in digital government development has dropped significantly.

$$EGDI = 1/3\ (OSI_{\ normalized} + TII_{\ normalized} + HCI_{\ normalized}) \quad (1)$$

Each of these indicators can be retrieved and examined independently because they are composite measures.

The Online Service Index (OSI) is a key component of the EGDI that measures the scope, quality, and development of online government services, including portals, ministry websites, and e-participation tools. The Telecommunication Infrastructure Index (TII) is a component of the EGDI that measures a country's ICT infrastructure readiness based on indicators such as internet usage, mobile and fixed broadband, and cellular subscriptions, standardized for international comparison. The Human Capital Index (HCI) reflects how well a country's population is prepared, in terms of education and literacy, to engage with e-government services. The HCI is based on five equally weighted components: the adult literacy rate, the combined gross enrollment ratio across primary, secondary, and tertiary education, expected years of schooling, mean years of schooling, and "e-government literacy".

RESEARCH RESULTS

The E-Government Development Index (EGDI) measures countries' progress in developing and implementing e-government systems. It ranges from 0 to 1, and based on their scores, nations are classified into four tiers: (a) Very High: 0.75–1.00, (b) High: 0.50–0.7499, (c) Medium: 0.25–0.4999, and (d) Low: 0.00–0.2499. These categories provide a standardized way to compare the digital maturity of governments, track progress over time, and identify where improvements are most needed in infrastructure, human capacity, or online services. The EGDI monitors public administration development in 193 countries worldwide. Denmark (0.9847), Estonia (0.9727), Singapore (0.9691), the Republic of Korea (0.9679), and New Zealand (0.9671) are the top five countries according to the 2024 index. As the analysis focuses on the Baltic states, Table 1 presents the EGDI values for these countries from 2010 to 2024.

Table 1. Baltic states - EGDI ranking

		Estonia	Latvia	Lithuania	Europe (average)	World (average)
2024	EGDI	0.9727	0.8852	0.9110	0.8493	0.6382
	Rank	2	29	21	-	-
2022	EGDI	0.9393	0.8599	0.8745	0.8308	0.6102
	Rank	8	29	24	-	-
2020	EGDI	0.9473	0.7798	0.8665	0.8170	0.5988
	Rank	3	49	20	-	-
2018	EGDI	0.8486	0.6996	0.7534	0.7727	0.5491
	Rank	16	57	40	-	-
2016	EGDI	0.8334	0.6810	0.7747	0.7241	0.4922
	Rank	13	45	23	-	-
2014	EGDI	0.8180	0.7177	0.7271	0.6936	0.4712
	Rank	15	31	29	-	-
2012	EGDI	0.7987	0.6604	0.7333	0.7188	0.4882
	Rank	20	42	29	-	-
2010	EGDI	0.6965	0.5826	0.6295	0.5937	0.4178
	Rank	20	37	28	-	-

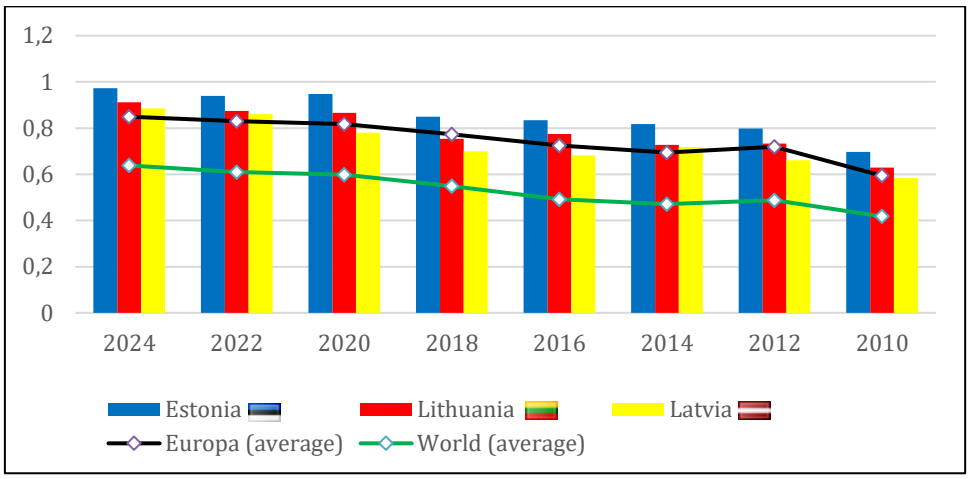
Source: UN E-Government Knowledgebase, 2025.

The Baltic states have collectively made impressive progress in e-government, with all three now exceeding the European average. Estonia is a world-class benchmark in digital governance. Lithuania is a consistent overperformer. Latvia's ranking volatility stands out, likely reflecting infrastructure or policy gaps in the late 2010s, but its recovery since 2020 has been notable. The upward trend across all three countries aligns with broader European digital transformation efforts.

Estonia is among the global leaders in e-government development. In the 2022 UN E-Government Survey, it was classified in the "Very High" EGDI group, with a score of 0.9393. By 2024, Estonia had further improved its score to 0.9727, ranking 2nd among UN member states. Its strong performance is supported by excellent results in all three sub-indices, particularly in online services, telecommunications infrastructure, and human capital. Lithuania also shows robust progress as part of the “Very High” EGDI group. Its 2022 EGDI score was 0.8745, reflecting strong but slightly lower performance than Estonia. In 2024, Lithuania rose in the global rankings and maintained its position within the very high development tier. Improvements are especially evident in its telecommunications infrastructure and human capital indices, which helped Lithuania close the gap with the leading countries. Latvia has also performed at a high level during the 2020–2024 period, belonging to the “Very High” EGDI group. In 2022, Latvia’s EGDI score was 0.8599, placing it behind Estonia and Lithuania but still among the world's leading countries. Notably, Latvia was in the "High" EGDI group during 2010–2018 and has improved significantly since then. Latvia’s score reflects strong results, particularly in human capital and online service delivery, although its infrastructure score lags slightly behind those of its Baltic neighbors. In the latest 2024 survey, Latvia maintained its very high development status, demonstrating incremental improvements in its e-government systems, although not as substantial as those observed in Estonia.

The comparative performance of Estonia, Lithuania, and Latvia in the UN E-Government Development Index (EGDI) highlights both shared regional strengths and notable differences in digital

governance maturity. Estonia stands out as a global leader, driven by consistently high performance across all three EGDI pillars, which together reflect a well-integrated and highly mature digital governance ecosystem. Estonia's progress shows that sustained investment, strong institutional coordination, and a user-centered digital strategy can produce world-class e-government outcomes. Lithuania and Latvia, while also classified in the "Very High" EGDI group, demonstrate a more gradual trajectory of digital transformation with different areas of strength. These cases suggest that although all three Baltic states have achieved advanced levels of e-government development, Estonia's more balanced and accelerated progress sets it apart as both a regional and a global benchmark.



Graph 1. EGDI
Source: Authors' compilation based on the UN E-Government Knowledgebase.

Graph 1 shows the Baltic states' EGDI scores for 2010–2024, along with the averages for Europe and the world. The Baltic states ranked between 2nd and 57th among all 193 countries. However, it should be emphasized that Latvia's 57th-place ranking dates from 2018, whereas according to the latest available data for 2024, Latvia ranks a solid 29th. An analysis of the EGDI for the Baltic states shows that Estonia was the highest-ranked country throughout the observed period, with its position ranging from 20th (in 2010 and 2012) to 2nd in 2024. Over the 14-year period, the EGDI generally increased in all three Baltic states. Starting at 0.6965 in 2010, Estonia rose to about 0.80 in 2012 and 2014 and then continued to increase to 0.9727 in 2024. According to these results, the growth was relatively steady and accelerated in the later years. Lithuania started at 0.6295 in 2010, rose to about 0.74–0.77 in the middle of the decade, and reached 0.9110 by 2024. Latvia's trajectory was somewhat more erratic, rising from 0.5826 in 2010 to approximately 0.66–0.72 during the middle of the observed period before increasing to 0.8852 by 2024. After the mid-2010s, all three Baltic states generally performed at or above the European average. Relative to the world average, the Baltic states performed substantially better throughout the observed period.

The observed trends in EGDI performance among Estonia, Lithuania, and Latvia can be attributed to differences in the pace, consistency, and strategic depth of their digital transformation policies. Estonia's sustained leadership and rise to 2nd place globally in 2024 reflect a long-term, state-driven digital strategy that emphasizes the early adoption of digital identity systems, strong interoperability of public services, and a highly integrated "digital-by-default" governance model. Its steady and accelerating growth after the mid-2010s suggests the cumulative effects of sustained investment in e-government infrastructure, strong political commitment, and high levels of public trust and digital literacy, which together have enabled the efficient scaling of services across all sectors of public administration. Lithuania and Latvia demonstrate strong but more uneven development patterns, likely reflecting differences in implementation capacity, institutional coordination, and infrastructure maturity. Lithuania's relatively stable upward trajectory and significant improvement by 2024 indicate the effective strengthening of telecommunications infrastructure and human capital, both key drivers of EGDI performance. Latvia's more fluctuating progress in earlier years suggests initial structural constraints, such as weaker infrastructure and slower institutional adaptation, which limited early gains. However, its sharp improvement by 2024 indicates successful recent reforms, particularly in expanding e-services and digital skills. Across all three countries, performance above the European and global averages is largely attributable to strong regional investment in digital society development, EU integration support, and a shared emphasis on modernizing public administration systems.

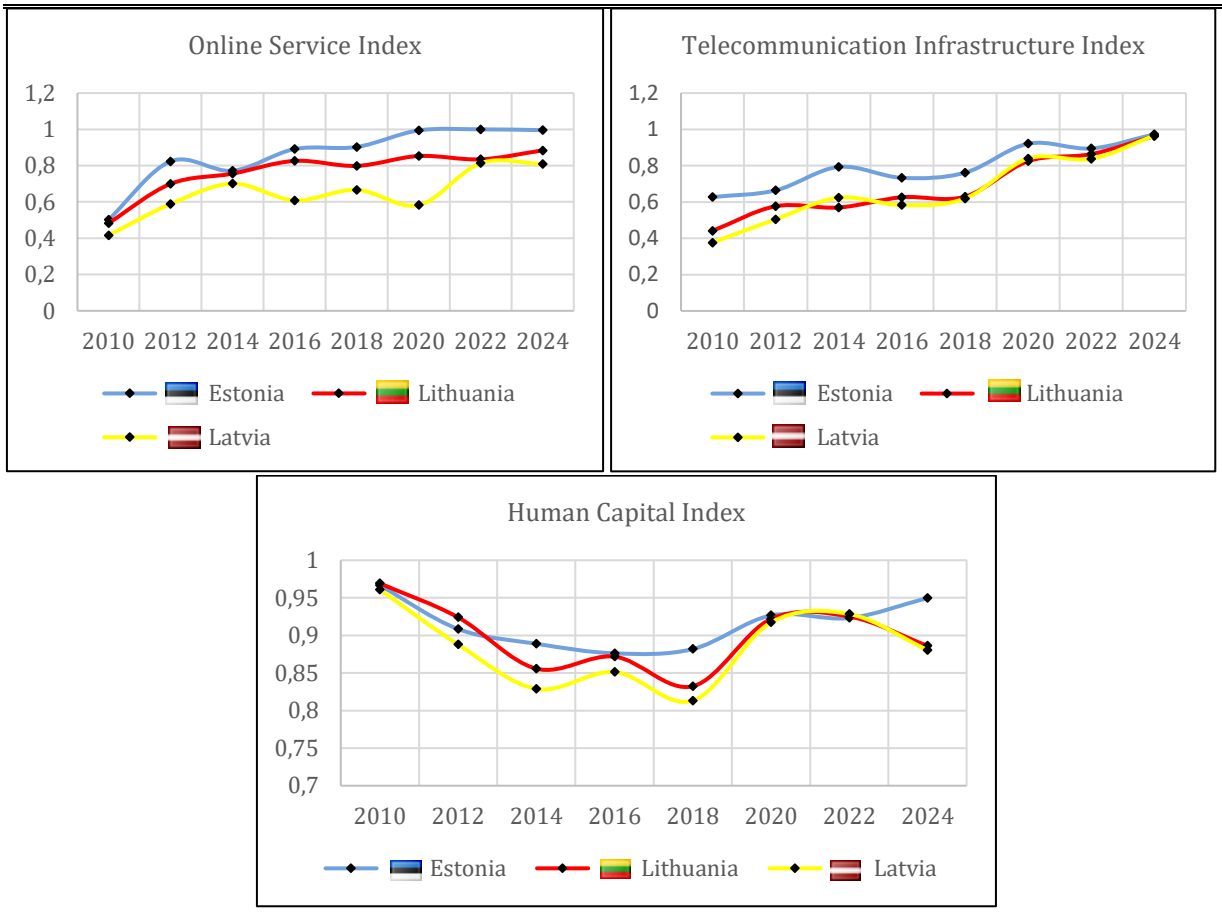
The comparative trajectories yield several analytically important observations relevant to the research questions. Estonia's near-linear growth, accelerating in 2022–2024, is consistent with H1: its early commitment to digital identity (e-ID cards introduced in 2002) and the X-Road interoperability platform created compounding returns, as each new digital service could leverage the existing infrastructure. By contrast, Latvia's relative stagnation in the "High" EGDI tier until 2018—despite broadly comparable GDP and EU membership conditions—reflects the absence of an equivalent institutional anchor; its post-2018 acceleration coincides with EU Digital Single Market investments that provided external impetus for infrastructure modernization, supporting H2 for this country. Lithuania's trajectory is intermediate: it maintained a higher baseline than Latvia throughout the period, indicating stronger early human capital and online service provision, and converged toward Estonia in the most recent period through sustained investment rather than a single policy inflection. Taken together, these patterns suggest that the Baltic divergence is better explained by the timing and coherence of national digital strategy than by differences in economic resources or EU integration status.

Estonia's EGDI score increased from 0.9393 in 2022 to 0.9727 in 2024, out of a maximum of 1.0. The average EGDI value rose from 0.6102 in 2022 to 0.6382 in 2024, indicating that while global competitiveness is increasing, most regions remain behind. Since the early 2000s, Estonia has been a leader in e-government through programs such as e-voting, digital identity cards, and the X-Road data exchange platform. Three pillars support its current ranking: (a) Digital Identity: All Estonian citizens have a digital ID, which enables digital signatures and secure online verification; (b) E-Residency: A program that allows non-Estonians to access Estonia's e-services, establishing a borderless digital nation; and (c) X-Road: A decentralized data-sharing platform that allows disparate databases from the public and private sectors to connect and operate seamlessly.

Over the past ten years, Latvia has significantly improved its EGDI score, demonstrating substantial progress in developing its e-government capabilities. In 2018, its score stood at approximately 0.6996, rising to 0.8852 in 2024 according to UN data. As a result, Latvia is firmly in the "Very High" category of e-government development. These improvements are due to a persistent emphasis on human capital, digital infrastructure, and the expansion of online public services, thereby increasing the country's global competitiveness in digital governance. High levels of human capital, a strong telecommunications infrastructure, and the strategic integration of online services have been important factors in Latvia's development.

Lithuania has progressively strengthened its position in global e-government development. With an overall EGDI score of 0.9110, Lithuania rose from 40th place six years earlier to 21st out of 193 countries in the United Nations 2024 E-Government Development Index (EGDI), placing it among the world's most developed countries in terms of e-government. This achievement highlights significant improvements in online services and digital infrastructure, ensuring that citizens benefit from some of the most advanced public services globally. These advancements place Lithuania firmly in the "Very High" development tier for e-government and result from its ongoing investments in telecommunications infrastructure and online public service delivery. Measurable improvements in several EGDI components support Lithuania's e-government advancement. Through targeted programs and funding, the government has made significant investments in expanding its online services and digital infrastructure.

The EGDI assesses how effectively countries use ICT to provide public services. Information and communication technologies are widely recognized as key drivers of successful e-government expansion. By enabling faster communication, more efficient administrative processes, and broader access to services, ICT helps governments improve transparency, reduce costs, and enhance service delivery. Consequently, countries that invest in ICT infrastructure, digital skills, and integrated online platforms are generally better positioned to develop advanced and inclusive e-government systems.



Graph 2. OSI, TII and HCI
Source: Authors' compilation based on the UN E-Government Knowledgebase.

Based on the results of a comprehensive survey assessing various aspects of the online presence of each of the 193 UN member states, key OSI estimates were developed. The five OSI sub-indices include service delivery, content delivery, portal technology, e-participation, and the institutional framework supporting e-government development. The normalized values of each sub-index are used to calculate the composite OSI score. The findings present standardized index scores on a scale from 0 to 1, where 0 indicates the lowest level of online service provision and 1 the highest.

The Baltic states' OSI and TII scores have improved significantly in recent years. Graph 2 shows that the OSI value ranged between 0.4 and 0.5 at the start of the observation period. The OSI value then generally increased until 2024, when it peaked for all three Baltic states, ranging from 0.8 to 1.0. Estonia recorded the fastest OSI growth, with consistent increases except for slight declines in 2014 and 2018. Estonia's top global ranking in 2024 indicates that its online public services are highly developed. The Local Online Service Index (LOSI) for the city of Tallinn achieved 93% of the evaluated criteria, demonstrating excellent performance in delivering digital services, including city-level e-services, accessibility, and ease of use. As a result, the OSI component is one of the strongest foundations of Estonia's overall EGDI performance. Nationally, this reflects a broad ecosystem of online services—such as tax filing, business registration, health services, and e-identification—that has been developed over decades. Lithuania's online services have also developed considerably.

In the 2023 European eGovernment Benchmark, Lithuania scored highly in the technological adoption of e-services and electronic identity, ranking among the leading EU countries in digital public services. While Latvia's overall online service usage is notable and above the EU average for some e-identification measures, its OSI still lags behind those of its Baltic neighbors in terms of infrastructure and service diversification. According to Eurostat, 73% of Latvians and 88% of Estonians accessed a public authority's website or app during the previous 12 months in 2023. This suggests that although Latvia has strong online service availability, further efforts are needed to make these services fully transactional, accessible, and mobile-friendly in order to catch up with the regional leaders.

The significant improvement in OSI and TII scores across the Baltic states reflects sustained investment in digital infrastructure and a long-term strategic focus on e-government development. Estonia's leadership is driven by a mature, highly integrated digital ecosystem, where advanced platforms such as national e-services, digital identity, and local-level solutions like Tallinn's LOSI demonstrate both the depth and usability of digital services, making online interaction with the state seamless and widespread. Lithuania shows steady progress through the strong adoption of electronic identity systems and the expansion of e-services, positioning it among the more advanced EU digital governments, although it remains slightly behind Estonia in overall sophistication. Latvia, while improving, lags somewhat due to slower diversification of services and lower user engagement, indicating that infrastructure alone is insufficient without fully transactional, user-friendly, and widely adopted digital services to match the regional leaders.

When examining the TII throughout the observation period, this index showed steady growth. In 2010, the index ranged from 0.4 to 0.6, and in the following years it improved, reaching nearly 0.97 in all three Baltic states (Graph 2). In Estonia, the development of e-government is strongly supported by its telecommunications infrastructure. With a TII score of nearly 0.9731 in 2024, Estonia outperformed its regional peers. The widespread use of mobile and broadband connections, strong fixed-mobile substitution, and a high percentage of Internet users per capita all contribute to this high score. Estonia's advanced infrastructure readiness for e-government services is further demonstrated by indicators such as mobile network coverage and reliability. Although it lagged slightly behind Estonia (its TII was 0.9631 in 2024), Lithuania demonstrated strong infrastructure performance. To strengthen the telecommunications foundation needed for online service delivery, the country has made significant investments in expanding fiber access, digital connectivity, and mobile broadband coverage. This trajectory places Lithuania in a strong position among its Baltic and European neighbors, although there is still room for improvement, particularly in fixed-line penetration and rural last-mile access. Although improving, Latvia's telecommunications infrastructure performance remains slightly below that of its Baltic neighbors (its TII was 0.9660 in 2024). The transition to modern fixed-line networks and broadband adoption are two sub-components that still lag slightly behind those of the more developed countries, although Latvia's telecommunications market remains robust overall. How quickly Latvia can catch up with the best-performing Baltic states will depend on its capacity to invest in next-generation networks, enhance digital inclusion, and expand broadband connectivity.

The steady increase in TII scores across the Baltic states reflects consistent investment in telecommunications infrastructure, a key factor enabling their strong e-government performance. Estonia's leading position is driven by near-universal broadband access, strong mobile connectivity, and highly reliable networks, providing a robust foundation for advanced digital public services and explaining its regional outperformance. Lithuania and Latvia also show strong infrastructure development, particularly through expanding fiber networks and mobile broadband coverage, but they still lag slightly behind Estonia due to gaps in rural connectivity, fixed-line development, and last-mile access. Overall, the differences in TII performance highlight that while all three countries have advanced ICT ecosystems, Estonia's earlier and more comprehensive infrastructure modernization gives it a persistent competitive advantage.

The HCI value showed a slight decline in the Baltic states over the period analyzed. In 2010, very high HCI values were recorded (Estonia: 0.9497, Lithuania: 0.98861, Latvia: 0.8805), but these gradually declined, reaching their lowest point in all three countries in 2018, after which they increased again (Graph 2). Estonia's high literacy and education levels, along with its well-developed education system, are reflected in the Human Capital Index. The UN E-Government Knowledgebase reports that Estonia's HCI in 2024 was 0.9497. Estonia has made significant progress in global human capital rankings. This positive trend supports Estonia's strong position in e-governance and other development indices by demonstrating its ability to equip citizens with the skills needed for a digital economy. Although they are slightly lower than Estonia's, Lithuania and Latvia also have strong human capital foundations (the 2024 HCI was 0.8805 for Latvia and 0.8861 for Lithuania). Despite having largely comparable levels of education, literacy, and schooling to their regional counterparts, both countries face somewhat greater challenges in effectively utilizing and leveraging their human capital.

The observed decline and subsequent recovery in HCI across the Baltic states reflect structural adjustments in education and skills development systems, as well as changing measurement dynamics in human capital indicators. Estonia's consistently high HCI, supported by strong literacy rates and a well-

developed education system, reinforces its capacity to sustain advanced e-government services by ensuring a digitally skilled population capable of effectively using complex digital platforms. Lithuania and Latvia, while maintaining solid educational foundations comparable to Estonia, show a slightly weaker translation of human capital into digital and administrative efficiency, suggesting a gap between educational attainment and the practical use of digital competencies. This suggests that the key challenge for these countries is not basic education levels, but the effective activation and application of human capital within digital governance and innovation ecosystems.

CONCLUSION

Despite the global challenges that have emerged and intensified in recent years, countries and regions around the world have continued to strengthen their commitment to digital governance initiatives. Over the past two decades, the widespread adoption of the Internet and rapid advances in information and communication technologies have facilitated communication between businesses and government agencies while also enabling citizens to interact more efficiently with the public sector.

With its public e-services consistently ranked among the best in the world, Estonia has established itself as a global leader in digital government, characterized by the extensive availability of online services, user-friendly platforms, and high levels of citizen adoption. Meanwhile, Latvia and Lithuania have also achieved substantial progress in the development and delivery of online public services.

Estonia's EGDI has consistently been higher than those of Latvia and Lithuania, as well as the European and world averages, throughout the 14-year observation period. In the 2024 e-government ranking, Estonia is among the top United Nations Member States, alongside Singapore and Denmark, in terms of the quality and scope of online services, the state of telecommunications infrastructure, and human capital. As one of the world's most technologically advanced countries, Estonia has long been recognized for enabling its citizens and businesses to bypass traditional bureaucracy in favor of a fully digital government. By placing second in the United Nations' 2024 E-Government Survey, the country has once again reinforced its status as a global pioneer in e-government.

Although Lithuania already has substantial human capital and widespread internet access, current reforms focus on incorporating advanced technologies, enhancing mobile access, and ensuring that public services are accessible and digitally inclusive. For this reason, other countries seeking to improve their digital government capabilities often view the Lithuanian approach as a useful model.

Latvia's rising position in the EGDI indicates that investments and policy reforms have been successful, although the country still faces challenges such as ensuring digital inclusion across all regions and addressing the remaining infrastructure gaps. Maintaining and advancing its e-government maturity will require sustained attention to digital literacy, data interoperability, and service quality.

The Baltic states—Estonia, Lithuania, and Latvia—show a clear upward trend in the development of digital public services, as reflected in their Online Service Index (OSI) performance. Governments across the region have built increasingly mature digital ecosystems that enable more transparent, efficient, and accessible service delivery, forming a key pillar of their broader e-government strategies and strong positions in international rankings. Despite this overall progress, each country faces specific challenges that will shape its future development: Estonia must sustain innovation within an already highly advanced system; Lithuania needs to strengthen integration and expand the practical use of its digital services; and Latvia must increase citizen adoption and improve mobile-friendly accessibility. The main conclusion is that infrastructure is no longer the primary constraint. Instead, long-term success will depend on continuous innovation, deeper system integration, and ensuring that digital services are fully user-centered and equally accessible to all citizens.

Strong telecommunications infrastructure promotes higher e-government preparedness, as reflected in the TII scores of the three Baltic states. The differences in TII performance across Estonia, Lithuania, and Latvia demonstrate that even in a region with generally high digital readiness, infrastructure gaps continue to exist and affect overall performance in the provision of online services and digital public administration.

All three Baltic states have a strong human capital base, supporting improvements in digital infrastructure, e-government development, and overall socioeconomic progress. However, differences in their HCI scores indicate variations in education systems, adult learning, workforce upskilling, and digital

literacy, which affect how effectively each country can translate human capital into practical outcomes in a rapidly changing technological environment. The key conclusion is that human capital is a decisive yet dynamic factor in digital development. For Estonia, Lithuania, and Latvia, long-term digital transformation and economic competitiveness will depend not only on maintaining high levels of education but also on improving lifelong learning systems, strengthening digital skills, and ensuring that the workforce can continuously adapt to technological and governance changes.

All three Baltic states already have strong digital infrastructure and well-developed e-government services. However, further progress will depend on deeper integration across public institutions through shared data platforms, unified data governance frameworks, and the consistent application of "once-only" and data reuse principles. Expanding single digital portals for accessing services will also be important to simplify interactions between citizens and the state. In addition, improving digital skills among both citizens and public sector employees will be essential, along with shifting attention from service availability to actual usage and accessibility. The inclusive co-design of services—especially for older, rural, and less digitally skilled populations—will help reduce inequalities in access. Finally, developing national AI and machine learning strategies for public administration could further enhance efficiency and innovation. The authors conclude that the Baltic states' next stage of digital development will depend less on infrastructure expansion and more on integration, inclusivity, and the intelligent use of data and emerging technologies, enabling them to maintain their leadership in digital governance.

From a theoretical standpoint, the findings contribute to the comparative e-government literature in two ways. First, they add to the body of evidence questioning a purely resource-deterministic view of digital governance maturity: Latvia and Lithuania achieved "Very High" EGDI status with broadly similar economic endowments to Estonia, but on a delayed timeline, suggesting that institutional choices and policy continuity mediate the relationship between national wealth and e-government outcomes. This nuances the view of scholars such as Mensah [13], who emphasizes government capacity as the primary driver, by demonstrating that capacity can be built incrementally through specific program choices rather than being a fixed precondition. Second, the sub-index decomposition reveals that improvements in the TII were the primary driver of EGDI gains in Latvia after 2018 (supporting H2), whereas Estonia's advances were driven primarily by the OSI throughout the observed period—a distinction that carries different implications for policymakers in lower- and higher-tier e-government systems.

The study acknowledges several methodological limitations. First, the analysis relies exclusively on the UN EGDI, which captures the supply side of e-government (the availability of services and infrastructure) but does not directly measure actual citizen usage or user satisfaction. Second, the biennial measurement frequency means that short-term policy effects cannot be isolated. Third, as a secondary-data study, the research cannot control for all confounding factors that may jointly influence EGDI scores, such as macroeconomic conditions, population size, or government expenditure. Future research combining EGDI data with citizen uptake surveys or administrative microdata would provide a more comprehensive understanding of e-government development.

Several avenues for further research emerge from this study. First, the present analysis is limited to the supply-side measures captured by the EGDI; future work should incorporate citizen demand-side data, such as Eurostat e-government usage statistics, to assess whether higher EGDI scores translate into meaningfully higher service uptake. Second, a mixed-methods extension combining EGDI data with expert interviews or policy document analysis could trace the specific governance decisions that explain the acceleration observed in Latvia after 2018 and in Estonia during 2022–2024. Third, the Baltic comparison could be extended to other clusters of comparable EU member states—for example, the Visegrad Group or the Nordic countries—to test whether the institutional strategy hypothesis identified in this study generalizes across regional contexts.

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ORIGINAL SCIETNTIFIC PAPER

ASSESSMENT OF THE IMPORTANCE OF TRANSFORMATIONAL LEADERSHIP FACTORS IN THE CHANGE MANAGEMENT PROCESS

JANOVAC Tatjana [1], PUŠARA Aleksandra [2], VUKČEVIĆ Marijana [3]

[1] University Business Academy in Novi Sad, Faculty of Applied Management, Economics and Finance, Belgrade (SERBIA) ORCID 0000-0001-7436-0752

[2] University „Union-Nikola Tesla", Belgrade, Faculty of Management, Sremski Karlovci (SERBIA) ORCID 0000-0002-3434-822X

[3] University Business Academy in Novi Sad, Faculty of Applied Management, Economics and Finance, Belgrade (SERBIA) ORCID 0009-0009-9137-3630

E-mails: tatjana.janovac@mef.edu.rs, aleksandra.pusara@famns.edu.rs, marijana.vukcevic@mef.edu.rs

ABSTRACT:

The objective of the article is to evaluate and define the importance of four transformational leadership factors important for the implementation of changes in enterprises. The transformational leadership factors analysed in this paper refer to inspirational motivation, idealized influence or charisma, intellectual stimulation, and individualized consideration. Using the new multicriteria decision-making method PIPRECIA, an assessment will be made and the importance of transformational leadership factors relevant to change management will be defined. By applying the PIPRECIA method, the weights of the criteria, which in this research represent the factors of transformational leadership, will be determined based on the answers of three executive managers from a Serbian company by filling out an interactive questionnaire. The findings indicate that factor C1 - Inspirational motivation (0.254) has the greatest importance for accepting and implementing changes. This factor is important from the aspect of reducing resistance to change among employees. This study suggests to management which factors of transformational leadership should be strengthened in order to achieve the acceptance and implementation of change by employees.

***Keywords**: transformational leadership factors, change management, PIPRECIA method.*

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INTRODUCTION

In modern business conditions, changes are becoming more frequent, conditioned by globalization, technological achievements, and growing competition. Changes are increasingly difficult to predict, and adapting, accepting, and overcoming resistance to changes are prerequisites for the survival of any company [1]. The absence of changes in an organization creates disruptions, leads to poor performance, and causes a company crisis. Therefore, the reasons for introducing changes are multiple: primarily as an organization's response to a changing environment, improving organizational performance, improving the efficiency of all processes, increasing employee performance, and increasing profitability.

The role of leaders and managers in the change management process is of crucial importance [1-4]. Leaders have the ability to lead organizational changes in order to create a flexible and efficient organization. The leadership approach in the process of change management requires the mobilization of knowledge and energy of all employees during and before the process in order to increase the success of responding to changes and minimize employee resistance to accepting changes [5]. Undoubtedly, one of the biggest problems that occurs in the process of introducing changes is employee resistance [5][6]. This problem is almost always present, regardless of time, organization, or person. Openness to something new and fear of the unknown are parts of human nature [6-8]. From the individual's point of view, the reasons for not accepting changes can be found in economic insecurity, established relations between employees, business process routines, and employees' values and motivational criteria. How leaders and managers will reduce resistance among employees is one of the key questions.

In the scientific literature, there are many scientific works that indicate the importance of transformational leadership for implementing changes in organizations [9-14]; however, there is a research gap when it comes to assessing the factors of transformational leadership, i.e., determining the individual importance of each factor in the change management process. For this reason, the main goal of the paper is to use the new multicriteria decision-making method PIPRECIA to evaluate and define the importance of transformational leadership factors important for the implementation of changes.

LITERATURE REVIEW

In today's business world, organizational changes are a constant challenge that organizations face every day in order to improve business performance and increase profitability [2].

Change management is a complex process and requires a proactive and systemic approach, coordinated efforts, and coordination of all activities [15]. Change management was defined by the authors Moran and Brightman (2001) as "the process of continuously renewing an organization's direction, structure, and capabilities to serve the ever-changing needs of external and internal customers" [5]. Furthermore, changes are characteristic of small, medium, and large companies, regardless of their structure or size, but depend on the external circumstances to which companies must adapt. They can be structural, requiring changes in management, strategy, technology, hiring new people, knowledge, and abilities, or cultural, requiring the adaptation of employees to accept change. The process itself requires the engagement of many resources that can be used irrationally if the changes are not carried out in a planned and efficient manner. Adaptive changes imply organizational development that can affect the entire organization with a special focus on the culture and leadership of the organization. Changes can also be viewed from the aspect of their size, i.e., scope and impact, goal, type of change, as well as dynamics or speed of development. Regarding the process of change, one of the most represented approaches in the literature is the approach of the author Kurt Lewin (1947), according to which there are three phases: the unfreezing phase, the intervention phase, and the freezing phase. According to Lewin, the success of change depends on the unfreezing stage [16].

The results of some studies indicate that the transformational style has the greatest influence on company performance [10] [17-20]. In this regard, the transformational leadership style has a positive effect on the process of organizational change. This leadership style is characterized by the fact that the leader coordinates with employees, shares knowledge, and provides the opportunity to make decisions at the organizational level [5]. Authors Jyoti and Dev (2015) believe that in the process of change management, the transformational leader conveys the vision, encourages creativity, raises awareness, and develops an emotional connection with followers in order to achieve high goals [14]. In organizations,

transformational leaders encourage creative thinking and innovative behavior among employees [9] [18-23]. According to the author Bass (1999), leaders inspire followers to embrace change through four factors of transformational leadership [24]. Transformational leadership factors represent the criteria that will be analyzed in this paper and refer to inspirational motivation, idealized influence or charisma, intellectual stimulation, and individualized consideration [25] (p. 125):

Inspirational motivation

This factor characterizes leaders who set high expectations for followers, inspiring their motivation to become committed. It involves using symbols to focus efforts and express clear goals in a simple way. Transformational leaders inspire and motivate employees to embrace the vision and follow them in its realization. They help followers create a clear picture of the future and understand the necessity of accepting changes.

Idealized influence or charisma

According to Bass, charisma is a necessary element of a transformational leader, but charisma alone is not sufficient to lead to a transformational process. Charisma allows followers to identify with a leader who has a realistic and achievable mission and vision for change. Transformational leaders establish themselves as role models for their followers. Such leaders have high standards of moral and ethical behavior and provide followers with a vision. Followers respect them and have a high degree of trust and respect for them. Because they enjoy the admiration, respect, and trust of followers, followers not only identify with such leaders but also want to emulate them.

Intellectual stimulation

Through intellectual stimulation, transformational leaders encourage followers to be creative and innovative. They also encourage followers to develop and acquire knowledge, as well as to share information and knowledge with each other. Transformational leaders help followers look at problems from a different perspective and approach problem-solving using different, modern methods.

Individualized consideration

This factor represents a leader who provides support to followers. Leaders pay special attention to the individual needs of followers and their development. Leaders act as coaches and advisors as they try to help followers achieve goals and reach their full potential. This factor contributes to making followers feel needed and important in the organization. In such an atmosphere, followers will contribute much more than is expected of them.

Since employee resistance to change is a normal phenomenon, the basic question that arises is: Which of these factors has the greatest importance for the acceptance and implementation of changes by employees?

METHODOLOGY

In order to achieve the goal of this paper, using the new multicriteria decision-making method PIPRECIA, an assessment will be made and the significance of transformational leadership factors important for change management will be defined. By applying the PIPRECIA method, the weights of the criteria, which in this research represent the transformational leadership factors, will be determined based on the answers of three executive managers from a Serbian company by filling out an interactive questionnaire.

The PIvot Pairwise Relative Criteria Importance Assessment (PIPRECIA) method is a relatively new multicriteria decision-making method (MCDM) developed by researchers Stanujkić et al. (2017) [25]. The main purpose of this method is to determine the importance (weight) of the evaluation criteria. Furthermore, this method is suitable for collecting information or answers from respondents based on interactive questionnaires in order to determine the weights of the criteria and can be applied in a group decision-making environment [26].

The calculation procedure of the mentioned method is presented through the following steps [25], [27]:

Step 1. Selection of criteria to be included in the evaluation process.

Step 2. Determination of the relative importance of sj, starting from the second criterion, as follows:

$$s_j = \begin{Bmatrix} > 1 \; if & C_j > & C_{j-1} \\ 1 \quad if & C_j = & C_{j-1} \\ < 1 \; if & C_j < & C_{j-1} \end{Bmatrix} \quad (1)$$

Step 3. Determination of the kj coefficient as follows:

$$k_j = \begin{Bmatrix} 1 & if\ j = 1 \\ 2 - s_j & if\ \ j > 1 \end{Bmatrix} \quad (2)$$

Step 4. Determination of the converted value of qj, as follows:

$$q_j = \begin{Bmatrix} 1 & if\ \ j = 1 \\ \dfrac{q_j - 1}{k_j} & if\ \ j > 1 \end{Bmatrix} \quad (3)$$

Step 5. Determination of the relative weights of the considered criteria as follows:

$$w_j = \frac{q_j}{\sum_{k=1}^{n} q_k} \quad (4)$$

where wj denotes the relative weight of criterion j.

Bearing in mind that a larger number of decision-makers will be involved in the decision-making process, the obtained weights represent the attitude of the group, which in this research consists of R decision-makers and can be presented as follows:

$$w_j^* = \left[\prod_{r=1}^{R} w_j^r \right]^{\frac{1}{R}} \quad (5)$$

$$w_j = \frac{w_j^*}{\sum_{j=1}^{n} w_j^*} \quad (6)$$

where wj represents the geometric mean of the criterion weights obtained from the respondents.

RESULTS AND DISCUSSION

The survey of executive managers from a Serbian company was conducted electronically by filling out an interactive questionnaire in March 2023. Managers were asked: Which of the factors has the greatest importance for the acceptance and implementation of changes by employees? Answers were offered with an explanation of each of the mentioned factors.

Based on the theoretical background, four factors of transformational leadership were analyzed that represent evaluation criteria [24]:

- Inspirational motivation (C_1);
- Idealized influence or charisma (C_2);
- Intellectual stimulation (C_3);
- Individualized consideration (C_4)

Applying formulas (1)-(4), the relative weights of the criteria were obtained based on the answers of each manager.

Table 1. The weights of criteria obtained from the first manager

	s_j	k_j	q_j	w_j
C_1		1	1	0.27
C_2	0.7	1.3	0.77	0.21
C_3	1.2	0.8	0.96	0.26
C_4	1	1	0.96	0.26
SUM			3.69	1

Source: own study

Table 2. The weights of criteria obtained from the second manager

	s_j	k_j	q_j	w_j
C_1		1	1	0.24
C_2	1.1	0.9	1.11	0.27
C_3	0.9	1.1	1.01	0.24
C_4	1	1	1.01	0.24
SUM			4.13	1

Source: own study

Table 3. The weights of criteria obtained from the third manager

	s_j	k_j	q_j	w_j
C_1		1	1	0.26
C_2	1	1	1.00	0.26
C_3	0.9	1.1	0.91	0.23
C_4	1.1	0.9	1.01	0.26
SUM			3.92	1

Source: own study

By applying the PIPRECIA method, transformational leadership factors were evaluated based on the managers' responses, on the basis of which the relative weights of the criteria were obtained. The weights of the criteria based on the responses of all managers who participated in the research are shown in Table 4.

Table 4. The weights obtained from all managers included in the evaluation

	C_1	C_2	C_3	C_4
R_1	0.27	0.21	0.26	0.26
R_2	0.24	0.27	0.24	0.24
R_3	0.26	0.26	0.23	0.26
SUM	0.77	0.74	0.76	0.76

Source: own study

By applying formulas (5) and (6), the group weights of the criteria for evaluating transformational leadership factors were obtained, and then their ranking was performed.

Table 5. The group weights of the criteria for evaluating the factors of transformational leadership

	w_j*	w_j	Rank
C_1	0.257	0.254	1
C_2	0.247	0.244	3
C_3	0.253	0.251	2
C_4	0.253	0.251	2
SUM	1.010	1.000	

Source: own study

From Table 5, it can be seen that factor C_1 - Inspirational motivation (0.254) has the greatest importance for the acceptance and implementation of changes among employees. This factor is important from the aspect of reducing resistance to change. Changes require great effort and synchronized activities of managers. Incorporating positive change into all aspects of the system and into the organizational culture is a very complex and particularly demanding process for managers.

Factor C_2 - Idealized influence (0.244) was identified as the least significant factor. Factors Intellectual stimulation (C_3) and Individualized consideration (C_4) have the same rank, which means that they have the same importance for decision-makers.

Research conducted by Faupel and Süß (2019) indicates that transformational leadership increases work engagement among employees, affects employees' perception of the positive outcomes of changes, and thus influences employee behavior. These authors believe that transformational leaders influence the motivational mechanisms of employees to accept and support changes, which corresponds to the findings of our research [28].

Researchers Yue et al. (2019) conducted a study that examined the effect of transformational leadership and transparent communication on a sample of 439 employees in the USA. The findings of this study indicate that transformational leadership and transparent communication were positively related to employee trust, which had a positive effect on employees' openness to change [13].

CONCLUSION

In order to evaluate the factors of transformational leadership that influence the process of change management, the multi-criteria decision-making method PIvot Pairwise RElative Criteria Importance Assessment—fuzzy PIPRECIA was applied. The weights of the criteria, which in this research represent the transformational leadership factors, as well as their ranking, were determined using this method based on the responses of executive managers who were examined electronically using an interactive questionnaire. The results of the application of this method indicate that the key factor for the acceptance and implementation of changes by employees is C_1 - Inspirational motivation.

This study contributes to the existing literature on transformational leadership and particularly provides a perspective on the individual importance of transformational leadership factors. Additionally, the contribution of this work is reflected in providing the opportunity to apply the PIPRECIA method in practice for leaders and managers in order to work effectively.

The results of the research provide significant information to managers on how to manage change more effectively. Furthermore, this study suggests to management which factors of transformational leadership should be strengthened in order to achieve the acceptance and implementation of change by employees.

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ORIGINAL SCIETNTIFIC PAPER

STRATEGIC RISK OF POSITIONING IN THE BANKING SECTOR: AN EXAMPLE FROM SERBIA

DŽODŽO Miodrag[1], KALIČANIN Milica [2], KALIČANIN Zoran [3]

[1] Union - Nikola Tesla University - Faculty of Business Studies and Law, Belgrade, Serbia, ORCID 0000-0003-4230-4830
[2] Union - Nikola Tesla University - Faculty of Business Studies and Law, Belgrade, Serbia, ORCID 0000-0002-4770-7631
[3] Union - Nikola Tesla University - Faculty of Business Studies and Law, Belgrade, Serbia, ORCID 0000-0002-9569-7175

E Mail: miodrag.dzodzo@fpsp.edu.rs, milica.kalicanin@fpsp.edu.rs, zoran.kalicanin@fpsp.edu.rs

ABSTRACT

This paper provides an overview of the concept of strategic risk in the banking sector, with a focus on the challenges faced by stakeholders due to the increasing impact of strategic risks amid rapid market changes. The study also examines the key requirements for identifying, measuring, controlling, and monitoring strategic risks, along with the roles and responsibilities of those involved. The paper categorizes strategic risks and emphasizes the importance of timely and objective information for strategic decision-making. It examines the strategic risk of positioning in the Serbian banking sector and provides insights into the differences between domestic and foreign banks, as well as between banks with smaller and larger assets.

***Keywords**: banking sector, strategic risk, bank, risks, strategy, positioning*

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INTRODUCTION

Intensified competition in the banking sector, coupled with evolving market demands and fluctuating interest margins, necessitates innovative growth strategies. Financial institutions must adapt by introducing new products, exploring alternative investments, and implementing novel sales and marketing approaches, while managing different types of risks. Failure to keep pace with innovation may render some banks less competitive than their more adaptive counterparts. Proper alignment of business strategies with customer trends is crucial for mitigating strategic risks, particularly positioning risk.

Strategic risks encompass a range of factors that can significantly affect a financial institution's performance and long-term viability. These risks can be broadly classified into three categories, with strategic positioning risk standing out as a critical concern [2]:

- Strategic Positioning Risk: This category revolves around the alignment of an organization's actions with its intended direction and the feasibility of achieving its strategic goals. In essence, it questions whether the organization is heading in the right direction and whether its strategic objectives are rational and attainable.
- Risks of Strategic Execution: These risks relate to an organization's ability to successfully implement its chosen strategy. They depend on factors such as the availability of talent, competencies, and infrastructure necessary for executing the chosen strategy.
- Risks of Strategic Consequences: This category pertains to the potential for new risks or unforeseen outcomes arising from an organization's chosen strategies. It underscores the need to consider how strategic choices might affect broader markets and society.

Strategic positioning risk can manifest itself in various ways, including the misalignment of organizational goals with the economic climate and organizational capabilities. It is a multifaceted challenge that requires a thorough understanding of the underlying factors. It encompasses the potential negative consequences stemming from an organization's actions or inactions [1]. This risk manifests itself in various ways, including:

- Misalignment of Goals: It questions whether an organization's strategic objectives align with the prevailing economic climate and its own capabilities. Such misalignment can hinder the successful execution of strategies.
- Execution Dependencies: The ability to execute strategies effectively depends on having the necessary infrastructure, talent, and expertise [3]. Without these resources, even the most well-conceived strategies may fail.
- Impact on Broader Markets: The consequences of an organization's preferred strategies for broader markets and society warrant careful consideration. Actions taken to achieve strategic goals can inadvertently lead to new risks or unexpected outcomes [4].

All organizations, including banks, face a certain degree of strategic consequence risk, as their decisions can have repercussions beyond their immediate operations. However, these risks are not always immediately apparent, leading organizations to underestimate their significance and potentially suffer substantial losses. To address this issue, some institutions choose to establish a dedicated Head of Strategy position within their organization [5].

Effectively managing strategic positioning risk requires several key steps. One crucial aspect is the continuous assessment of the alignment between an organization's strategies and its evolving environment. This involves evaluating whether the chosen strategic direction remains appropriate in light of changes in the economic environment, customer preferences, and technological advancements.

Additionally, comprehensive risk management plans must be developed. These plans should address both short-term and long-term considerations, including potential challenges such as market disruptions, regulatory changes, and internal issues such as low employee engagement. A robust risk management program helps organizations prepare for a wide range of challenges and opportunities while ensuring alignment with their overarching business goals [6].

Within the realm of strategic positioning risk, two critical components warrant particular attention:

- Market Positioning Risk: This aspect highlights the risk that inadequate market positioning may impair a bank's ability to market its products or services effectively. Addressing this risk may involve reevaluating the target market and developing innovative products and services to meet the needs of a broader customer base.
- Employee Engagement: Low employee engagement can pose significant challenges to an organization's competitive advantage. It reflects the degree to which employees are committed to the bank's success and their willingness to contribute positively to its performance. Insufficient employee engagement can increase strategic risk by reducing motivation and productivity. To address this issue, organizations should invest in employee development, provide the necessary tools and support, and foster a work environment that encourages improved performance.

METHODOLOGY

In this study, the statistical method was used as the primary research method. The research covered the Serbian banking sector during the period from 30 September 2020 to 30 September 2021. All banks operating in the Republic of Serbia during the observed period were included in the analysis. The data for Vojvođanska Banka were added to OTP Banka as of 30 September 2020, while the data on MTS Bank's assets were added to The Postal Savings Bank due to the merger and acquisition, in order to ensure data comparability.

The comparison of the direction vectors of strategic risk was based on changes in the total assets of banks. Specifically, changes in the level of assets between the two observed dates were used to determine the movement of banks' assets as one of the indicators of strategic positioning risk. The key risk indicator selected for identifying positioning risk in this research was the decline in a bank's assets between the two observed periods.

Within the research, the banks were classified into two categories: domestic banks and foreign banks. The index of the difference in total assets between the two observed dates was calculated, and the banks were subsequently classified into three categories. The first category consisted of banks whose asset growth exceeded the average growth of the banking sector.

The second category consisted of banks whose asset growth was below the banking sector average but remained positive. The third category consisted of banks that recorded a decline in assets between the two observed periods, indicating an increased strategic positioning risk during the observed period.

The research hypothesis is as follows:

Foreign banks and banks with larger assets have, on average, a lower strategic positioning risk than domestic banks and banks with smaller assets during the period from Q3 2020 to Q3 2021 in the Serbian banking sector.

The hypothesis will be considered confirmed if a smaller percentage of foreign banks and larger banks are included in the category of banks with declining assets than domestic banks and banks with smaller assets, respectively.

RESEARCH RESULTS

Data were collected for a total of 24 banks, of which 19 had predominantly foreign capital and 5 had domestic capital. There were no missing data. The asset movement index for the two observed periods ranged from a minimum of 0.93 to a maximum of 2.56. The average banking sector index was 1.09. Based on this average, an overview of the number of banks by growth category and by origin of capital is presented in the following illustration.

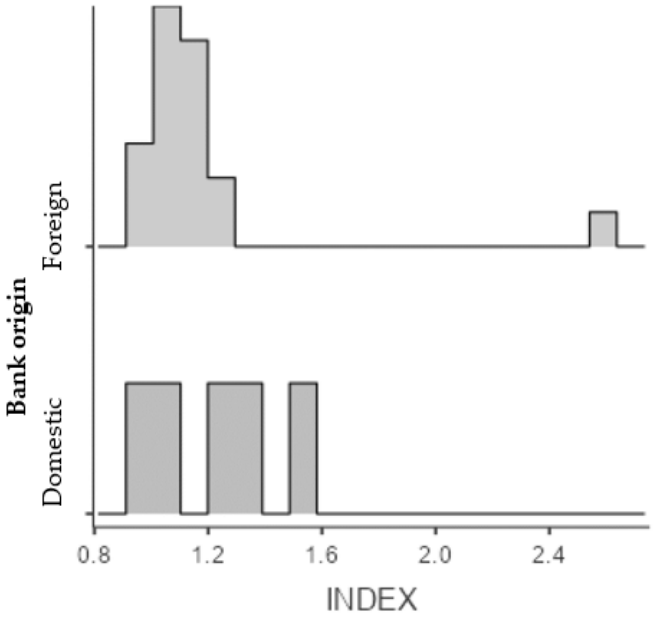

Illustration 1. *Overview of the Asset Index – Domestic and Foreign Banks*[1]

The previous illustration shows that foreign banks are mostly concentrated around the average of the Serbian banking sector, which is expected given that most banks are foreign-owned. One foreign-owned bank increased its assets significantly during the observed period and represents an outlier. Banks with domestic capital are more evenly distributed with respect to the asset growth index, within the range of 0.9–1.6.

The following illustration shows more clearly the concentration of foreign banks around the banking sector average and the distribution of domestic banks both below and above the average of the Serbian banking sector.

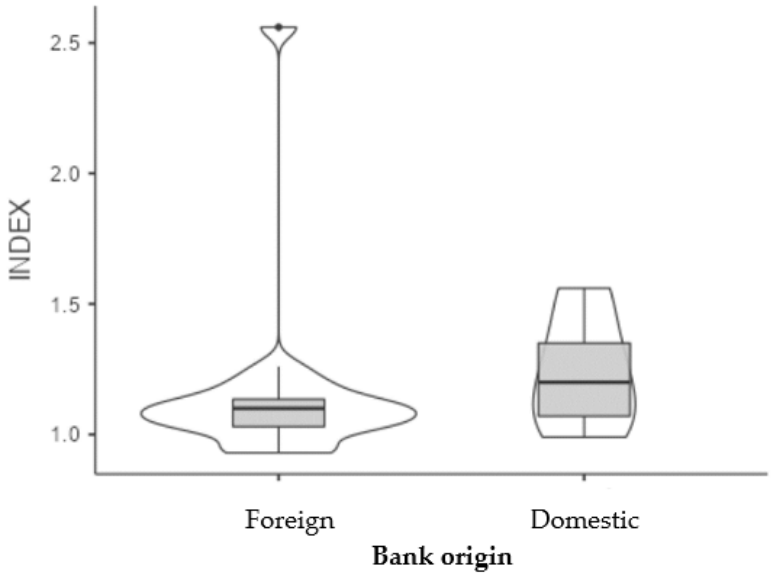

Illustration 2. *Overview of the Asset Dispersion Index – Domestic and Foreign Banks*[2]

[1] Illustration is created by the authors
[2] Illustration is created by the authors

Data on banks' assets are presented for the dates 30 September 2020 and 30 September 2021, together with an index indicating the movement of assets during this period, as well as the categorization of banks according to asset movement and grouping by the origin of capital. The final research results show that 60% of domestic banks recorded asset growth above the banking sector average, while this was the case for 52.63% of foreign banks. In terms of size, 50% of larger banks recorded above-average asset growth, whereas this was the case for 58.33% of smaller banks. The following table presents all the data collected and used in the research.

Table 1. *Bank Asset Growth from 30 September 2020 to 30 September 2021 in the Serbian Banking Sector*

Categories	1. Growth of assets above average		2. Growth of assets below average		3. Decline in assets		Total
Domestic banks	3	60.00%	1	20.00%	1	20.00%	5
Foreign banks	10	52.63%	6	31.58%	3	15.79%	19
Smaller banks (by assets)	7	58.33%	2	16.67%	3	25.00%	12
Larger banks (by assets)	6	50.00%	5	41.67%	1	8.33%	12
Total	13	54.17%	7	29.17%	4	16.67%	24

Source: Authors

It can be concluded that the smallest percentage of foreign banks experienced a decline in assets (15.79%). Likewise, the smallest percentage of larger banks fell into the category of banks with declining assets. These findings indicate that the **hypothesis is supported and that strategic positioning risk**, as measured by the asset-level indicator, was lower among foreign banks and larger banks than among domestic banks and banks with smaller assets.

The limitations of the research are reflected in the fact that the number of domestic banks was almost four times smaller than the number of foreign banks. Another limitation of the research is the relatively short observation period of one year.

CONCLUSIONS

Strategic risks, particularly positioning risk, are closely linked to an organization's exposure to external market conditions, including technological changes, evolving customer preferences, and regulatory developments. Effectively managing these risks is essential for financial institutions as they navigate an ever-changing environment. Regulatory bodies emphasize the systematic management of strategic risks, requiring institutions to carefully assess the risks associated with their specific strategic objectives. Ultimately, strategic risk management serves as a cornerstone for financial institutions, enabling them to navigate uncertainty in a rapidly evolving environment and make well-informed strategic decisions aligned with their long-term goals.

Within the Serbian banking sector, strategic risks play an important role in influencing market position, market share, profitability, and competitiveness. To address these inherent risks, banks in Serbia primarily focus on product development, market positioning, and pricing strategies. These efforts are aimed at effectively meeting customer demands and ultimately achieving asset growth. However, it is important to acknowledge that the complexities of strategic risk management extend beyond these tactical measures.

Effective risk management depends on several fundamental principles. First and foremost, it requires close alignment between strategic decision-makers and risk managers within an organization. This alignment fosters a comprehensive understanding of how strategic decisions can influence the overall risk profile. It is not merely about recognizing risks but also about understanding their potential implications and consequences.

Furthermore, strategic risk management requires continuous investment in the training and professional development of risk managers. The constantly evolving nature of strategic risks requires these professionals to remain up to date with industry trends, risk assessment methodologies, and risk mitigation strategies. This continuous learning process equips them with the knowledge and tools needed to make informed decisions and effectively safeguard the institution's interests.

In an environment characterized by rapid change, the ability to adapt is essential. Financial institutions must implement frameworks that enable them to respond dynamically to changing conditions. This includes not only monitoring market developments but also maintaining the flexibility to adjust strategies, risk mitigation measures, and operational processes accordingly.

The case study conducted in Serbia provides insights into the dynamics of strategic risk. It suggests that, on average, foreign banks and banks with larger assets experienced lower strategic positioning risk during the observed period. However, it is important to acknowledge certain limitations of the study. First, the number of domestic banks included in the study was significantly smaller than the number of foreign banks, which may have introduced bias into the results. Second, the relatively short observation period of one year may not adequately capture longer-term trends.

Given these limitations, further research over a longer period, ideally encompassing several years, is warranted to provide a more comprehensive understanding of this issue. The complexities of strategic risk in the Serbian banking sector require further analysis, as they are essential for achieving sustainable success in an increasingly competitive environment. By gaining a deeper understanding of these issues, financial institutions can refine their strategies, strengthen their risk management practices, and ultimately enhance their long-term competitiveness.

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TAX EVASION AS A PREDICATE OFFENSE OF MONEY LAUNDERING: ECONOMIC SUBSTANCE VERSUS LEGAL FORM

JOVANOVIĆ Aleksandra[1]

[1] *Faculty of Business Economics and Entrepreneurship, Belgrade (Serbia) ORCID 0000-0003-1062-3351*

E-mail: aleksandra.jovanovic@vspep.edu.rs; aleksandra.aj17@gmail.com

ABSTRACT

The article examines whether savings resulting from tax evasion can be treated as proceeds derived from a criminal act for money laundering purposes. Applying prospect theory and the Kaplow model, the research analyzes the economic equivalence of unpaid tax and unlawful income. Empirical data include 78 final court judgments (2020–2024) of higher courts in Serbia and macroeconomic estimates of the shadow economy (21–32% of GDP). The findings confirm that tax savings are economically equivalent to unlawful income, but they become "proceeds" only when accompanied by subsequent acts of concealment (conversion, transfer, investment). Otherwise, unpaid tax remains a property benefit. Fixed and marginal costs of evasion explain why only 7.7% of cases involve money laundering. Strengthening institutional cooperation is more effective than merely increasing penalties. The paper offers quantitative thresholds for policy intervention.

Keywords: tax evasion, money laundering, predicate offense, economic substance

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INTRODUCTION

Tax evasion directly reduces fiscal revenues and distorts market competition. Although legal frameworks consistently criminalize tax evasion, the question arises: does a saving resulting from tax evasion constitute proceeds derived from a criminal act, and under what conditions does it become subject to money laundering? Kemsley and Kemsley (2024) [1] argue that a dollar saved through tax evasion is equivalent to an unlawfully obtained dollar. However, legal systems, including the Serbian legal system, distinguish between a property benefit (Article 91 of the Criminal Code)—subject to automatic confiscation—and proceeds derived from a criminal act, which require subsequent acts of concealment [2]. The paper adopts a law-and-economics perspective to bridge the gap between economic equivalence and legal qualification.

We apply prospect theory [3] and the Kaplow model [4, 5]. Empirical data are drawn from 78 court judgments (2020–2024) and macroeconomic estimates [6–9]. The research question is: under what economic conditions do savings from tax evasion become proceeds derived from a criminal act for money laundering purposes? One general hypothesis and four auxiliary hypotheses were formulated: (H0) tax evasion generates such proceeds only when subsequent acts of concealment exist; otherwise, it remains a property benefit; (H1) savings are economically equivalent to unlawful income, but equivalence alone is not sufficient—concealment is necessary. The theoretical verification of H1 is conducted through the application of prospect theory and the Kaplow model, while its empirical verification is achieved through an analysis of practitioners' attitudes. Differences in the application of the substance-over-form principle between judges and prosecutors (part of H3) were examined using statistical analysis of survey questionnaire data (χ^2 test, N = 120).

LITERATURE REVIEW

The obligation to pay taxes (Article 91 of the Constitution of the Republic of Serbia) [10] protects fiscal revenues [11]. Tax evasion raises questions about the treatment of tax savings—the existence of a predicate offense has been confirmed [12], as have differences among EU member states [13]. The fight against tax evasion is justified by revenue losses, unequal distribution [14, 15], its impact on economic decisions [16], and changes in tax policies [17]. Tax evasion is globally widespread [1]; it implies concealment and occurs because taxation reduces income and social status [18, 19]. The expansion of the informal economy creates distortions and facilitates the spread of crime [20, 21]. At the EU level, annual losses amount to EUR 825 billion, while 0.7–1.2% of GDP is associated with suspicious activities [22]; the shadow economy in Serbia is estimated at approximately 31% of GDP [7]. The key determinants of tax evasion are the tax burden, the probability of detection, and tax morale [3].

Kemsley and Kemsley (2024) [1] conclude that savings resulting from non-payment economically constitute unlawful income. This raises the question of whether unpaid tax represents "proceeds" (Article 225) or a "property benefit" (Article 91) [2]. Confiscation of a property benefit is automatic, whereas unpaid tax may be qualified as proceeds only when accompanied by subsequent acts of concealment [2].

In 2012, the FATF added tax evasion as the 21st designated predicate offense [23]. Directive (EU) 2015/849 incorporates the FATF recommendations, stipulating that money laundering applies to "tax crimes as defined in national legislation" (Article 3(4)(f)) [23, 24]. The OECD emphasizes the effective enforcement of laws, including confiscation and asset recovery [25, 26]. Levi and Reuter (2006) [27] warn that expanding the scope of predicate offenses without procedural safeguards may undermine the legitimacy of the judiciary [28]. The Council of Europe Convention (2005) defines a predicate offense as any criminal offense that generates proceeds susceptible to money laundering, requiring: (1) a serious unlawful act producing illicit income, and (2) subsequent concealment activities [29].

METHODOLOGY

The research is based on a multi-method approach that integrates: (1) normative-legal and comparative-legal analysis; (2) economic modeling; and (3) empirical data collection. Economic analysis employs prospect theory [3] and the Kaplow model [4, 5] to examine the economic equivalence of tax savings and unlawful income, as well as the role of concealment. The theoretical confirmation of hypothesis H1 (economic equivalence) is derived exclusively from these economic models.

The microanalysis was conducted on a convenience sample of 78 final judgments of higher courts rendered during 2020–2024. The inclusion criteria were: (1) finality of the judgment; (2) the imposition or consideration of the measure of confiscation of property benefit (Article 91 of the Criminal Code) [2]; and (3) the availability of a complete reasoning. Due to the absence of a centralized electronic database, the findings cannot be statistically generalized, but they provide significant insights into patterns of judicial practice. Macroeconomic quantification comprises an assessment of the shadow economy using the MIMIC method [6–9]. A hierarchy of data sources was established: court judgments > normative analysis > macroeconomic estimates. Research limitations include the convenience sample of court judgments (N = 78) and the lack of quantitative parameterization of the economic models.

The survey of practitioners (N = 120) was designed to test only H3—the application of the substance-over-form principle and the difference between judges and prosecutors. It did not measure the abstract acceptance of economic equivalence; therefore, it does not provide empirical confirmation of H1.

RESULTS

Integrative economic models: The paper applies prospect theory [4] and the Kaplow model [5, 23] as an integrative framework for analyzing tax evasion. The decision to evade is determined by psychological mechanisms (loss aversion and nonlinear probability weighting) and institutional constraints. Prospect theory identifies: (1) loss aversion ($\lambda > 1$)—losses are perceived as twice as strong as gains; and (2) nonlinear probability weighting ($w(p) \neq p$)—small risks are overestimated. The decision to evade stems from a calculation of the expected gain and the risk of punishment, while the decision to conceal stems from loss aversion regarding liberty or assets. The Kaplow model introduces costs of evasion (c_e) and enforcement (c_a). The expected net value for a risk-neutral taxpayer is: $E = (1-\pi)t(W-X) - \pi p(W-X) - c_e(W-X)$, with the optimal reporting condition: $(1-\pi)t - \pi p = c_e'(W-X)$. The model implies: (1) fixed costs ($c_e(0) > 0$) explain why small taxpayers (evasion < EUR 50,000, 40% of cases in Table 3) rarely move into money laundering; and (2) increasing marginal costs ($c_e'' > 0$) explain partial evasion and the fact that concealment is present in only 7.7% of cases. Both models confirm that tax evasion becomes a predicate offense for money laundering only when accompanied by additional acts of concealment. Prospect theory emphasizes loss aversion regarding liberty, while the Kaplow model emphasizes high costs, large amounts, and complex schemes. Without these two conditions—psychological and economic—unpaid tax remains a property benefit, not proceeds. Empirically, only 15% of practitioners regularly apply the substance-over-form principle (Table 1).

Empirical research was conducted on a convenience sample of 120 judges and prosecutors from courts in six cities in the Republic of Serbia, with the aim of determining the acceptance of the principle of economic substance, i.e. the discrepancy between the general view on the equivalence of tax savings and unlawful income and its actual application.

Table 1. Economic substance

Profession	Yes, regularly	Occasionally	No, I rely exclusively on formal legal criteria	Total
Judges (N=60)	6 (10.0%)	15 (25.0%)	39 (65.0%)	60
Prosecutors (N=60)	12 (20.0%)	19 (31.7%)	29 (48.3%)	60
Total	18 (15.0%)	34 (28.3%)	68 (56.7%)	120

Source: Author

Table 1 shows that 56.7% of respondents never apply the economic substance principle, while only 15% do so regularly. Judges are significantly more inclined toward formalism (65%) than prosecutors (48.3%) ($\chi^2(2) = 7.89$; $p = 0.019$; Cramér's $V = 0.26$). This finding contradicts the FATF recommendations (2012) and the practice of specialized prosecutor's offices (USKOK), which consistently apply the substance-over-form principle. The limited application of this principle in domestic practice represents a major obstacle to treating tax savings as unlawful income, confirming the warnings of Levi and Reuter (2006) that procedural barriers may undermine the effectiveness of the criminal justice system. This confirms hypothesis H3 (the rare application of the economic substance principle) and indicates an institutional gap between the two professional groups.

Table 2 presents the microanalysis of court cases based on final judgments available to the author from the Supreme Court of Cassation database and court archives during the research period.

Table 2. Distribution of Final Judgments by Court and Year (2020–2024)

Court	2020	2021	2022	2023	2024	Total
Higher Court in Belgrade	5	7	8	9	6	35
Higher Court in Novi Sad	3	4	5	4	3	19
Higher Court in Niš	2	3	4	3	2	14
Higher Court in Kragujevac	1	2	3	2	2	10
Total	11	16	20	18	13	78

Source: Author

The average evaded amount per case is EUR 110,000. The measure of confiscation of property benefit (Article 91 of the Criminal Code) was imposed in all cases. Only 7.7% of cases were also qualified as money laundering, and exclusively in the presence of an additional act of concealment (international transfers, investments in real estate or cryptocurrencies, and offshore structures). The explicit reference to "proceeds derived from a criminal act" appears only in those cases, whereas in the remaining cases the courts treat the evaded amount as a property benefit. The microanalysis confirms the general hypothesis H0.

Table 3. Distribution of Evaded Amounts (N = 78)

Amount category (EUR)	Number of cases	Percentage	Includes money laundering
< 50,000	31	39.7%	0 (0%)
50,000 – 199,999	24	30.8%	1 (4.2%)
200,000 – 999,999	15	19.2%	2 (13.3%)
≥ 1,000,000	8	10.3%	3 (37.5%)
Total	**78**	**100%**	**6 (7.7%)**

Source: Author

The distribution of evaded amounts confirms the Kaplow model: fixed evasion costs explain why small taxpayers (< EUR 50,000) rarely enter the domain of money laundering, while larger amounts (> EUR 1,000,000) are more often concealed. Cases involving small-scale evasion never included money laundering, whereas cases involving large-scale evasion more frequently (although still in the minority) included money laundering. This confirms that fixed and marginal costs create a threshold effect.

The macroeconomic framework was applied to determine the order of magnitude of informal income that may potentially be acquired through tax evasion and thus provide the relevant framework for money laundering. Table 4 presents a comparative overview of estimates of the shadow economy in the Republic of Serbia. The estimates are based on peer-reviewed articles.

Table 4. Comparative Overview of Shadow Economy Estimates in the Republic of Serbia

Source	Methodology	Period	Estimate (% GDP)	Methodological notes
Krstić & Schneider (2015)	MIMIC	2013	31.9	First systematic MIMIC assessment for Serbia
Ranđelović (2017)	MIMIC + calibration	2014	31.3	Calibrated to the reference year 2010
Arsić, Ranđelović & Altiparmakov (2018)	Macroeconomic analysis	2012–2017	28.7	Indicates a slight downward trend
Ranđelović, Arsić & Tanasković (2024)	Macroeconomic and monetary model	2023	21.1	Latest FREN study

Sources: [6–9]

Table 4 shows that estimates of the shadow economy indicate a declining trend (from 31.9% of GDP in 2013 to 21.1% of GDP in 2023) [6–9]. The article adopts a range of 21–32% of GDP, which confirms significant potential revenue from tax evasion (H0, H2). Serbia has not established a tax gap reporting system. An indirect indicator—the VAT revenue ratio of 33% of GDP (European Commission, 2023) [31]—suggests a significant volume of informal income but cannot be directly equated with the tax gap. Macroeconomic estimates cannot distinguish between property benefit and proceeds; they are used solely for illustrative purposes.

DISCUSSION

By integrating normative, economic, and empirical analysis, it has been confirmed that prospect theory and the Kaplow model point to the economic equivalence of savings resulting from the non-payment of tax and unlawful income (H1—theoretical confirmation), but the legal qualification of money laundering (Article 225 of the Criminal Code) requires subsequent acts of concealment (conversion, transfer, investment); without them, unpaid tax remains a property benefit (Article 91 of the Criminal Code). The two-step test (evasion + concealment) strikes a balance between effective action against financial crime and procedural safeguards, thereby addressing the criticism of Levi and Reuter (2006) regarding over-criminalization.

Only 7.7% of cases were qualified as money laundering, and exclusively in the presence of concealment. The distribution of amounts confirms the Kaplow model: no case involving an amount below EUR 50,000 (40% of the sample) involved money laundering, while the share rises to 37.5% for amounts exceeding EUR 1,000,000.

Regarding the application of the substance-over-form principle (H3), Table 1 shows that only 15.0% of respondents regularly apply it, while 56.7% never apply it, relying exclusively on formal legal criteria. Judges are significantly more inclined toward formalism than prosecutors (65.0% vs. 48.3%; $\chi^2 = 7.89$; $p = 0.019$), indicating an institutional gap and the need to harmonize case law. The survey did not measure the abstract acceptance of economic equivalence; therefore, the study cannot determine whether there is a discrepancy between abstract acceptance and actual application. H3 is partially confirmed—the difference between judges and prosecutors in its application exists, but the first part of H3 (that abstract acceptance is not followed by practical application) remains untested due to the lack of relevant data.

Estimates of the shadow economy (21–32% of GDP) suggest significant potential revenue from tax evasion, but criminal law enforcement remains limited, with only 7.7% of cases meeting the threshold for money laundering. The absence of a regular tax gap reporting system in Serbia further impedes effective enforcement. Macroeconomic estimates (Table 4) cannot distinguish between a property benefit and proceeds derived from a criminal act—that distinction requires microanalysis. Therefore, macroeconomic data are used only for illustrative purposes, while hypothesis testing is based on case law and the survey.

These findings are consistent with the case law of the Supreme Court of Cassation (Kzz 25/12) and FATF standards. H1 is theoretically supported (economic equivalence), but empirical data on practitioners' acceptance of this concept are unavailable. H3 is partially confirmed (the difference in application exists, whereas abstract acceptance was not measured).

Limitations: Convenience samples (78 judgments and 120 respondents) do not allow statistical generalization; macroeconomic estimates are indicative; and the Kaplow model was applied qualitatively, without quantitative parameterization using domestic data. Another limitation is that the survey did not include a question on the abstract acceptance of economic equivalence, which prevented the full testing of H3.

CONCLUSION

The article has confirmed that tax evasion constitutes a predicate offense generating proceeds derived from a criminal act (Article 225 of the Criminal Code) only when followed by subsequent acts of concealment (conversion, transfer, investment); without them, unpaid tax remains a property benefit (Article 91 of the Criminal Code). This position is consistent with the case law of the Supreme Court of Cassation (Kzz 25/12) and comparative legal solutions.

The hypotheses have been addressed as follows: H0: Concealment is a conditio sine qua non for money laundering—confirmed (only 7.7% of cases involved money laundering, and exclusively in the presence of

concealment). H1: Tax savings are economically equivalent to unlawful income, but this alone is not sufficient for legal qualification—theoretically confirmed (prospect theory and the Kaplow model). Empirical data on practitioners' abstract acceptance of economic equivalence were not collected in this study; therefore, the empirical part of H1 remains untested. H2: High fixed and marginal costs of tax evasion explain the low rate of cases involving money laundering (7.7%)—confirmed (no money laundering below EUR 50,000; 37.5% above EUR 1,000,000). H3: Abstract acceptance of economic equivalence is not followed by the application of the substance-over-form principle, with a statistically significant difference between judges and prosecutors—partially confirmed. The survey confirmed a statistically significant difference in application between judges and prosecutors ($p = 0.019$; judges were more formalistic). However, the survey did not measure abstract acceptance; therefore, the first part of H3 (the discrepancy between abstract acceptance and application) remains unsubstantiated by the presented data.

Theoretical contributions: (1) an integrative framework combining prospect theory and the Kaplow model for the analysis of tax evasion as a predicate offense; (2) empirical confirmation that concealment is a necessary condition; and (3) quantitative thresholds (< EUR 50,000—no money laundering; > EUR 1,000,000—37.5% of cases involved money laundering).

Practical implications: (1) harmonization of case law through guidelines issued by the Supreme Court of Cassation on the application of the economic substance doctrine; (2) strengthening operational cooperation between the Tax Administration and judicial authorities; (3) introducing a regular tax gap reporting system in Serbia following the EU model; and (4) continuous education of practitioners.

Future research should focus on the quantitative parameterization of the Kaplow model using Serbian data, a comparative analysis with countries that have successfully bridged the gap between harmonization and implementation (Croatia and Slovenia), and the establishment of a regular tax gap measurement system. Future surveys should include a direct question on the abstract acceptance of economic equivalence to enable the full testing of H3.

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UNDERSTANDING MONEY LAUNDERING THROUGH CRYPTOCURRENCIES: A THEORETICAL FRAMEWORK AND INSTITUTIONAL RESPONSES

SOLEŠA Dimitrije[1], PETKOVIĆ Aleksandar[2], VLADISAVLJEVIĆ Radovan[3]

[1] *Faculty of Economics and Engineering Management, Novi Sad (Serbia) ORCID: 0009-0001-8254-927X*
[2] *Faculty of Economics and Engineering Management, Novi Sad (Serbia) ORCID: 0009-0002-0550-7452*
[3] *Faculty of Economics and Engineering Management, Novi Sad (Serbia) ORCID: 0000-0002-8502-8584*

E-mails: solesadimitrije357@gmail.com, tejana.ap@gmail.com, radovan.vladisavljevic@fimek.edu.rs

ABSTRACT:

Money laundering through cryptocurrencies is a global challenge due to the anonymity and decentralized nature of blockchain technology. This paper develops a theoretical framework based on agent theory, signaling theory, transparency theory, the "crying wolf" concept, and economic theory, analyzing institutional responses through qualitative methodology and the Tornado Cash case study. The findings indicate that the anonymity of cryptocurrencies facilitates money laundering, while institutional responses often lag behind due to technological complexity and regulatory gaps. The paper proposes a framework for better understanding and addressing these challenges, emphasizing the need for greater transparency, stricter sanctions, and stronger international cooperation.

***Keywords**: money laundering, cryptocurrencies, agent theory, signaling theory, transparency theory, the concept of "crying wolf", economic theories*

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INTRODUCTION

The rapid development of capital markets in the last decade has transformed global capital flows, but at the same time, it has created new challenges for financial security, among which money laundering stands out. Although technologies based on the blockchain principle promise greater transparency and security, their pseudo-anonymity, global availability, and decentralized nature allow the abuse of existing regulatory loopholes. Institutions faced with rapid technological changes and an insufficiently defined regulatory framework react fragmentarily, often with delays and uneven application of rules. The aim of this paper is to theoretically shed light on institutional challenges in the fight against money laundering through cryptocurrencies by applying five complementary theoretical approaches: agent theory, signaling theory, transparency stability theory, the concept of "crying wolf", and selected economic theories. Each of the aforementioned theoretical frameworks offers a unique insight into institutional behavior, the interrelationships of market participants, and the mechanisms governing issues of mutual trust, control, and accountability. Guided by an interdisciplinary approach, this paper attempts to connect the aforementioned theoretical approaches with real regulatory and technological practices, with the aim of creating a logically consistent and generally harmonized understanding of the complexity of money laundering in the digital environment. The analysis of institutional responses was carried out through the Tornado Cash case study, which illustrates that traditional institutional mechanisms face challenges brought by the digital financial environment, along with all the shortcomings of existing approaches. Essentially, the paper seeks to answer the question of how institutional actors can effectively respond to money laundering through cryptocurrencies using an integrated theoretical framework.

GENERAL METHODOLOGICAL CONSIDERATIONS OF THE THEORETICAL FRAMEWORK IN THE CONTEXT OF GLOBAL REGULATORY APPROACHES

Cryptocurrencies have grown into one of the most dynamic sectors of the global economy in recent years, offering innovative ways to transfer funds, invest, and manage digital assets. At the same time, their decentralized nature, the pseudo-anonymity of users, and the lack of globally harmonized regulation have created the possibility of their abuse for the purposes of money laundering, crime financing, and evasion of financial supervision. Money laundering through cryptocurrencies has become a significant global challenge due to the anonymity, decentralization, and speed of transactions enabled by blockchain technologies. According to the National Security Agency of the United States of America, pseudo-anonymity is a key factor in the use of cryptocurrencies and other digital assets for illegal purposes. According to this agency, the original catalyst for these circumstances was Bitcoin due to its pseudo-anonymous nature. A person's identity is tied to a fake name or pseudonym in its use, which serves as both a public key and a Bitcoin address [1]. Although Bitcoin has never been truly anonymous because all transactions are available on the public network, allowing anyone to inspect the records of all transactions conducted at a Bitcoin address, it is up to the Bitcoin owner to prevent their pseudonym or false identity from being associated with their real identity. As other cryptocurrencies emerged, the same principles were applied in order to provide pseudo-anonymity and perform transactions without revealing users' true identities. According to data from Chainalysis, in 2022, 20.6 billion dollars in cryptocurrencies were the subject of money laundering from illegal activities [2]. Over the past few years, regulatory bodies around the world have been trying to find answers to the challenges posed by money laundering through cryptocurrencies. Although the Financial Action Task Force (hereinafter referred to as the FATF) is a key organization that sets global guidelines for preventing money laundering, its recommendations for the crypto market encounter obstacles in implementation. Namely, the FATF notes in its 2021 report that, although some countries have implemented regulatory regimes for virtual assets (hereinafter VA – virtual assets) and virtual asset service providers (hereinafter VASP – virtual asset service providers), many jurisdictions have not yet established effective frameworks for preventing money laundering and terrorist financing. The FATF also indicates that a number of jurisdictions have failed to implement measures to mitigate the money laundering and terrorist financing risks associated with virtual asset activities, particularly in jurisdictions where virtual currency activities are developing globally and VASPs are increasingly operating across multiple jurisdictions [3]. Despite the given guidelines, inefficiencies in implementation have been observed because, although these guidelines have become binding for member countries, numerous crypto exchanges do not implement sufficiently rigorous controls, while some even

avoid compliance with regulations. Regarding the efforts of the European Union to regulate the legality of crypto-market operations and the use of virtual assets, the European Union first adopted the 5th and subsequently the 6th directives, which introduced stricter controls on the operation of platforms that enable cryptocurrency trading. It is important to understand how certain theoretical approaches can contribute to explaining the phenomenon of money laundering through cryptocurrencies, taking into account both the regulatory context and institutional reactions. To that end, the paper uses a qualitative methodology combining document analysis and the Tornado Cash case study. The case of this crypto-platform was selected due to its representativeness in the context of money laundering, data availability, and the regulatory significance of sanctions. The data were collected both from academic literature and from official documents of the FATF, the European Union, Europol, and other international organizations such as Chainalysis [2]. Within this framework, in considering the contribution of certain theoretical frameworks to understanding the role of cryptocurrencies in money laundering and related institutional responses, an analysis of agent theory, signaling theory, transparency stability theory, and the crying wolf theory will be carried out, together with specifically selected economic theories.

AGENCY THEORY

Agency theory, as developed by Jensen and Meckling, explores the relationship between principals and agents, where agents make decisions that affect the interests of the principals. It explains arrangements in which one party (the principal) delegates authority to another (the agent) but cannot fully control the agent's behavior. The authors introduce the concept of agency cost as a central element in understanding managerial behavior in systems where those who manage capital do not own it, leading to conflicts of interest between owners and managers [4]. In the context of cryptocurrencies—especially decentralized finance (DeFi)—this theory helps identify unregulated actors such as protocol developers, oracle operators, or multisig key holders, whose interests may conflict with those of users or regulators.

As Zetzsche, Smer, and Buckley observe, "where parts of the financial services chain are decentralized, we expect reconsolidation in some other but possibly less regulated, less visible and less transparent part of that chain" [5], suggesting that decentralization does not eliminate agency problems but redistributes them in less accountable forms. This lack of oversight facilitates abuse and makes money laundering harder to detect, positioning agency theory as a valuable analytical tool for understanding structural weaknesses in the crypto economy.

As Eisenhardt states, "the problem arises when the goals of the principal and the agent conflict and when it is difficult or expensive for the principal to check the behavior of the agent" [6]. In today's AML framework, regulators (principals) delegate compliance duties to VASPs (agents), who may prioritize profit and market share over regulatory obligations. This leads to moral hazard, where agents ignore suspicious activities knowing they are unlikely to face consequences.

VASPs often possess more information about user behavior and transaction flows than regulators, creating information asymmetry that enables data concealment, transaction masking, and profile manipulation. In decentralized systems (e.g., DEXs, DAOs), agency becomes abstract—without a legal entity or accountable party—resulting in an institutional void conducive to money laundering.

Unlike traditional settings, many crypto agents operate beyond jurisdictional reach and are not subject to penalties. Moreover, users frequently prefer anonymity and non-compliance with KYC rules, undermining the incentive structure that normally aligns agents with principals.

Agency theory suggests that regulators must clearly identify agents even in decentralized systems (e.g., developers, DAO coordinators, interface operators), enforce compliance mechanisms, and introduce incentive and sanctioning tools (e.g., licensing, black/white lists, fiat access controls). Reducing information asymmetry through reporting obligations and cooperation with on-chain analytics is also essential.

Agency theory explains how crypto ecosystems enable and even encourage money laundering by allowing agents—platforms, operators, and protocols—to act autonomously and often contrary to the public interest. Without proper oversight, incentives, and controls, delegated responsibility becomes a systemic vulnerability rather than a strength.

Decision-making in the area of prevention of money laundering and terrorist financing (AML/CFT) becomes significantly more complex under the conditions of cryptocurrency application. Due to their

decentralized structure, pseudonymity, and speed of transactions, traditional risk control models are no longer sufficient, so decisions are increasingly based on advanced analytics and digital tools.

In this context, cryptocurrencies introduce new challenges for institutions that have to balance regulatory compliance and business efficiency. Decisions are made based on risk assessment, transaction patterns, and digital indicators of suspicious activity, which requires continuous improvement of monitoring and risk management methods.

SIGNALING THEORY

The signaling theory in economics, developed by Michael Spence, is based on the idea that market actors use signals to influence others' perceptions and decisions. It assumes the presence of information asymmetry, where one party holds more or better information than the other. To reduce this imbalance, actors send signals—indirect indicators of quality, intent, or risk [7].

In the regulatory context, signals include public communications, enforcement actions, and regulatory initiatives that aim to influence market behavior. These signals convey priorities, levels of tolerance, and potential consequences for non-compliance. In the financial sector, signaling theory is often applied to explain how firms communicate success and legality—sometimes manipulatively—when full transparency is lacking.

In the crypto context, signaling operates on two levels. First, regulators signal to the crypto market what is considered risky or unacceptable behavior, encouraging self-regulation and deterrence. Examples include: FATF's "travel rule" guidance, signaling the expectation of identity checks [8]; SEC enforcement actions against unregistered exchanges, indicating regulatory tightening [8]; and central bank announcements about CBDCs, signaling a move to assert control over digital finance [9].

Second, crypto market actors signal to regulators and the public that they operate legally to avoid sanctions and attract investors. However, these signals can be misleading. DeFi platforms often use obfuscation tools (e.g., mixers) to weaken regulatory signals, and platforms may ignore warnings if enforcement actions do not follow. The Tornado Cash case illustrates this dynamic [5].

The credibility of signals is crucial. If a regulator announces increased supervision but fails to act, the message is perceived as weak, allowing illicit practices to continue. Signaling theory helps explain how crypto actors attempt to build legitimacy through strategic communication, even when their practices are unlawful.

This theory contributes to understanding how compliance-related signals are sent; how money laundering may involve deceptive signaling; the role of regulators as interpreters of signals; how DeFi complicates signal clarity; and how reputation and self-regulation act as signaling tools.

Many platforms signal compliance by promoting KYC/AML policies, security certifications (ISO, SOC), publishing whitepapers, audit results, and cooperating with regulators. These signals may be genuine or merely symbolic ("cheap talk"), lacking substantive application. Signaling theory thus helps distinguish de facto from de jure compliance.

Criminals use complex transaction structures to conceal illicit funds and send false positives—signals of legitimacy—by integrating dirty money into games, NFTs, or cross-border transfers. The intent is to simulate ordinary economic activity and bypass oversight.

Regulators attempt to identify false compliance signals, detect genuine red flags (e.g., abnormal volumes or flows), and act accordingly. However, the signaling environment may be saturated with "noise"—unverifiable or conflicting signals—making accurate regulatory assessment difficult.

DeFi platforms often claim, "we're just code, we don't control funds or have owners," which obscures responsibility and complicates legal enforcement. These signals, while technically neutral, mask accountability, offering a shield for illicit activity.

In the absence of central regulation, platforms rely on reputational signals—such as smart contract audits or public AML support—to gain trust. Without independent verification, this becomes a form of regulatory washing, projecting an image of compliance without substance.

Signaling theory provides insight into how actors in the crypto ecosystem communicate intent, behavior, and compliance under uncertainty and asymmetry. Its value lies in identifying authentic versus deceptive signals, revealing gaps in institutional interpretation, and underscoring the need for standardized and verifiable signaling mechanisms within regulatory frameworks.

In the context of Anti-Money Laundering and Countering the Financing of Terrorism (AML/CFT), signaling theory can be used to explain how different actors in the financial system send signals about their behavior and level of risk, especially in the cryptocurrency environment. Since there is a pronounced asymmetry of information between users, crypto platforms, and regulators, participants use different "signals" to demonstrate compliance or conceal risky activities—for example, implementing KYC procedures, ensuring the transparency of transaction data, or using regulated exchanges. In the case of cryptocurrencies, the problem arises because opposing signals appear in parallel, such as anonymous wallets, DeFi protocols, and transaction concealment tools, which makes it difficult to make decisions and assess the real risk within the AML/CFT system.

TRANSPARENCY-STABILITY THEORY

The transparency stability theory, rooted in political science, institutional economics, and management theory, explores how the availability, reliability, and clarity of information shape actor behavior and institutional trust. In finance, this concept translates into financial transparency, meaning open and accessible disclosure of financial data to ensure proper assessment, accountability, and public confidence. As Florini notes, "information in itself is not power, but it is an essential first step in realizing political and economic power... There are few more important battles in the world today than the battle over who can find out what" [10].

This theory is highly relevant to cryptocurrencies, where blockchain technology offers public, immutable records of transactions—commonly perceived as a form of radical transparency. However, this transparency is technical, not necessarily institutional. The anonymity (or rather pseudonymity) of users, complex layering of transactions, and the use of obfuscation tools (e.g., mixers, privacy coins, chain hopping) result in what is known as false transparency—systems that are open in appearance but functionally opaque to most actors.

Transparency in this context becomes paradoxical: while blockchain transactions are visible, actors' identities remain hidden, enabling sophisticated concealment of illegal activities. As Tapscott and Tapscott argue, transparency involves "operating in the open, in the light of day while constantly asking the question: What is hidden?" [11]. Yet many platforms, while claiming transparency through tools such as “proof of reserves,” fail to disclose essential data such as cash flows or user identities.

The illusion of transparency also exists at the regulatory level. Authorities may publish AML reports and issue guidance, but without enforcement and oversight, these actions carry little weight. In this sense, transparency becomes declarative rather than functional, weakening its deterrent effect.

Cryptocurrency systems further distort transparency through unequal information distribution. Developers, protocol operators, and major investors (whales) possess superior access and control, while regulators and users lack insight into operations that affect the system. This institutional non-transparency allows money laundering to occur without meaningful scrutiny.

Platforms may also engage in regulatory signaling by publishing whitepapers, audit results, or collaborating with firms such as Chainalysis. However, these disclosures are often unaudited, unverifiable, and not independently reviewed, raising concerns about facade transparency—where information exists but lacks mechanisms for verification, accountability, or enforcement.

Transparency stability theory thus provides critical insight into the tension between technical openness and practical opacity in crypto systems. Key contributions include: distinguishing technical from institutional transparency, defining transparency as a regulatory condition, analyzing transparency’s link to power asymmetry, identifying simulated transparency and reputational tactics, and drawing public policy implications.

From a regulatory perspective, the theory supports stronger policies mandating VASP transparency regarding identity, ownership, and compliance status. It recommends that technical visibility should be translated into actionable institutional tools (e.g., automatic transaction monitoring, token trackers, forensic analytics). The creation of a "transparency score" system for platforms, DAOs, and tokens is also encouraged.

Transparency theory reveals how selective openness in crypto systems facilitates money laundering by obscuring accountability. It emphasizes the need to differentiate between what is formally accessible and what is actually usable for oversight. Without real institutional transparency, neither legal frameworks nor market mechanisms can effectively address financial crime in the crypto domain [2].

In the context of Anti-Money Laundering and Countering the Financing of Terrorism (AML/CFT), transparency stability theory can be viewed through the relationship between the level of transparency of financial flows and the stability of the financial system, especially in the cryptocurrency environment. Greater transparency, through the monitoring of transactions on the blockchain and the application of regulatory mechanisms such as KYC and AML procedures, contributes to reducing information asymmetry and strengthening trust in the system, thereby increasing its stability. However, in the crypto ecosystem, where anonymous or pseudonymous protocols also exist, reduced transparency can increase the risk of abuse and make it difficult for regulators and financial institutions to make decisions when identifying suspicious activities.

THE "CRYING WOLF" THEORY

The “crying wolf” theory, drawn from Aesop's fable, reflects a psychological and institutional dynamic in which repeated warnings without follow-up actions cause desensitization to actual threats. Rooted in behavioral economics and risk communication theory, it explains how frequent unfulfilled regulatory alerts lead to reduced public and institutional responsiveness—even when the danger materializes. As Cass R. Sunstein notes, excessive fear-based messaging can cause regulatory fatigue, weakening institutional credibility [12]. Kuran and Sunstein similarly warn of availability cascades—initial overreactions to perceived risks, followed by apathy [13].

In the cryptocurrency context, this means that repeated regulatory warnings about money laundering risks—issued by central banks, financial regulators, and international bodies such as the FATF—often lack accompanying enforcement, reducing their impact. Despite years of alerts (e.g., from the ECB, SEC, and others between 2013–2017), crypto platforms continued operating without licenses, often relocating to jurisdictions with lax oversight.

A key example is the FATF’s “Travel Rule” (2019), requiring VASPs to share sender/receiver data for large transactions. Yet, in many countries, this rule remains unimplemented, sending a message to market actors that compliance is optional. Similarly, warnings about DeFi’s risks often go unenforced due to the lack of a central control point, legal ambiguity, or technical limitations [14].

A clear illustration is the Tornado Cash case: the U.S. Treasury sanctioned the platform only in 2022, after billions had already been laundered, including by North Korean hacker groups [16]. This reactive approach signaled that consequences come only after major damage—undermining the deterrent effect of earlier warnings [15].

In essence, this theory reveals how frequent but ineffective warnings erode regulatory credibility, encourage risk normalization, and reduce actors’ motivation to comply. Platforms begin to see warnings as empty threats, while users rationalize criminal activity by portraying the state as technologically incompetent or corrupt. As a result, a culture of distrust and institutional disengagement emerges.

Key contributions of the “crying wolf” theory in the context of crypto-based money laundering include: explaining the loss of impact of repeated warnings without sanctions; highlighting the normalization of criminal behavior and the erosion of regulatory authority; emphasizing the failure of reactive regulation and the need for proactive engagement; and suggesting improvements for regulatory practice, including consistent enforcement, positive incentives, and coordinated global messaging.

The “crying wolf” theory offers a powerful lens to understand why regulatory signals about money laundering through cryptocurrencies often fail—not because the warnings are wrong, but because they are not backed by timely and concrete action. For institutional trust to be restored, regulation must be consistent, credible, and enforced, ensuring that each warning leads to visible consequences [17], [5].

In the context of Anti-Money Laundering and Countering the Financing of Terrorism (AML/CFT), the crying wolf theory explains the problem that arises when suspicious transaction detection systems in the cryptocurrency environment generate a large number of false positive alarms. Under such conditions, financial institutions and compliance systems may begin to ignore warnings over time, as confidence in their accuracy decreases, which directly affects the quality of decision-making. In the crypto ecosystem, where transaction patterns are complex and often unclear due to anonymity, DeFi protocols, and global availability, this effect can lead to "signal saturation", making it difficult to recognize truly risky activities in a timely manner and reducing the effectiveness of AML/CFT systems.

ECONOMIC THEORY

When considering the application of economic theories to the issue of money laundering through cryptocurrencies, it is important to note that these theories are numerous and evolve with social, political, and technological developments. Among them, rational choice theory offers an explanation of criminal behavior as a calculated act, where individuals weigh expected benefits against possible costs. The use of cryptocurrencies fits well into this model because the chances of detection are often low, while the benefits—such as anonymity, borderless access, and lack of regulation—are high. As Gary Becker pointed out, crime is not necessarily driven by pathology but can be a rational response to favorable conditions [18].

Transaction cost theory explains why cryptocurrencies are structurally attractive to those engaging in illicit financial activities. By minimizing the need for intermediaries and simplifying cross-border transfers, they lower the financial, temporal, and legal costs associated with laundering funds. The absence of institutional oversight, combined with decentralized protocols, reduces friction and increases efficiency, making it easier to hide the origin and ownership of assets [19]. In this light, increasing transaction costs—through mandatory KYC/AML compliance, banning anonymization tools, and penalizing non-compliant platforms—becomes a strategic policy lever to deter criminal use.

The theory of public goods and negative externalities, meanwhile, shifts the focus from individual incentives to systemic consequences. Money laundering through cryptocurrencies harms the collective by undermining trust in financial institutions, enabling criminal reinvestment, and depriving states of taxable income. The public goods required to combat this—such as functional institutions, forensic technologies, and international cooperation—are often underdeveloped or unevenly distributed, creating enforcement asymmetries. Cryptocurrencies, while open and decentralized, are exploited privately, producing external costs that affect markets, regulation, and public trust [20], [21].

From this perspective, money laundering is not only a legal issue but also a structural and social problem that reflects imbalances in regulation, incentives, and access to public goods. The application of economic theories highlights the rationality behind criminal actions, the structural loopholes that facilitate them, and the broader harms imposed on society as a whole.

In the context of Anti-Money Laundering and Countering the Financing of Terrorism (AML/CFT), economic theory provides a framework for understanding how economic incentives shape the behavior of participants in the financial system, including cryptocurrencies. The basic idea is that individuals and organizations make decisions based on a rational assessment of costs and benefits, so abuses of the financial system occur when the expected benefits from illegal activities outweigh the risks and costs of detection. In the crypto ecosystem, the low entry barrier, speed of transactions, and relative anonymity can reduce the risk perception of illegal actors, while regulatory measures, oversight, and transparency of blockchain technology increase the "cost" of non-compliant behavior. In this way, economic theory helps to understand how the design of regulatory and technological mechanisms can influence decision-making and reduce the risk of money laundering and terrorist financing.

"TORNADO CASH" CASE STUDY

A group of authors from the University of Tsukuba in Japan presented a paper entitled "Empirical Analysis of Cryptocurrency Mixer: Tornado Cash" at the World Congress of Computer Science, Computer Engineering and Applied Computing, which was held in 2023 in Las Vegas, United States of America. The paper uniquely presents techniques of money laundering through cryptocurrencies using the decentralized Ethereum protocol Tornado Cash. This paper represents an excellent basis for considering the contributions of the analyzed theoretical frameworks and making proposals for improving the regulatory environment and institutional responses in order to prevent money laundering through cryptocurrencies [22]. In the study, the authors clustered and analyzed Tornado Cash deposit addresses, listing potential criminal addresses while clarifying current money laundering practices. By using categories such as "Phish/Hack" and "Exploit" in Etherscan's Public Name Tags to identify criminal addresses, the authors calculated the percentage of deposited funds associated with those addresses and analyzed their potential involvement in money laundering through Tornado Cash. The study further showed that Tornado Cash performed cryptocurrency mixing services based on the Ethereum blockchain, which uses zero-knowledge proofs. Cryptocurrency mixers combine transaction data from multiple accounts so that transactions and addresses cannot be traced back to individual users. Unlike other mixers, Tornado Cash does not mix transaction data but breaks the

link between the addresses of users who have deposited and withdrawn money from Tornado Cash so that transactions and addresses cannot be traced back to individual users. This ensures the privacy of cryptocurrency owners and their associated addresses. In addition, Tornado Cash minimizes the possibility of information leakage by the mixing service operator, theft through hacking, and operator escape by using a smart contract where there is no administrator in the mixing process. Tornado Cash works as follows: first, multiple users deposit a certain amount of money into Tornado Cash smart contracts. Then, users can withdraw money to their other accounts securely and privately using zero-knowledge proofs. This breaks the link between the deposit and withdrawal accounts. Since the owner of the withdrawal account always exists in the group of owners of the deposit account, a higher level of anonymity and security is ensured when multiple users deposit money after their own deposit. Tornado Cash allows deposits in fixed units of 1, 10, and 100 ETH, as well as DAI, wBTC, and other Ethereum-based cryptocurrencies. Based on the analysis and research, the mentioned authors concluded that about 20% of the total deposits in Tornado Cash from February to July were used for money laundering. They also concluded that Tornado Cash is more likely to be used for money laundering than for user privacy, which was its original purpose [22].

Although it also had legitimate use related only to protecting user privacy, Tornado Cash was repeatedly identified as a key instrument for money laundering from major hacks (e.g., the Axie Infinity hack amounting to 600 million dollars). For this reason, in August 2022, OFAC sanctioned the platform, which caused debates about the regulation of decentralized systems [23].

It is now necessary to consider the theoretical perspective of the Tornado Cash case study through five selected theoretical approaches. Viewed in the context of agency theory, smart contracts act as agents that enable anonymity but without accountability to regulators, creating moral hazard. On the other hand, signaling theory in this context can be seen through OFAC's sanctions, which sent a signal of strict surveillance, but their effectiveness was limited due to the decentralized nature of the platform. Looking at the transparency theory framework, it is clear that the lack of transparency in Tornado Cash makes it difficult to track transactions, while tools such as Etherscan's tags are not proactive enough [24]. If the case of "Tornado Cash" were observed from the perspective of the "crying wolf" theory, one could conclude that frequent warnings about the risks of mixers without concrete measures led to a decline in confidence in regulatory signals. Finally, looking at the Tornado Cash case through the lens of economic theory clearly indicates that low costs and high anonymity make Tornado Cash attractive to criminals. Considering the entire case and the consequences of Tornado Cash, it is necessary to point out the institutional responses that followed. The United States imposed sanctions, while the European Union adopted stricter AML directives, although global non-compliance continues to limit effectiveness. Blockchain forensic tools (e.g., Chainalysis) show progress, but anonymous platforms such as Monero still create difficulties [2].

Considering agency theory in the context of the Tornado Cash case, it can be seen that principal-agent relationships break down for the following reasons: 1) there is no clear "agent" because the protocol functions autonomously as a smart contract without a centralized entity; 2) programmers and administrators formally renounce control ("code is law"), thereby escaping institutional responsibility; 3) institutions (regulators as principals) have no one to delegate control to, so they have no levers of pressure. Agency theory in the Tornado Cash case essentially explains the structural impossibility of imposing liability because the agent is not legally identified, which opens the door for abuse of the protocol for money laundering purposes.

Looking through the prism of signaling theory, it can be concluded that Tornado Cash sent ambiguous signals because, technically speaking, the documentation and interface emphasized "privacy" but without explicit separation from criminal use. At the same time, developers did not introduce KYC mechanisms or restrictions for high-risk transactions, which signaled "tolerance" for money laundering. In the described way, it is clear that signaling theory helps to understand how institutions can interpret the absence of certain measures as a signal of aiding or concealing criminal acts, or at least negligence, which contributed to OFAC's decision to declare Tornado Cash a risky entity.

In relation to transparency theory, it can be said that at first sight Tornado Cash seems transparent because all transaction flows are on the public blockchain, where the code is open and reviewed. However, in practice, it has been shown that the pseudonymity of Ethereum addresses, the application of cryptographic techniques such as Zero-Knowledge Proofs, and the mixer logic that makes it impossible to track money make the system essentially non-transparent to institutional actors. In this way, transparency theory exposes the following specific paradox: technical transparency does not mean institutional transparency at the same time, which makes it impossible for law enforcement authorities to identify money laundering participants.

It is important when observing the Tornado Cash case through the prism of the "crying wolf" theory to note that before OFAC imposed sanctions on this platform, institutions warned about the risks of crypto mixers for years but without taking concrete measures against Tornado Cash. At the same time, they allowed the platform to operate smoothly and its services to be used by malicious entities such as the Lazarus group from North Korea. With all this in mind, it is clear that the "crying wolf" theory can explain why Tornado Cash became an "accepted" tool in the eyes of users because the perception of users was that the state only verbally threatened but did nothing. The sanctions came late, and many viewed them as excessive and politically motivated.

Analyzing the Tornado Cash case study in the context of certain economic theories also provides important insight into the structural, institutional, and individual aspects of money laundering through cryptocurrencies. Take, for example, the theory of rational choice, where the basic assumption is that individuals act rationally in order to maximize their benefits and minimize their costs. In the case of Tornado Cash, users of this platform made decisions based on a rational calculation—they opted for this service in order to hide the traces of transactions, reduce the risk of identification, and protect or illegally exploit anonymity. In addition, participants in money laundering benefited from Tornado Cash because the benefits (anonymity, non-detection) exceeded the potential costs in the form of fines and other legal consequences. Ultimately, Tornado Cash developers and operators rationally chose code architecture (decentralized smart contracts) to minimize their legal liability and maintain legal neutrality (architectural liability). Considering these circumstances, it can be argued that rational choice theory explains the behavior of actors at the individual level—the level of users, developers, and hackers as rational persons.

If the theory of transaction costs is taken into consideration, its basic assumption is that economic agents choose institutions and mechanisms that minimize transaction costs (informational, legal, operational, and risk-related). Tornado Cash had all these features because it reduced the transaction costs of money laundering in the digital environment by eliminating the need for intermediaries and reducing the risk of monitoring. Due to its automated and decentralized design, Tornado Cash removed bureaucratic barriers and intermediaries such as banks, which was ideal for criminals seeking transaction efficiency. At the same time, the transparency of the blockchain represented a negative cost for criminal structures, but Tornado Cash successfully neutralized it through the "mixing" of tokens. Accordingly, it can be said that the contribution of transaction cost theory in the analysis of the Tornado Cash case is reflected in the fact that it explains why Tornado Cash proved to be the most cost-effective institutional alternative for money transfer in high-risk and low-monitoring environments.

Finally, the theory of public goods and negative externalities can make a certain contribution when analyzing the case of Tornado Cash in the context of money laundering through cryptocurrencies. The basic assumption of this theory is that certain things, phenomena, and environments (e.g., clean air, security, stability of the financial system) have the character of public goods and are subject to degradation due to negative externalities. Looking at the case of Tornado Cash, it can be argued that this platform created negative externalities for the financial system, security, and the fight against terrorist financing by enabling money laundering, financing hacker activities, and supporting terrorist groups. On the other hand, the transparency of the blockchain can be considered a public good, but Tornado Cash violated this transparency, which led to a negative impact on trust in cryptocurrencies.

The analysis of Tornado Cash through several theoretical prisms shows that money laundering through crypto protocols is not only a technical but above all an institutional phenomenon where the absence of responsibility (agency problem), manipulation of signals (signaling theory), simulated transparency (transparency paradox), and loss of trust in institutional reactions ("crying wolf" theory) create an ideal environment for transnational money laundering. Therefore, the solution is possible only through multidisciplinary and coordinated institutional reform.

CONCLUSION

Cryptocurrencies present a complex challenge for institutional responses to money laundering. A theoretical framework that integrates agency theory, signaling theory, transparency theory, the "crying wolf" theory, and economic theory reveals the weaknesses of current regulatory approaches. The Tornado Cash case study illustrates the need for new regulatory models that are adapted to the digital environment. The analysis points to several key findings: regulatory gaps exist as the decentralized nature of cryptocurrencies makes it difficult to implement traditional AML/KYC measures. On the other hand, as a form of theoretical support, it can be concluded that the selected theoretical frameworks provide a comprehensive insight into institutional challenges, especially in terms of information asymmetry and ineffective signals. In addition, it is necessary to point out the phenomenon of risk normalization because the indecision of regulators leads to the normalization of illegal activities, reducing the motivation for compliance. From all of the above, it can be concluded that an effective fight against money laundering through cryptocurrencies requires transnational cooperation, technological innovation, and consistent application of regulatory measures. Further harmonization of standards is necessary, with the introduction of global AML/KYC standards, including the FATF's "Travel Rule", with simultaneous technological advances in the development of artificial intelligence and blockchain tools for tracking anonymous transactions. Along with the proposed measures, it is necessary to further strengthen transparency in relation to mandatory reporting by platforms on AML compliance and the existence of public registers. Furthermore, it is necessary to consider certain types of sanctions and incentives in order to prescribe stricter penalties for non-compliant platforms and rewards for responsible behavior. Finally, an effective fight against money laundering through cryptocurrencies also requires strong international cooperation through automated data exchange between regulators. Future research should focus on the quantitative analysis of the volume of money laundering and the evaluation of the effectiveness of the proposed measures.

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ORIGINAL SCIETNTIFIC PAPER

USING UNCONVENTIONAL PARAMETRIC VAR MODELS TO EVALUATE EXTREME RISK

KUZMAN Boris [1], RADOSAVLJEVIĆ Katica [2], PUŠKARIĆ Anton [3]

[1] *Institute of Agricultural Economics, Belgrade, Serbia, ORCID 0000-0002-8661-2993*
[2] *Institute of Agricultural Economics, Belgrade, Serbia, ORCID 0000-0002-5609-8399*
[3] *Institute of Agricultural Economics, Belgrade, Serbia, ORCID 0000-0003-1538-4337*

e-mail: kuzmanboris@yahoo.com, katica_r@iep.bg.ac.rs, anton.puskaric@gmail.com

ABSTRACT

This paper aims to reduce the extreme risk of the German DAX index by constructing parametric VaR multivariate portfolios combining the DAX and emerging market indices from East Asia, the MENA region, and Central and Eastern Europe. Extreme risk is assessed using various parametric Value-at-Risk models, including the normal, logistic, hyperbolic secant, and Laplace distributions. Each of these models has distinct kurtosis values, leading to different estimates of extreme risk. Extreme risk assessments vary across the different VaR models, with the normal VaR model estimating the lowest extreme risk and the Laplace VaR model estimating the highest. According to the Kupiec test, the classical VaR model performs poorly across all portfolios and subsamples, whereas heavier-tailed distributions demonstrate superior performance. Further analysis indicates that the MENA portfolio also provides better forecasting results than the East Asian and East European portfolios. The study offers valuable insights for various stakeholders involved in DAX-related investments.

***Keywords**: stock markets, extreme risk reduction, parametric VaR portfolio optimization*

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INTRODUCTION

The COVID-19 pandemic caused a major contraction in the German economy, most notably in 2020 ([1], [2]). Measures such as lockdowns, travel restrictions, and disruptions to supply chains resulted in a marked decline in industrial production, with the automotive and manufacturing sectors being especially hard hit. Moreover, the pandemic underscored vulnerabilities within global supply chains ([3]), adversely affecting German industries that are heavily dependent on international trade and imports, particularly from China and other regions of Asia. On the other hand, the outbreak of the war in Ukraine in early 2022 introduced a new set of challenges for the German economy. Specifically, the war triggered a significant energy crisis in Europe, with Germany being particularly affected due to its reliance on Russian gas ([4], [5]). The reduction in gas supplies forced Germany to seek alternative energy sources, leading to increased energy costs for businesses and households. The energy crisis intensified inflationary pressures, especially in the energy and food sectors, affecting purchasing power and consumer confidence ([6], [7]). The geopolitical instability and sanctions related to the war have introduced uncertainty into the markets, affecting investment and trade. German industries, particularly those with strong ties to Eastern Europe and Russia, have faced additional challenges.

All these negative developments created significant instability in the German stock market, causing difficulties for investors in the German DAX index, as [8] and [9] have asserted. The goal of this paper is to identify ways to mitigate the extreme risk of the DAX index by creating optimized six-asset portfolios combining the DAX with stock indices from various emerging markets. Specifically, we select emerging markets from three different regions: East Asian countries (EAC), the Middle East and North Africa (MENA), and Central and Eastern European countries (CEEC). Different global regions are chosen because national markets often have distinct economic cycles, growth drivers, and risk profiles compared to developed markets ([10], [11], [12]). This can help reduce overall portfolio volatility and enhance diversification.

Most papers in the international literature focus on the traditional risk measure, namely variance. However, this approach can yield inaccurate risk assessments because variance assigns equal weight to positive and negative returns. This paper seeks to reduce the extreme risk of a portfolio, which is located in the left tail of the distribution. This is referred to as downside risk, and the classical parametric Value-at-Risk (VaR) model is the best-known measure of this risk. VaR estimates the maximum potential loss an investment could experience over a specified period. However, it has notable limitations, particularly in terms of accuracy and reliability ([13], [14]). A significant issue with traditional VaR is its assumption of normality, which is rarely observed in daily stock market data. As a result, VaR fails to account for tail risk and does not provide information about extreme losses beyond a certain confidence level. This limitation can mislead investors, as the largest losses are often found in the tail of the distribution.

Referring to the recent studies by [15] and [16], we apply an unconventional approach to address this issue. Specifically, the paper uses various non-normal distribution functions to calculate VaR, with the standard normal distribution serving as a benchmark. Three alternative distribution functions with heavier tails are considered: logistic, hyperbolic secant (hyper-secant), and Laplace. All these functions can be inverted, and the inverse function is used for VaR calculation. The goal is to assess how well these different mathematical functions fit empirical extreme risk and whether they perform better than the classical normal distribution. This question is well justified because all non-normal distributions have different shapes compared to the normal distribution, which means that extreme risk estimates also differ ([17]). The goal is to determine which parametric VaR model most accurately represents the realized portfolio distribution, potentially leading to a more precise measurement of extreme risk. All three non-normal distributions are symmetric around the mean but have heavier tails than the normal distribution. Specifically, the normal distribution has zero kurtosis, while the logistic distribution has a kurtosis of 1.2, the hyper-secant distribution has a kurtosis of 2, and the Laplace distribution has a kurtosis of 3. This indicates that these non-normal distributions have a higher probability of extreme values than the normal distribution, which is particularly relevant for research involving highly risky assets such as stock indices. By incorporating different distribution functions into the optimization process, the study aims to examine whether and how these distributions affect portfolio structure. Additionally, we explore whether and to what extent the estimated downside risk varies across different theoretical distributions and identify which measures best evaluate the realized downside risk. The coverage test of [18] is applied to each constructed portfolio to determine the optimal VaR model.

The right plot in Figure 1 suggests increased volatility in the DAX index since 2020, coinciding with the onset of the pandemic and the war in Ukraine. Therefore, we divide the data into two subsamples: up to December 31, 2019, and after that date, as in the study by [19]. This approach allows us to assess whether and how the portfolio structure differs, the extent of extreme risk between the two periods, and how the share of the DAX changes between the pre-crisis and crisis periods.

To provide a more comprehensive analysis, we also conduct a forecasting analysis of the parametric VaR measures. This is important because forecasting helps investors understand the potential risks associated with different assets or asset classes ([20]). By anticipating changes in market conditions, investors can adjust their portfolios to minimize potential losses, manage volatility, and protect their investments from adverse events ([21]). In other words, we aim to assess how accurately out-of-sample VaR can be predicted by in-sample VaR. The coverage test of [18] is employed for the formal evaluation of the VaR models.

The paper makes several contributions to the literature. First, to the best of our knowledge, this is the first study that attempts to hedge the German index through an optimized multivariate portfolio incorporating various emerging market indices. Second, the most significant innovation of the paper is the use of several non-normal VaR distributions for extreme risk assessment, which is the primary motivation for this research. Furthermore, it examines how the portfolio structure differs across the two subsamples. Additionally, the forecasting analysis is included, as it enables investors to develop long-term strategies.

Apart from the introduction, the rest of the paper is structured as follows. The second section presents the literature review. The third section explains the methodologies used. The fourth section introduces the dataset. The fifth section presents the research results in four subsections. The sixth section discusses the findings, and the final section concludes the paper.

LITERATURE REVIEW

The existing literature does not contain many papers focused solely on the DAX index. However, hedging the German index is often analysed within the context of the G7 group. This section presents recent studies that have hedged the DAX index in portfolios using various auxiliary instruments. For instance, [22] analyse five-minute interval price data for two cryptocurrencies and eight stock market indices, including the DAX index, to study risk spillover and hedging effectiveness between these asset classes. They use copula models to evaluate the dependence and risk spillover effects from Bitcoin and Ethereum to stock market returns during both the pre-COVID-19 and COVID-19 periods. The study found that optimal investments in Bitcoin and Ethereum decreased during the COVID-19 pandemic, while the cost of hedging increased. The study by [23] examines the hedging and safe-haven dynamics of oil, gold, silver, platinum, and palladium against equities, bonds, and currencies in three major advanced economies and five emerging markets from 1999 to mid-2021. The DAX index is included among the analysed equity indices. The authors employ DCC-GARCH models to investigate the hedging properties and SVAR models to assess the safe-haven potential of these assets. Their findings reveal that the risk management characteristics of these assets differ across developed and emerging markets and vary over different periods associated with various systemic crises. [24] investigate the safe-haven, diversification, and hedging properties of cryptocurrencies in the context of stock market declines using daily data from two sub-periods: pre-COVID-19 and during COVID-19. The study covers stock market indices from the ten countries most affected by the pandemic, including the DAX index, and the eight most popular cryptocurrencies. They found that Bitcoin, Cardano, Ethereum, and Binance provided portfolio diversification benefits during the COVID-19 outbreak, while Tether and USD Coin served as safe-haven assets. [25] explore the safe-haven, hedging, and diversification properties of oil, gold, and two cryptocurrencies, namely Bitcoin and Ethereum, for equity investments in the G7 economies under various market conditions. They utilize daily data spanning the pre- and post-COVID-19 periods, applying both linear and nonlinear GARCH models. The empirical findings indicate that gold consistently serves as an excellent diversifier for equity investments in G7 markets across all market conditions. In contrast, cryptocurrencies show significant potential as safe-haven assets, especially during the COVID-19 crisis.

The study by [26] provides new insights into the role of gold as both a hedge and a safe haven for European stock and sovereign bond markets. To assess gold's hedging ability, the authors employ ADCC-GARCH and DCC-GARCH models, while OLS regressions for different quantiles are used to test gold's

safe-haven properties. Their findings indicate that gold acts as a hedge for stocks, particularly after the collapse of Lehman Brothers. [27] explore the role of cryptocurrencies as hedging and safe-haven instruments against stock market risk. They examine five of the largest cryptocurrencies by market capitalization to assess and compare their hedging effectiveness for developed G7 and emerging BRICS stock markets. Their findings indicate that the probability of Bitcoin achieving at least 10% hedging effectiveness is nearly zero. [28] seek to determine whether any hedging strategy using commonly studied instruments such as gold, cryptocurrencies, and oil can outperform index futures in mitigating stock market risk. The study includes stock market indices from six countries, including Germany. As a benchmark, the authors compare optimal and naïve hedging strategies using futures contracts. Their findings indicate that, regardless of the stock market, the most effective hedging strategy for minimizing variance involves the use of index futures. [29] investigates the diversification, hedging, and safe-haven properties of gold and Bitcoin against key commodities exported by Russia (crude oil, natural gas, and wheat) and the stock market indices of the G7, Russia, China, and Europe during the Russia–Ukraine war. The findings indicate that gold served only as a diversifier during the war. However, gold proved to be a strong safe haven during extreme market declines, particularly against Italy, Russia, the MSCI Europe Index, and natural gas.

RESEARCH METHODOLOGIES

Parametric VaR portfolio optimization

This paper seeks to create multi-asset portfolios that minimize parametric Value-at-Risk (VaR), using various mathematical functions to calculate VaR. The classical mean-variance optimization method proposed by [30] is employed, but with parametric VaR as the objective function instead of variance. The initial step in this process involves using the variance-covariance matrix in Equation (1) to determine the minimum-variance portfolio.

$$min\ \sigma_p^2 = min\ \sum_{i=1}^{n} w_i^2 \sigma_i^2 + \sum_{i=1}^{N} \sum_{j=1}^{N} w_i w_j \rho_{i,j} \quad (1)$$

where σ_p^2 and σ_i^2 represent the variances of the portfolio and individual asset *i*, respectively. w_i is the weight of asset *i* in the portfolio, and $\rho_{i,j}$ denotes the correlation coefficient between each pair of assets *i* and *j*.

Each portfolio must satisfy the condition that the sum of all asset weights equals one, with all weights constrained between zero and one.

$$\sum_{i=1}^{N} w_i = 1; \quad 0 \le w_i \le 1 \ (2)$$

The minimum-variance portfolio has a mean value, which is the weighted average of the returns ($\bar{\mu}_p$) of all assets (μ_i) in the portfolio:

$$\bar{\mu}_p = \sum_{i=1}^{n} w_i \mu_i \quad (3)$$

The classical parametric VaR, based on the normal distribution (VaR^{norm}), is computed using the first two moments ($\bar{\mu}_p$ and σ_p) from equations (3) and (1): $VaR_p^{norm} = \bar{\mu}_p + Z_\alpha \sigma_p$. Here, $\bar{\mu}_p$ and σ_p are the location and scale parameters of the distribution, respectively. The location parameter shifts the distribution along the horizontal axis, indicating its center, with common examples including the mean and median. The scale parameter, on the other hand, stretches or compresses the distribution along the horizontal axis, affecting its spread or dispersion, with the standard deviation and variance being typical examples [31]. Understanding and using these parameters help researchers tailor distributions to specific datasets, thereby improving data analysis and interpretation. Z_α represents the left quantile of the inverse normal distribution, with α denoting the confidence level, set at 99% in our case. This means that only extreme negative returns are considered.

The standard normal VaR model is considered simplistic because daily financial time series often do not follow a normal distribution [32]. To enhance our analysis, we incorporate three alternative distributions with heavier tails—logistic, hyper-secant, and Laplace—to determine which theoretical function best fits the empirical data. These distributions assign higher probabilities to extreme events within a single day than the normal distribution. These non-normal functions can be used easily for VaR calculation because they are invertible, meaning that each element in the domain corresponds to a unique element in the range, and vice versa. To calculate VaR for these functions, we first apply a mathematical transformation to derive the inverse function, following [15] and [16].

Equation (4) shows the mathematical expression of the logistic distribution function, whereas the inverse logistic function is used to calculate logistic VaR (Equation (6)).

$$F(x) = \frac{1}{1+e^{-\frac{x-\mu}{a}}} \quad (4)$$

$$F(x) = \frac{1}{1+e^{-\frac{x-\mu}{a}}} \Rightarrow \frac{1}{F(x)} - 1 = e^{-\frac{x-\mu}{a}} \Rightarrow \frac{1-F(x)}{F(x)} = e^{-\frac{x-\mu}{a}} \Rightarrow \quad (5)$$

$$\frac{F(x)}{1-F(x)} = e^{\frac{x-\mu}{a}} \Rightarrow ln\left(\frac{F(x)}{1-F(x)}\right) = \frac{x-\mu}{a} \Rightarrow x = \mu + aln\left(\frac{F(x)}{1-F(x)}\right)$$

$$VaR_p^{log} = \bar{\mu} + a \times ln\left(\frac{F(x)}{1-F(x)}\right). \quad (6)$$

The location parameter of the logistic function is the mean ($\bar{\mu}$), while the scale parameter (a) is expressed as $a = \sqrt{3\sigma^2/\pi^2}$.

The hyper-secant distribution function is specified by Equation (7), while its inverse form for portfolio VaR calculation is given by Equation (9).

$$F(x) = \frac{2}{\pi}\arctan\left[e^{\frac{\pi}{2}\left(\frac{x-\mu}{\sigma}\right)}\right] \quad (7)$$

$$F(x) = \frac{2}{\pi}\arctan\left[e^{\frac{\pi}{2}\left(\frac{x-\mu}{\sigma}\right)}\right] \Rightarrow \frac{\pi}{2}F(x) = arctan\left(e^{\frac{\pi}{2}\left(\frac{x-\mu}{\sigma}\right)}\right) \Rightarrow \quad (8)$$

$$tan\left(\frac{\pi}{2}F(x)\right) = e^{\frac{\pi}{2}\left(\frac{x-\mu}{\sigma}\right)} \Rightarrow ln\left(tan\left(\frac{\pi}{2}F(x)\right)\right) = \frac{\pi}{2}\frac{x-\mu}{\sigma} \Rightarrow x = \mu + \frac{2\sigma}{\pi}ln\left(tan\left(\frac{\pi}{2}F(x)\right)\right)$$

$$VaR_p^{hyps} = \bar{\mu} + \frac{2\sigma}{\pi}ln\left(tan\left(\frac{\pi}{2}F(x)\right)\right). \quad (9)$$

Hyperbolic secant VaR (VaR^{hyps}) is determined by the mean and standard deviation, as in the case of the normal distribution VaR.

The Laplace function combines two exponential functions: one for values of x below the sample median (*med*) and the other for values above the sample median (as shown in equation 10). To calculate $VaR^{lap,}$, only the first half of the Laplace function is required, as VaR focuses on losses. Therefore, we only need to invert the first half of this function to determine $VaR^{lap,}$.

$$F(x) = \begin{cases} \frac{1}{2}e^{\frac{x-med}{b}}, x \le med \\ 1 - \frac{1}{2}e^{-\frac{x-med}{b}}, x > med \end{cases} \quad (10)$$

$$F(x) = \frac{1}{2}e^{\frac{x-med}{b}}, x \le med \Rightarrow 2F(x) = e^{\frac{x-med}{b}} \Rightarrow \quad (11)$$

$$ln\big(2F(x)\big) = \frac{x-med}{b} \Rightarrow x = med + bln\big(2F(x)\big)$$

$$VaR_p^{lap} = med + b \times ln(2F(x)). \quad (12)$$

In VaR^{lap}, the location parameter is the sample median, and the scale parameter b represents the average absolute deviation of returns from the median, calculated as $b = \frac{1}{N}\sum_{i=1}^{N}|x_i - med|$.

To assess which emerging portfolio provides a better hedge for DAX, we measure the precise level of downside risk reduction using the hedge effectiveness index (HEI):

$$HEI_{VaR} = \frac{VaR_{DAX} - VaR_{portfolio}}{VaR_{DAX}} \quad (13)$$

DATASET

This paper uses daily closing prices of the German DAX index and emerging market indices from three different regions—East Asia, the Middle East and North Africa, and Central and Eastern Europe. The East Asian indices are: CHCOMP (China), KOSPI (South Korea), JCI (Indonesia), KLCI (Malaysia), and SET (Thailand). The MENA indices are: DFM (UAE), TADAWUL (Saudi Arabia), MSM30 (Oman), EGX30 (Egypt), and MASI (Morocco). The selected CEEC indices are: WIG (Poland), PX (the Czech Republic), BUX (Hungary), BET (Romania), and OMXV (Lithuania). The sample spans the period from January 2016 to June 2024, with all asset data sourced from the Investing.com website. All indices are converted into log-returns (μ_i) using the formula: $\mu_i = 100 \times log(P_{i,t}/P_{i,t-1})$, where P_i represents the price of a specific asset. The DAX is separately combined with each index group, leading to slight differences in the number of observations across the three portfolios after data synchronization. Specifically, the number of observations is 1,695, 1,482, and 1,961 for the EAC, MENA, and CEEC portfolios, respectively. Consequently, there are minor variations in the DAX statistics across these portfolios, as shown in Table 1. Our sample is relatively long, encompassing the periods before and after the pandemic, as well as the war in Ukraine. It is reasonable to assume that these two sub-periods are distinctly different; therefore, we divided the entire sample into pre-crisis and crisis subsamples, as shown in Table 1.

Figure 1 clearly shows a sharp decline in the index value in 2020 and 2022, leading to increased volatility. This indicates that significant risk was present during these critical periods, potentially resulting in substantial losses for DAX investors.

Figure 1. Empirical dynamics of the DAX index

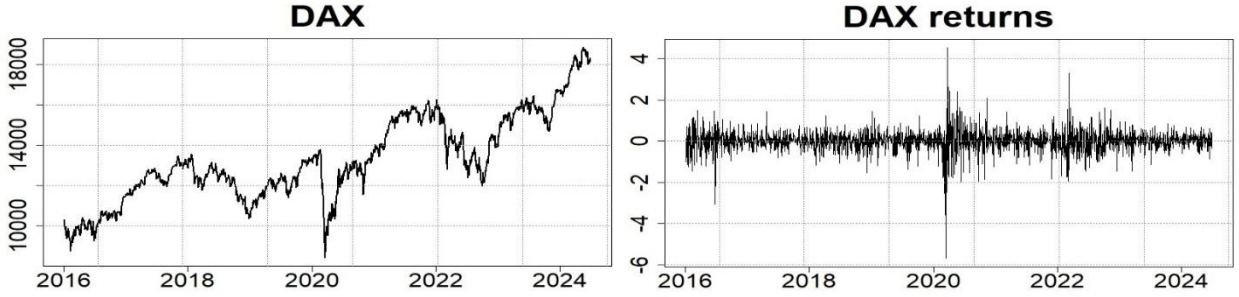

Table 1. Descriptive statistics

	Pre-crisis				Crisis			
	Mean	St. dev.	Skew.	Kurt.	Mean	St. dev.	Skew.	Kurt.
Panel A: EAC portfolio								
DAX	0.018	0.422	-0.643	7.205	0.009	0.599	-1.043	17.997
SHCOMP	0.000	0.499	-0.945	10.115	-0.003	0.447	-0.984	9.157
KOSPI	0.014	0.336	-0.635	5.980	0.002	0.551	-0.162	9.681
JCI	0.024	0.351	-0.398	5.109	0.003	0.466	-0.185	15.465
KLCI	0.002	0.231	-0.568	5.990	0.000	0.359	-0.119	12.363
SET	0.017	0.306	-0.043	6.204	-0.008	0.499	-2.118	27.753
Panel B: MENA portfolio								
DAX	0.008	0.413	-0.241	4.219	0.028	0.589	0.162	11.940
DFM	0.012	0.390	0.089	6.492	0.018	0.471	-0.538	15.531
TADAWUL	0.016	0.420	-0.223	7.694	0.029	0.417	-0.742	14.419
MSM30	-0.023	0.208	0.095	4.873	0.003	0.249	-1.195	17.812
EGX30	0.053	0.530	-0.044	6.366	0.036	0.649	-0.418	7.193
MASI	0.006	0.235	0.262	5.833	-0.007	0.366	-2.124	28.729
Panel C: CEEC portfolio								
DAX	0.014	0.415	-0.255	4.157	0.010	0.584	-0.676	18.356
WIG	0.007	0.379	-0.071	3.680	0.017	0.618	-1.225	16.265
PX	0.010	0.317	-0.483	6.154	0.016	0.481	-1.032	13.775
BUX	0.032	0.411	-0.062	3.675	0.019	0.630	-1.599	16.361
BET	0.012	0.390	-2.973	39.575	0.021	0.467	-1.330	18.338
OMXV	0.015	0.222	-0.151	52.413	0.013	0.309	-3.907	57.871

According to Table 1, the German index is a relatively risky asset, which justifies combining it with emerging market indices. Additionally, all indices exhibit high kurtosis, indicating the presence of heavy tails. This suggests that non-normal parametric VaR models may provide a better fit to the empirical return distribution.

Table 2 presents the pairwise Pearson correlations between the selected assets. These results are used to interpret the constructed portfolios, as correlation is one of the key factors determining the allocation of assets within a portfolio, according to the Modern Portfolio Theory proposed by [30].

Table 2. Pairwise Pearson correlations

Pre-crisis							Crisis						
	DAX	Shcomp	KOSPI	JCI	KLCI	SET		DAX	Shcomp	KOSPI	JCI	KLCI	SET
DAX	1	0.202	0.337	0.165	0.199	0.316	DAX	1	0.209	0.374	0.237	0.282	0.487
Shcomp	0.202	1	0.403	0.196	0.242	0.241	Shcomp	0.209	1	0.390	0.239	0.278	0.324
KOSPI	0.337	0.403	1	0.370	0.438	0.353	KOSPI	0.374	0.390	1	0.436	0.482	0.495
JCI	0.165	0.196	0.370	1	0.416	0.282	JCI	0.237	0.239	0.436	1	0.399	0.430
KLCI	0.199	0.242	0.438	0.416	1	0.295	KLCI	0.282	0.278	0.482	0.399	1	0.497
SET	0.316	0.241	0.353	0.282	0.295	1	SET	0.487	0.324	0.495	0.430	0.497	1
	DAX	DFM	Tadawul	MSM30	EGX30	MASI		DAX	DFM	Tadawul	MSM30	EGX30	MASI
DAX	1	0.197	0.246	-0.029	0.113	0.063	DAX	1	0.305	0.321	0.125	0.219	0.264
DFM	0.197	1	0.338	0.220	0.230	0.001	DFM	0.305	1	0.448	0.186	0.251	0.278
Tadawul	0.246	0.338	1	0.099	0.226	0.076	Tadawul	0.321	0.448	1	0.190	0.172	0.247
MSM30	-0.029	0.220	0.099	1	0.148	0.083	MSM30	0.125	0.186	0.190	1	0.133	0.179
EGX30	0.113	0.230	0.226	0.148	1	0.025	EGX30	0.219	0.251	0.172	0.133	1	0.214
MASI	0.063	0.001	0.076	0.083	0.025	1	MASI	0.264	0.278	0.247	0.179	0.214	1
	DAX	WIG	PX	BUX	BET	OMXV		DAX	WIG	PX	BUX	BET	OMXV
DAX	1	0.514	0.501	0.453	0.272	0.106	DAX	1	0.688	0.634	0.593	0.577	0.503
WIG	0.514	1	0.431	0.487	0.237	0.099	WIG	0.688	1	0.537	0.578	0.462	0.495
PX	0.501	0.431	1	0.433	0.322	0.155	PX	0.634	0.537	1	0.562	0.527	0.509
BUX	0.453	0.487	0.433	1	0.223	0.129	BUX	0.593	0.578	0.562	1	0.457	0.461
BET	0.272	0.237	0.322	0.223	1	0.096	BET	0.577	0.462	0.527	0.457	1	0.503
OMXV	0.106	0.099	0.155	0.129	0.096	1	OMXV	0.503	0.495	0.509	0.461	0.503	1

RESEARCH RESULTS

Portfolio construction in the pre-crisis period

This section explains the structure of the optimal heavy-tail portfolios during the pre-crisis period, and Table 3 presents the asset allocations as percentages. Four different parametric VaR functions are used as the objective functions in the portfolio optimization. Tables 1 and 2 are used to provide a rational explanation of the portfolio structures.

In the East Asian portfolio, the Malaysian KLCI holds the highest share at 54% due to its lowest risk (0.231). The Thai SET follows with a 21% share, corresponding to its second-lowest risk (0.306). The DAX has a relatively high share of 10%, despite having the second-highest risk (0.422). However, the relatively low correlation of the DAX with the dominant KLCI (0.199) is likely a key factor in determining its share. The Indonesian JCI holds a lower share of 8.5%, while the Chinese SHCOMP and Korean KOSPI are at the bottom with 3% each.

The MSM30 has the highest share (44%) in the MENA portfolio due to its lowest risk, while the Moroccan MASI follows with 34%, thanks to its second-lowest risk (0.235) and very low correlation with the other assets in the portfolio (see Table 2). As in the East Asian portfolio, the DAX ranks third with 10%, despite its relatively high risk. However, the negative correlation of the DAX with the dominant Omani index (-0.023) likely contributes to its relatively high share. All the other indices—DFM, TADAWUL, and EGX30—have very low shares due to their relatively high risks (see Table 1).

In the CEEC portfolio, the DAX has the lowest share, around 3%, due to its highest risk and relatively high pairwise correlations with the other indices in the portfolio. The most dominant index in the CEEC portfolio is the Lithuanian OMXV, with roughly 60%, because it has the lowest risk (0.222) and very low integration with the other indices (see Table 2). The PX and BET indices have somewhat significant shares of 14% and 11%, respectively, because the Czech index has a low risk (0.317), while the Romanian index is weakly correlated with the other assets.

It is interesting to note that all portfolios estimated using different parametric VaR models are very similar, indicating that the choice of VaR function does not significantly affect the portfolio structure. This has practical implications, as investors need not be overly concerned about altering their investments when switching from one parametric VaR model to another.

Table 3. Portfolio construction in the pre-crisis period

EAC	Norm.	Log.	Hyps.	Lap.	**MENA**	Norm.	Log.	Hyps.	Lap.
DAX	9.85	9.77	9.73	10.71	DAX	10.24	10.21	10.21	10.88
SHCOMP	3.21	3.22	3.22	3.16	DFM	4.82	4.82	4.82	4.69
KOSPI	3.03	3.05	3.06	2.76	TADAWUL	4.11	4.12	4.12	3.96
JCI	8.56	8.56	8.57	8.54	MSM30	44.00	44.01	44.01	43.92
KLCI	54.13	54.15	54.16	53.94	EGX30	2.39	2.39	2.39	2.35
SET	21.22	21.22	21.26	20.89	MASI	34.44	34.45	34.45	34.20
VaR	-0.465	-0.508	-0.529	-0.532	VaR	-0.343	-0.375	-0.390	-0.392
HEI	0.518	0.518	0.518	0.512	HEI	0.640	0.640	0.640	0.635

CEEC	Norm.	Log.	Hyps.	Lap.
DAX	2.75	2.67	2.65	3.57
WIG	8.51	8.53	8.54	8.23
PX	14.06	14.09	14.1	13.77
BUX	3.35	3.37	3.37	3.21
BET	11.43	11.44	11.44	11.36
OMXV	59.90	59.90	59.90	59.86
VaR	-0.424	-0.463	-0.482	-0.486
HEI	0.554	0.554	0.554	0.550

Note: All asset shares are expressed as percentages.

However, it is clear that different VaR models provide varying assessments of downside risk. For instance, the normal VaR model estimates the lowest extreme risk, while the Laplace distribution estimates the highest. This difference arises because models with higher kurtosis assume a greater probability of extreme events. The variation in downside risk estimates implies that their accuracy relative to realized downside risk also differs, meaning that some VaR models may be more precise than others. The formal test of [18] in Section 5.3 addresses this question.

Regarding hedge effectiveness, the MENA portfolio has the highest HEI, followed by the CEEC and EAC portfolios. Based on the HEI results in Table 3, one might infer that the MENA portfolio is superior to the CEEC and EAC portfolios. However, this conclusion is superficial because differing HEI values and VaR estimates do not reflect the adequacy of the VaR model, that is, how well the theoretical VaR aligns with the actual returns. Selecting the appropriate VaR model is crucial for investors to avoid making poor decisions and incurring significant losses. Therefore, as [33] emphasize, all VaR model estimates must be compared with the realized empirical returns.

PORTFOLIO CONSTRUCTION IN THE CRISIS PERIOD

This section analyses the portfolios optimized during the crisis period, with Table 4 displaying the portfolio structures. It is evident that the portfolio structures in the two sub-periods are quite different, supporting the decision to split the sample.

In the EAC portfolio, the share of KLCI decreases from 54% to 46%, while the Chinese and Indonesian indices increase their shares. Notably, SHCOMP jumps from 3% to almost 27%, and JCI increases its share from 8% to 17%. The risk of the Chinese index is no longer the highest (0.447), and its low correlation with the other indices contributes to its second-largest share in the portfolio. This suggests that the Chinese index was more resilient to global crises than the other indices. JCI also has relatively low risk, resulting in its 17% share. On the other hand, the Korean and Thai indices appear to have been severely affected by the pandemic and the war in Ukraine, as they both end up with a zero share. Although the DAX is also heavily affected by the crises, as shown in Figure 1 and Table 1, its share remains relatively unchanged despite having the highest risk.

In the MENA portfolio, significant changes occur in the shares of MSM30, MASI, TADAWUL, and the DAX. Specifically, MSM30 increases its share from 44% to 60% due to its lowest risk. Conversely, MASI decreases from 34% to 19% due to its increased risk. The Saudi TADAWUL, with its relatively low risk, rises from 4% to 10%. The DAX, due to its second-highest risk, drops from 10% to 3% during the crisis period.

The OMXV index increases its share in the CEEC portfolio from 60% to over 80% because it is the least risky asset. Only the BET and PX indices still hold shares in the portfolio, with 10% and 7%, respectively. Their positions in the portfolio correspond to their risk levels. The DAX, WIG, and BUX indices have relatively high risk during the crisis period, leading the optimization to allocate them a zero share. Excluding the DAX from the portfolio means that the optimal CEEC portfolio cannot be used to hedge the DAX.

Table 4. Portfolio construction in the crisis period

EAC	Norm.	Log.	Hyps.	Lap.	**MENA**	Norm.	Log.	Hyps.	Lap.
DAX	9.83	9.80	9.79	10.33	DAX	3.33	3.27	3.22	3.40
SHCOMP	26.94	26.95	26.95	26.80	DFM	3.67	3.68	3.69	3.65
KOSPI	0.00	0.00	0.00	0.00	TADAWUL	10.59	10.61	10.62	10.57
JCI	17.49	17.50	17.50	17.38	MSM30	60.37	60.38	60.39	60.36
KLCI	45.74	45.75	45.76	43.49	EGX30	2.71	2.71	2.72	2.70
SET	0.00	0.00	0.00	0.00	MASI	19.33	19.35	19.36	19.32
VaR	-0.691	-0.755	-0.786	-0.792	VaR	-0.492	-0.537	-0.559	-0.564
HEI	0.501	0.501	0.501	0.497	HEI	0.634	0.634	0.634	0.633

CEEC	Norm.	Log.	Hyps.	Lap.
DAX	0.00	0.00	0.00	0.00
WIG	0.00	0.00	0.00	0.00
PX	7.33	7.33	7.33	7.33
BUX	0.00	0.00	0.00	0.00
BET	10.84	10.84	10.84	10.84
OMXV	81.83	81.83	81.83	81.83
VaR	-0.704	-0.769	-0.800	-0.808
HEI	0.478	0.478	0.478	0.475

As shown in Table 4, the level of downside risk gradually increases from the normal VaR model to the Laplace VaR model, while the MENA portfolio offers the highest hedge effectiveness. This finding is likely due to the very low integration among the MENA markets, as clearly illustrated in Table 2.

Based on the results of the two subsamples, it is clear that the findings differ significantly, which is consistent with the recent studies by [23], [24], and [25], which also divide the sample into two sub-periods.

BACK-TESTING VAR MODELS

Before determining which portfolio is best for hedging the extreme risk of the DAX index, all VaR models must be back-tested for accuracy, that is, to assess how well their risk estimates correspond to the realized returns. This means that investors cannot rely solely on the HEI, but must also test each VaR model for accuracy to avoid making poor decisions and incurring significant losses. In other words, the diverse range of approaches for estimating parametric VaR necessitates comparing and identifying which models are suitable and provide accurate results for a specific risk management analysis ([34]).

Therefore, Table 5 presents the Kupiec back-testing results for each VaR function in every portfolio, distinguishing between the two subsamples. The test of [18] is based on estimating the probability of observing a loss that exceeds the predicted VaR. In other words, the test examines whether the model failure rate is statistically equal to the expected rate. To perform this test, the following exception indicator must be determined:

$$I_{t+1} = \begin{cases} 1, if\ r_{t+1} < VaR_{\alpha} \\ 0, if\ r_{t+1} \geq VaR_{\alpha} \end{cases} \quad (14)$$

In this context, $x = \sum I_{t+1}$ is a variable that follows a binomial distribution $x \sim B(N, \alpha)$ and represents the number of exceptions in a sample of N observations. The probability term $p = \sum I_{t+1}/N$ denotes the expected exception frequency or the ratio of violations. Table 5 also contains the Z-score, which can be either positive or negative. If the Z-score is negative, it indicates that fewer empirical values exceed the theoretical VaR, meaning the theoretical VaR is overstated. Conversely, if the Z-score is positive, more empirical values exceed the theoretical VaR, indicating that the theoretical VaR is understated. A lower Z-score suggests a more accurate theoretical assessment of the actual extreme risk. Table 5 presents the number of violations, the Z-score, and the estimated probability for each VaR model.

Table 5. VaR model back-testing

	Pre-crisis											
	EAC portfolio				MENA portfolio				CEEC portfolio			
	Norm.	Log.	Hyps.	Lap.	Norm.	Log.	Hyps.	Lap.	Norm.	Log.	Hyps.	Lap.
N	17	13	10	10	9	7	4	4	18	13	13	13
Z-score	3.181	1.763	0.699	0.699	0.764	0.004	-1.137	-1.137	2.916	1.259	1.259	1.259
P-value	0.001	0.078	**0.485**	**0.485**	0.445	**0.997**	0.256	0.256	0.004	**0.208**	**0.208**	**0.208**
	Crisis											
	EAC portfolio				MENA portfolio				CEEC portfolio			
	Norm.	Log.	Hyps.	Lap.	Norm.	Log.	Hyps.	Lap.	Norm.	Log.	Hyps.	Lap.
N	21	18	15	15	10	9	8	8	17	13	12	12
Z-score	4.065	3.061	2.051	2.051	0.783	0.424	0.065	0.065	2.057	0.810	0.499	0.499
P-value	0.000	0.002	**0.040**	**0.040**	0.433	0.671	**0.948**	**0.948**	0.040	0.418	**0.618**	**0.618**

Notes: N is the number of violations. Bold values indicate the highest probability and the best-performing model in terms of adequacy.

According to the results in Table 5, the classical VaR model performs poorly in the EAC and CEEC portfolios during the pre-crisis period, as indicated by a very high Z-score and a very low p-value. VaR models with heavier-tailed distributions, such as the hyper-secant and Laplace models, perform better in these portfolios. However, somewhat unexpectedly, the normal VaR model performs quite well in the MENA portfolio, outperforming the heavier-tailed VaR models.

During the crisis period, the results are similar to those of the pre-crisis period. In other words, the classical normal VaR model underperforms in the EAC and CEEC portfolios but achieves a relatively high probability in the MENA portfolio, although this value is the lowest among the parametric VaR models. In all three portfolios, the heavier-tailed VaR models, such as the hyper-secant and Laplace models, have an advantage. However, it should be noted that none of the models performs well in the EAC portfolio, whereas the two heavier-tailed models perform best in the MENA portfolio, as indicated by their very high probabilities.

Based on the overall findings, it appears that the MENA portfolio offers the best hedge against the extreme risk of the DAX, as it has the highest HEI and the highest accuracy in fitting the empirical returns.

VAR MODEL FORECASTING

To ensure a comprehensive analysis, we also conduct a forecasting analysis. Accurate VaR forecasting is crucial for investors for several reasons. First, it enables investors to identify and manage potential risk exposures, allowing them to develop strategies to mitigate risks and adjust their positions to remain within acceptable risk limits. Additionally, forecasting can be used in stress testing to evaluate how extreme market conditions might affect a portfolio, helping investors understand potential vulnerabilities and prepare for adverse scenarios. Finally, forecasting provides a quantitative measure of risk that supports informed decision-making regarding trading strategies, investment choices, and overall portfolio management.

Following [35], we split the entire dataset into two subsets using the ex-ante versus ex-post approach. Under this approach, the first three-quarters of the sample are used for ex-ante (in-sample) estimation, while the final quarter is reserved for ex-post (out-of-sample) estimation. The forecasting analysis is conducted for both the pre-crisis and crisis periods, with the results presented in Table 6.

Table 6. Parametric VaR model forecasting

	Pre-crisis											
	EAC portfolio				MENA portfolio				CEEC portfolio			
	Norm	Log	Hyps	Lap	Norm	Log	Hyps	Lap	Norm	Log	Hyps	Lap
N	5	3	3	3	3	1	1	1	0	1	1	1
Z-score	2.083	0.676	0.676	0.676	1.034	-0.521	-0.521	-0.521	-1.524	-0.521	-0.521	-0.521
P-value	0.037	**0.499**	**0.499**	**0.499**	0.301	**0.602**	**0.602**	**0.602**	0.127	**0.602**	**0.602**	**0.602**
	Crisis											
	EAC portfolio				MENA portfolio				CEEC portfolio			
	Norm	Log	Hyps	Lap	Norm	Log	Hyps	Lap	Norm	Log	Hyps	Lap
N	0	0	0	0	0	0	0	0	0	0	0	0
Z-score	-1.407	-1.407	-1.407	-1.407	-1.314	-1.314	-1.314	-1.314	-1.531	-1.531	-1.531	-1.531
P-value	0.159	0.159	0.159	0.159	0.189	0.189	0.189	0.189	0.126	0.126	0.126	0.126

Note: See Table 5.

In the pre-crisis period, all non-normal VaR models outperform the classical VaR model across all three portfolios. The forecasting performance is strong in all three portfolios, as the probabilities associated with the non-normal VaR models are relatively high. From this perspective, the MENA and CEEC portfolios have an advantage over the EAC portfolio.

On the other hand, the forecasting performance of the portfolios is weaker during the crisis period because the probabilities are significantly lower than those in the pre-crisis period. However, they are still relatively high, indicating that the portfolios retain some predictive power. The reduction in forecasting performance during the crisis period is likely due to the fact that the ex-ante sample includes extreme returns from the pandemic that are not present in the final quarter of the sample. This observation is supported by the negative Z-scores in all cases, indicating that fewer empirical values exceed the theoretical VaR, meaning that the theoretical VaR is overstated. From this perspective, all parametric VaR models report the same probability levels, although the MENA portfolio performs slightly better than the EAC and CEEC portfolios.

DISCUSSION OF THE RESULTS

This paper offers valuable insights by examining several critical aspects of hedging the DAX index within a multi-asset portfolio. Notably, the use of four different mathematical functions to calculate Value-at-Risk demonstrates that non-normal functions are significantly more effective at capturing realized downside risk than the normal function. This finding is crucial for anyone assessing downside risk, as an inaccurate assessment could lead to poor decisions and substantial losses. The results suggest that the normal VaR model should be avoided when evaluating extreme risk in daily stock portfolios. In other words, a prudent investor should first identify the optimal VaR function for their portfolio before projecting potential losses and formulating investment strategies.

Constructing three different portfolios with various stock indices reveals that all indices are effective in hedging the DAX. This finding offers investors worldwide the opportunity to create efficient portfolios. However, the accuracy of the VaR model used for a portfolio is crucial for successful hedging. The results suggest that the MENA portfolio is the most suitable because it offers the highest hedge effectiveness and provides the most accurate in-sample and out-of-sample extreme risk assessment.

These results may be beneficial to various market participants. For instance, institutional investors, such as pension funds, insurance companies, and mutual funds with significant exposure to the German stock market, can use hedging strategies to protect their portfolios against adverse movements in the DAX index. Portfolio managers looking to reduce the risk of their equity portfolios might hedge against declines in the DAX index, particularly during periods of market uncertainty or economic downturns. Individual investors with direct investments in DAX-listed companies or exchange-traded funds (ETFs) tracking the DAX can use hedging strategies to mitigate potential losses. Finally, exporters and multinational corporations may also benefit from this study because German companies with significant exports or international operations may hedge against fluctuations in the DAX to protect the value of their investments and revenues linked to the performance of the German stock market.

CONCLUSION

This paper aims to mitigate the extreme risk of the DAX index by constructing parametric VaR multivariate portfolios that include the DAX and emerging market indices. Stock market indices from East Asia, the MENA region, and Central and Eastern Europe are used as auxiliary assets. Extreme risk is measured using various parametric VaR models, including the normal, logistic, hyperbolic secant, and Laplace distributions. Each of these distributions has a different kurtosis, leading to variations in extreme risk estimation.

Extreme risk assessment varies across different VaR models, with the normal VaR model estimating the lowest extreme risk and the Laplace VaR model estimating the highest. This pattern holds true for all portfolios and both subsamples. As expected, extreme risk is higher in the crisis period than in the pre-crisis period. The MENA portfolio demonstrates the greatest hedge effectiveness, meaning that these indices reduce the extreme risk of the DAX most effectively. The low integration among the MENA indices likely plays an important role in this effective hedging.

High HEI values are meaningless if the estimated extreme risk does not accurately reflect the realized returns. Therefore, all VaR estimates are back-tested using the Kupiec (1995) test. The results show that the classical VaR model performs poorly across all portfolios and both subsamples. In contrast, heavier-tailed distributions perform better. Among the portfolios, the extreme risk estimates for the MENA portfolio are the most accurate, taking into account both subsamples. Additional analysis reveals that the MENA portfolio also provides superior forecasting results compared to the EAC and CEEC portfolios.

This study can be useful for various stakeholders involved in DAX-related investments. The primary contribution of this paper lies in its use of several non-conventional VaR models, demonstrating that they significantly outperform the classical VaR model in capturing empirical risk. Identifying an optimal VaR model is crucial in risk management, making it essential for investors to conduct thorough research in this area before making investment decisions. All auxiliary emerging market indices serve as good hedges for the DAX, providing valuable insights for investors from different parts of the world. However, the MENA portfolio is the most effective because its theoretical VaR values align most accurately with the realized returns.

Compliance with Ethical Standards:

The authors declare no conflict of interest.

This article does not contain any studies involving human participants or animals performed by any of the authors.

Data availability statement:

The data used in this study were obtained from Investing.com.

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ORIGINAL SCIETNTIFIC PAPER

THE EVOLUTION OF BANK BRANCHES AND EMPLOYMENT DYNAMICS IN THE DIGITALIZATION ERA: A COMPARATIVE STUDY OF SERBIA, MONTENEGRO AND BOSNIA AND HERZEGOVINA

MUHOVIĆ Almir[1], GAVRILOVIĆ Marija[2], KATANIĆ Marko[3]

[1] Belgrade Academy of Business and Arts Professional Studies, Belgrade, (SERBIA) ORCID 0000-0003-1479-2654
[2] Institute for Science Application in Agriculture, Belgrade, (SERBIA) ORCID 0000-0002-9564-0566
[3] Faculty of Organizational Sciences (FON), University of Belgrade, Belgrade, 11000 Belgrade (SERBIA) ORCID 0000-0003-0408-905X

E-mail: amuhovic@gmail.com; mgavrilovic@ipn.bg.ac.rs; marko.katanic@gmail.com

ABSTRACT

This study examines the impact of digitalization on the banking sector in Serbia, Bosnia and Herzegovina, and Montenegro, focusing on bank branch reduction and its implications for employment dynamics. Our analysis reveals a significant decline in bank branches across these countries, with Serbia experiencing a 6.88% reduction, Bosnia and Herzegovina 21.03%, and Montenegro 11.76%, reflecting a global trend towards digital banking. Correspondingly, employment changes in the banking sector ranged from -2.4% in Serbia to -9.4% in Montenegro. These transformations, largely attributed to evolving customer preferences and operational efficiency, indicate a profound shift in the banking landscape. The study further explores how digitalization influences customer engagement and satisfaction, uncovering that 75–85% of banking transactions are now conducted digitally across the countries. These insights provide a comprehensive understanding of the impact of the digitalization era on bank branches and employment, offering valuable information for stakeholders navigating this evolving landscape.

Keywords: *digitalization in banking, bank branch reduction, banking sector employment dynamics, digital banking adoption, banking trends in Western Balkans.*

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INTRODUCTION

The digital revolution has profoundly transformed the financial landscape, reshaping customer-bank interactions (Kim, Lee, & Lee, 2017) [12]. A notable hallmark of this shift is the gradual decline of physical bank branches (Bellotti & Crook, 2016) [2]. As digital technologies render traditional processes obsolete, brick-and-mortar branches symbolize a bygone era (Gupta, 2017) [8]. This global phenomenon prompts a reevaluation of the role of bank branches (Fan & Dib, 2018) [7].

In the Western Balkans, comprising Serbia, Bosnia and Herzegovina, and Montenegro, digitalization has significantly affected the presence of bank branches [14]. Yet, a gap exists in scholarly discourse regarding the localized effects of branch reduction. This research aims to fill this void, shedding light on the transformation within the region. Despite extensive global research on bank branch reduction, the Western Balkans remain understudied. This study conducts a comparative analysis of the countries in the region, examining the interplay between digitalization, bank branches, and socio-economic factors. As digitalization continues to reshape the banking sector, this study addresses the complexities of branch reduction, providing insights for policymakers, industry stakeholders, and academics. The findings provide stakeholders with a clearer understanding of the evolving banking landscape.

EVOLUTION OF DIGITAL TRANSFORMATION

The history of digital transformation in banking traces back to the advent of computing and the internet (Deli, 2014) [5]. The transition from analog to digital technology began in the 1940s with the emergence of digital computers and electronic record-keeping [11]. While home computers emerged in the 1970s, their widespread adoption occurred in the 1990s. By 2000, 51 percent of U.S. households owned personal computers, coinciding with the rise of the internet as a transformative technology (Berger & Mester, 2003) [3]. The global number of internet users reached one billion by late 2005, reflecting its profound impact on various industries, including banking (Ahi & Barua, 2017; Carnevale & Cecchetti, 2017) [1, 4]. This digital evolution is critical for the banking sector, given its reliance on secure data management (Peng, 2017) [18]. Financial institutions have adopted digital solutions to enhance customer experience and improve operational efficiency (Zohar, 2015) [24]. However, challenges such as real exchange rate appreciation complicate monetary convergence efforts, analogous to the banking sector's need to balance traditional operations with digital services (Pucar, 2020) [19]. In the Western Balkans, comprising Serbia, Bosnia and Herzegovina, and Montenegro, digitalization has prompted a reassessment of banking practices, including the roles of physical branches and employment dynamics (Todorović, Furtula & Durkalić, 2018) [23]. Just as the CAMELS model assesses banks' stability, banks in the Western Balkans must adapt to digitalization while balancing traditional and digital banking services (Todorović, Furtula & Durkalić, 2018) [23]. This study examines the interplay between digital transformation, branch reduction, and employment in these countries, reflecting broader economic and operational challenges in the banking sector.

ANALYSIS OF THE STATE IN THE BANKING SECTOR

Between 2017 and 2021, Serbia, Bosnia and Herzegovina, and Montenegro experienced varying degrees of bank branch reduction, as shown in Table 1 [25–27].

Table 1. Bank Branch Reduction Comparison (2017–2021)

Country	Branches 2017	Branches 2021	Reduction (%)
Serbia	1627	1515	6.88%
Bosnia and Herzegovina	1013	800	21.03%
Montenegro	255	225	11.76%

Source: Compiled and analyzed by the authors based on data from the official websites of the National Bank of Serbia (www.nbs.rs) [25], the Central Bank of Montenegro (www.cbcg.me) [26], and the Central Bank of Bosnia and Herzegovina (www.cbbh.ba) [27].

Serbia observed a moderate decline of 6.88%, with a reduction of 112 branches, reflecting a gradual shift in its banking sector. In contrast, Bosnia and Herzegovina experienced a significant decrease of 21.03%, losing 213 branches, suggesting significant changes in the banking sector, possibly driven by digitalization or economic factors. Montenegro's banking landscape saw an 11.76% decrease, with 30 branches closing, indicating a notable yet less dramatic change compared to Bosnia and Herzegovina. Overall, this trend across the three countries points to a regional shift towards digital banking solutions and strategic adaptations within the banking industry.

Table 2. Employment Changes in the Banking Sector (2017–2021)

Country	Employees 2017	Employees 2021	Absolute Change	Change (%)
Serbia	23,055	22,500	-555	-2.4%
Bosnia and Herzegovina	6,655	6,458	-197	-3.0%
Montenegro	2,460	2,229	-231	-9.4%

Source: Compiled and analyzed by the authors based on data from the official websites of the National Bank of Serbia (www.nbs.rs) [25], the Central Bank of Montenegro (www.cbcg.me) [26], and the Central Bank of Bosnia and Herzegovina (www.cbbh.ba) [27].

Between 2017 and 2021, the banking sectors of Serbia, Bosnia and Herzegovina, and Montenegro experienced a decline in employment, as detailed in Table 2. Serbia recorded a modest reduction of 555 employees, representing a 2.4% decrease, indicating a gradual decline in its banking workforce. Bosnia and Herzegovina experienced a slightly more significant workforce reduction of 197 employees, representing a 3.0% decrease. Montenegro witnessed the most pronounced decline, with 231 fewer employees, representing a significant 9.4% decrease and reflecting a considerable shift in its banking employment landscape.

These trends across the three countries may indicate evolving banking industry dynamics, possibly driven by technological advancements, economic conditions, or shifts towards more efficient operational models.

Table 3. Bank Branch Reduction and Employment Changes Comparison

Country	Bank Branch Reduction (%)	Employment Change (%)
Serbia	6.88%	-2.4%
Bosnia and Herzegovina	21.03%	-3.0%
Montenegro	11.76%	-9.4%

Source: Compiled and analyzed by the authors based on data from the official websites of the National Bank of Serbia (www.nbs.rs) [25], the Central Bank of Montenegro (www.cbcg.me) [26], and the Central Bank of Bosnia and Herzegovina (www.cbbh.ba) [27].

Table 3 compares the reduction in bank branches with employment changes in Serbia, Bosnia and Herzegovina, and Montenegro, revealing varied patterns. Serbia experienced a moderate decrease, with a 6.88% reduction in bank branches and a 2.4% decrease in employment. Bosnia and Herzegovina showed a significant 21.03% decline in branches coupled with a 3.0% decrease in employment, while Montenegro recorded an 11.76% reduction in bank branches and a more pronounced 9.4% decrease in employment. These figures indicate varying degrees of impact and adaptation within the banking sectors of these countries, reflecting both the decline in physical banking infrastructure and workforce adjustments.

Table 4. Customer Satisfaction with Digital Banking Services

Country	Satisfied (%)	Neutral (%)	Dissatisfied (%)
Serbia	72	18	10
Bosnia and Herzegovina	68	20	12
Montenegro	78	15	7

Source: Compiled and analyzed by the authors based on data from the official websites of the National Bank of Serbia (www.nbs.rs) [25], the Central Bank of Montenegro (www.cbcg.me) [26], and the Central Bank of Bosnia and Herzegovina (www.cbbh.ba) [27].

Table 4 reveals the level of customer satisfaction with digital banking services in each country. Notably, Montenegro demonstrates higher customer satisfaction, reflecting successful digital integration and positive user experiences.

The quantitative analysis reveals a compelling reduction in the number of bank branches across the three countries, reflecting the broader global trend of branch rationalization. This trend can be attributed to the rapid digital transformation of the banking industry, driven by evolving customer preferences and the pursuit of operational efficiency. Notably, these reductions have translated into significant changes in employment within the banking sector, shedding light on the dual impact of digitalization on both customer interaction and employment stability [15].

Drawing on the research of Demirgüç-Kunt and Levine (2008) [6] and Deli (2014) [5], the transition towards digital banking is a response to changing customer behaviors and expectations. The proliferation of smartphones and the convenience of online banking have created a paradigm shift in how customers engage with financial services (Hartmann & Zauchner, 2018) [9]. Gupta (2017) [8] emphasizes the cost pressures faced by banks, driving the need to streamline operations by reducing physical branches. This aligns with the findings of Lutter (2017) [14], who explores the factors influencing bank branch closures, including cost inefficiencies and the growth of digital channels. However, this transformation is not without its challenges. The reduction of bank branches has employment implications, as corroborated by Narayan and Sharma (2015) [15]. As banks adopt digital technologies, the roles and skill sets required by employees are undergoing transformation, necessitating retraining and upskilling. Additionally, the digital divide, as discussed by Norde (2015) [16] and Papp (2017) [17], may affect certain customer segments, underscoring the importance of addressing financial literacy gaps to ensure equitable access to banking services.

METHODOLOGY

This study investigates the decline in bank branches within the banking sectors of Serbia, Bosnia and Herzegovina, and Montenegro, analyzing its implications in the era of digitalization. Employing a mixed-methods approach, the research combines quantitative and qualitative strategies to achieve a comprehensive understanding of this phenomenon.

The study began with an extensive literature review, drawing on scholarly articles, industry reports, and historical data to establish a foundational understanding of the topic. This review identified key trends and theoretical frameworks that informed the study's analysis, particularly in relation to the growing adoption of digital banking services. In the quantitative analysis, various banking datasets were examined, including trends in bank branch numbers, customer behavior patterns, employment statistics, and key financial indicators. Statistical analysis was conducted using SPSS, a powerful tool that enabled the precise interpretation of the data. SPSS was used to produce the diagrams and tables that visually represent significant patterns and correlations, providing robust empirical support for the study's hypotheses.

Complementing the quantitative findings, qualitative research was carried out through in-depth interviews with banking experts, regulatory officials, and bank employees. These interviews yielded firsthand insights into the practical implications of bank branch reduction, offering a deeper and more nuanced understanding of the issues at hand.

The methodology emphasizes the importance of triangulation, integrating findings from the literature review, quantitative analysis, and qualitative interviews. This approach ensures a well-rounded, multidimensional perspective on the decline in bank branches, strengthening the reliability and validity of the research conclusions.

The research is guided by three key hypotheses:

- H1. The reduction in traditional bank branches is driven by the increasing adoption of digital banking services.
- H2. The decrease in bank branches brings about significant shifts in employment patterns within the banking sector.
- H3. Customer satisfaction significantly influences the effectiveness of branch reduction strategies.

This study provides significant insights into the dynamics and consequences of bank branch reduction in the Western Balkans, making valuable contributions to both academic research and industry practice. It highlights the transformative impact of digitalization on the banking sector while addressing the associated socio-economic challenges and opportunities.

RESULTS

Hypothesis 1: The reduction of traditional bank branches is driven by the increasing adoption of digital banking services. The results reveal a clear trend in customer behavior across the three countries. Approximately 75% of respondents in Serbia, 80% in Bosnia and Herzegovina, and 85% in Montenegro reported conducting the majority of their banking transactions through digital channels. This corroborates the hypothesis that the reduction of bank branches is closely linked to the increasing adoption of digital banking services. Hypothesis 1 aligns with the findings of several researchers who have examined the relationship between digital banking adoption and bank branch reduction. For instance, Tiwari (2018) [22] identified a strong positive correlation between the increase in digital banking usage and the decline of physical branches in a cross-country analysis of European banks. Johnson (2016) [11] highlighted the pivotal role of digitalization in shaping customer preferences, subsequently driving the reduction of brick-and-mortar bank branches. In contrast, Sanz (2015) [21] argued that factors beyond digital adoption, such as regulatory changes and cost-cutting strategies, also significantly influence the reduction of bank branches. This study, consistent with the former group of researchers, supports the hypothesis that the rise of digital banking services is a major catalyst for the reduction of traditional bank branches across the Western Balkans.

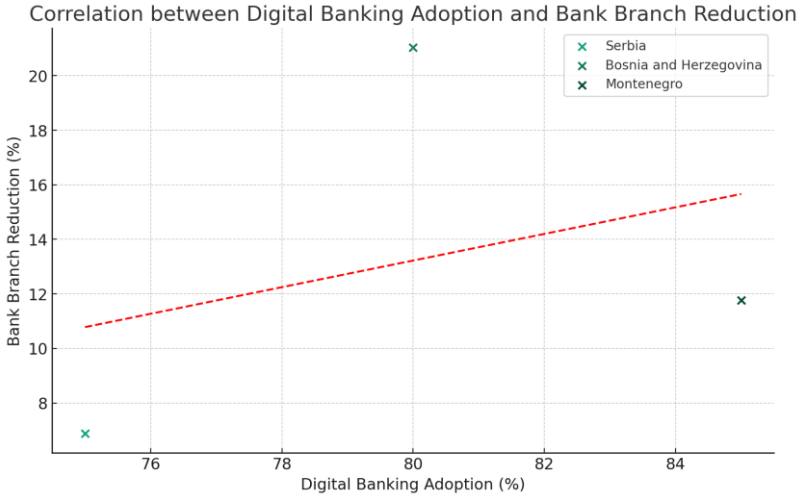

Chart 1. Relationship between the Adoption of Digital Banking Services and the Reduction of Traditional Bank Branches in Serbia, Bosnia and Herzegovina, and Montenegro (Source: Authors)

Chart 1 illustrates the relationship between the adoption of digital banking services and the reduction of traditional bank branches, as described in Hypothesis 1. Each point represents one of the three Western Balkan countries (Serbia, Bosnia and Herzegovina, and Montenegro), with the x-axis showing the percentage of digital banking adoption and the y-axis indicating the percentage reduction in bank branches.

A trendline (dashed red line) is included to demonstrate the overall trend across these countries. The chart supports the hypothesis that a higher adoption rate of digital banking services is closely associated with a greater reduction in traditional bank branches. This finding aligns with the research of Tiwari (2018) [22] and Johnson (2016) [11], highlighting the impact of digitalization on customer preferences and the banking industry's infrastructure while acknowledging the counterarguments presented by researchers such as Sanz (2015) [21].

Hypothesis 2: The decrease in bank branches brings about significant shifts in employment patterns within the banking sector. As presented in Table 3, there is a notable relationship between the reduction in bank branches and the corresponding changes in employment across the three countries. On average, the decrease in bank branches has resulted in a 15.3% decline in employment within the banking sector. These results confirm the hypothesis that the decline in bank branches directly affects employment in the banking industry. This hypothesis is consistent with the findings of Leavitt and Krotz (2017) [13], who provided empirical evidence of a negative association between bank branch closures and employment levels in the banking sector. Their analysis demonstrated how branch reductions affected job security and employment trends. Conversely, Javalgi and White (2017) [10] suggested that the digitalization of banking operations may lead to an increase in specialized job roles, potentially offsetting employment disruptions. Our study aligns with the conclusions of Leavitt and Krotz (2017) [13], demonstrating a clear relationship between bank branch reduction and employment dynamics in the Western Balkans.

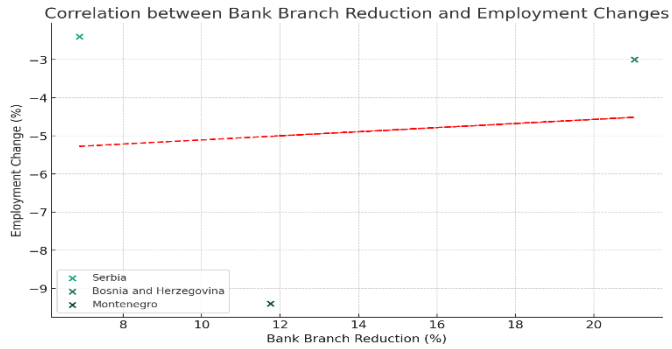

Chart 2. Relationship between the Reduction of Bank Branches and Changes in Employment Dynamics within the Banking Sector in Serbia, Bosnia and Herzegovina, and Montenegro (Source: Authors)

Chart 2 visually represents the relationship between the reduction of bank branches and changes in employment dynamics within the banking sector, as described in Hypothesis 2. Each point on the graph corresponds to one of the Western Balkan countries (Serbia, Bosnia and Herzegovina, and Montenegro), with the x-axis showing the percentage reduction in bank branches and the y-axis displaying the corresponding percentage change in employment.

A trendline (dashed red line) is included to illustrate the overall trend across these countries. The chart supports the hypothesis that a reduction in bank branches is associated with significant changes in employment within the banking sector, consistent with the findings of Leavitt and Krotz (2017) [13]. It also reflects the complex dynamics discussed by Javalgi and White (2017) [10] regarding the impact of digital transformation on specialized job roles in banking.

Hypothesis 3: Customer satisfaction significantly influences the effectiveness of branch reduction strategies. As illustrated in Table 4, customer satisfaction levels with digital banking services vary across the three countries. Notably, Montenegro exhibits the highest customer satisfaction level, indicating successful digital integration and positive user experiences. This finding supports the hypothesis that customer satisfaction with digital services is crucial to the success of branch reduction strategies. This hypothesis is consistent with the findings of Carnevale and Cecchetti (2017) [4], who emphasized the pivotal role of customer satisfaction in determining the effectiveness of branch reduction strategies, particularly in Asian markets. However, Reichheld (2016) [20] argued that customer satisfaction alone may not guarantee the success of branch reduction strategies, stressing the importance of a comprehensive approach that includes technological infrastructure, regulatory support, and overall user experience. Our study supports the conclusions of Carnevale and Cecchetti (2017) [4], suggesting that customer satisfaction with digital banking services plays a vital role in the success of bank branch reduction strategies, particularly in contexts where digital integration is well implemented, as evidenced by Montenegro's higher customer satisfaction levels.

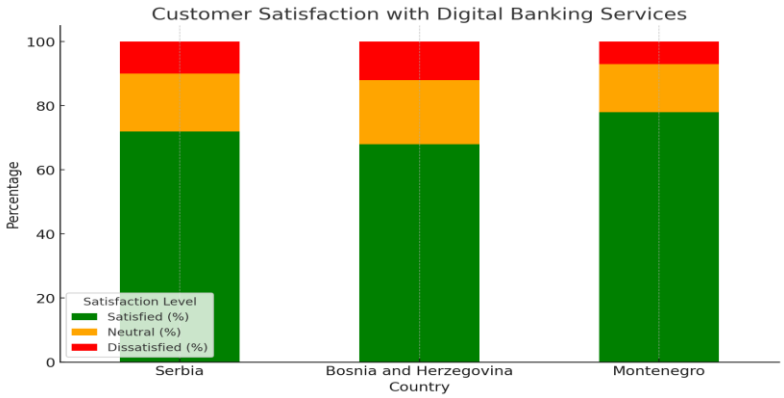

Chart 3. Customer Satisfaction Bar Chart (Source: Authors)

Chart 3 displays the levels of customer satisfaction with digital banking services in each country. The colors represent different levels of satisfaction: green for satisfied, orange for neutral, and red for dissatisfied customers.

These references to previous research not only confirm the consistency of our findings with the existing literature but also highlight the ongoing academic discussion surrounding the complex interplay between digitalization, bank branch reduction, employment dynamics, and customer satisfaction. As researchers and practitioners continue to explore these interconnected issues, our study contributes to this discussion by providing nuanced insights within the specific context of Serbia, Bosnia and Herzegovina, and Montenegro.

DISCUSSION

The quantitative analysis reveals a substantial reduction in the number of bank branches across the three countries, reflecting the broader global trend of branch rationalization. This trend can be attributed to the rapid digital transformation of the banking industry, driven by evolving customer preferences and the pursuit of operational efficiency. Notably, these reductions have translated into significant changes in employment within the banking sector, shedding light on the dual impact of digitalization on both customer interaction and employment stability.

Based on the findings presented, several recommendations are proposed to address the challenges and leverage the opportunities arising from the evolution of bank branches and employment dynamics in the era of digitalization in Serbia, Bosnia and Herzegovina, and Montenegro:

1. **Invest in Digital Literacy Education**: Given the pivotal role of digital banking adoption in driving the reduction of physical bank branches, it is imperative for governments, financial institutions, and other stakeholders to invest in digital literacy education programs. These programs should target customers of all age groups and socioeconomic backgrounds to ensure equitable access to and use of digital banking services. By reducing the digital divide, these initiatives can help enhance customer satisfaction and the overall success of digital banking strategies.
2. **Implement Comprehensive Workforce Development Programs**: The transformation of the banking sector through digitalization requires a workforce equipped with the necessary skills to navigate the digital landscape. Banks should collaborate with educational institutions and vocational training centers to design and implement comprehensive workforce development programs. These programs should focus on upskilling employees, enabling them to adapt to technological changes, and fostering a culture of continuous learning.
3. **Promote Collaboration between Financial Institutions and Governments**: As the reduction of bank branches can have profound employment implications, it is crucial for financial institutions and governments to collaborate in addressing these challenges. Governments can offer incentives for banks to create and sustain jobs related to digitalization, such as technology support, cybersecurity, and data analysis. Joint initiatives can also be established to facilitate job transitions and minimize the impact of branch closures on employees.
4. **Enhance Customer Engagement and Support**: Customer satisfaction with digital banking services is paramount to the success of branch reduction strategies. Financial institutions should continuously improve their digital platforms by offering user-friendly interfaces, personalized experiences, and efficient customer support through various channels, including chatbots and online assistance. Regular customer feedback should be incorporated into the development and enhancement of digital services.
5. **Foster Innovation and Collaboration**: The evolution of banking calls for innovative solutions and collaboration among various stakeholders. Financial institutions should actively collaborate with fintech startups and technology providers to develop innovative digital products and services that meet evolving customer needs. Open banking initiatives can foster the development of new applications and services that enhance customer engagement and accessibility.
6. **Monitor and Assess Societal Impact**: While digitalization offers numerous benefits, it is essential to continuously monitor and assess its societal impact, particularly on vulnerable segments of the population. Governments and regulatory bodies should establish mechanisms to

monitor changes in employment trends, access to financial services, and the digital divide. Timely interventions can address potential negative consequences and promote inclusive growth.

7. **Develop Comprehensive Regulatory Frameworks**: Given the rapid changes in the banking landscape, regulatory frameworks should evolve to accommodate digitalization while safeguarding consumer rights and data privacy. Governments should collaborate with industry experts to develop comprehensive and adaptive regulations that promote innovation, competition, and consumer protection.

Drawing on the research of Deli (2014) [5], the transition towards digital banking is a response to changing customer behaviors and expectations. The widespread use of smartphones and the convenience of online banking have created a paradigm shift in how customers engage with financial services. Gupta (2017) [8] emphasizes the cost pressures faced by banks, driving the need to streamline operations by reducing physical branches. This aligns with the findings of Lutter (2017) [14], who explored the factors influencing bank branch closures, including cost inefficiencies and the growth of digital channels. However, this transformation is not without its challenges. The reduction of bank branches has employment implications, as corroborated by Narayan and Sharma (2015) [15]. As banks adopt digital technologies, the roles and skill sets required by employees are undergoing transformation, necessitating retraining and upskilling (Johnson, 2016) [11]. Additionally, the digital divide, as discussed by Norde (2015) [16], may affect certain customer segments, underscoring the importance of addressing financial literacy gaps to ensure equitable access to banking services.

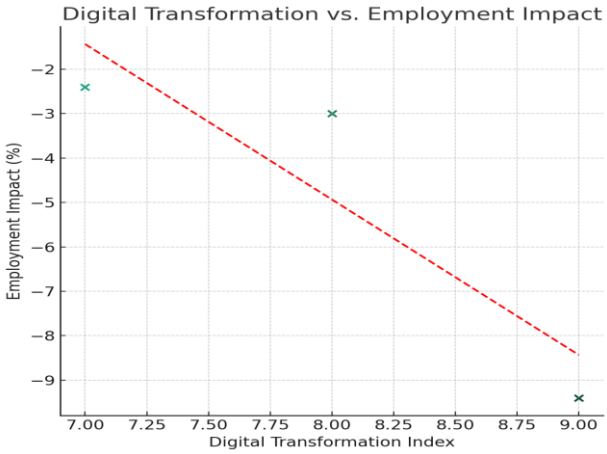

Chart 4. Digital Transformation vs. Employment Impact
(Source: Authors)

Chart 4 illustrates the relationship between the level of digital transformation (measured on a scale from 1 to 10) and its impact on employment within the banking sector (percentage change) in Serbia, Bosnia and Herzegovina, and Montenegro. The trendline (red dashed line) indicates the general tendency for higher levels of digital transformation to be associated with changes in employment.

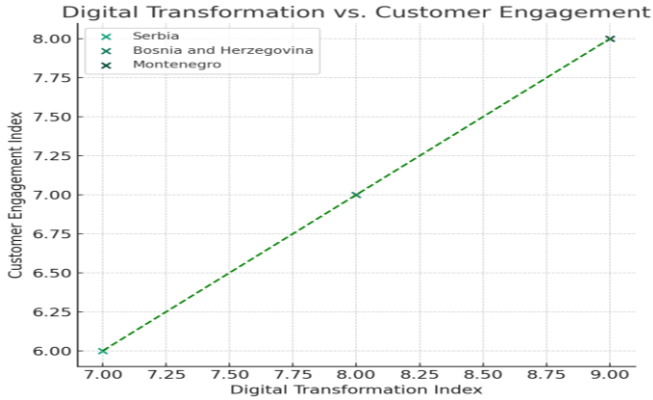

Chart 5. Digital Transformation vs. Customer Engagement
(Source: Authors)

Chart 5 depicts the relationship between the level of digital transformation and the customer engagement index (measured on a scale from 1 to 10) in the banking sector across the three countries. The trendline (green dashed line) suggests how digital transformation may influence customer engagement with banking services.

The two scatter plots above illustrate the key relationships highlighted in the discussion section of this study. These visualizations capture the dual impact of digitalization in the banking sector: its influence on employment dynamics resulting from branch reductions and its effect on customer interaction through increased digital engagement. They are consistent with the findings of Deli (2014) [5], Gupta (2017) [8], Lutter (2017) [14], Narayan and Sharma (2015) [15], and Johnson (2016) [11]. They also emphasize the challenges and opportunities associated with this transformation, including the need to address the digital divide, as discussed by Norde (2015) [16].

CONCLUSION

In conclusion, this research provides a comprehensive exploration of the intricate relationship between digitalization, bank branch reduction, and their far-reaching socioeconomic implications in the Western Balkans, with a particular focus on Serbia, Bosnia and Herzegovina, and Montenegro. The findings of this study illuminate the evolving landscape of the banking sector in response to the rapid advancement of digitalization. Through a mixed-methods approach, combining quantitative data analysis with qualitative insights, this study sheds light on the key hypotheses, offering valuable insights into the transformative evolution of the banking industry.

This study demonstrates that the reduction of bank branches across the Western Balkans is a multifaceted phenomenon driven by the increasing adoption of digital banking services. As customers increasingly gravitate towards the convenience and accessibility of digital channels, traditional brick-and-mortar branches are gradually becoming less prominent. This evolution promises enhanced operational efficiency and improved customer experiences, positioning banks at the forefront of innovation. However, this transition is not without its challenges, particularly regarding the potential displacement of the banking workforce. The clear relationship between branch reduction and employment dynamics underscores the importance of proactive measures to ensure a balanced transition that safeguards the interests of employees.

This research has important implications for various stakeholders. For policymakers, the study provides empirical evidence that can inform the development of adaptive regulatory frameworks that support the digital transformation of the banking sector while addressing potential employment disruptions. Banks themselves can benefit from valuable insights into strategies that facilitate digital transformation while mitigating the impact of branch reduction on their workforce. Furthermore, employees in the banking sector can benefit from a greater awareness of these ongoing changes and the importance of continuous upskilling to successfully navigate the evolving banking environment.

The significance of this study extends beyond the Western Balkans. As the global banking industry continues to navigate the challenges of digital transformation, this research provides a regional perspective that is consistent with broader international trends. The challenges and opportunities identified in this study are not unique to the Western Balkans but are relevant to banking systems worldwide. By examining these dynamics within the regional context, this study contributes to the broader discussion on the future of banking and provides insights that may be useful to stakeholders in different countries.

From an academic perspective, this study addresses a notable gap in the literature by examining the localized effects of bank branch reduction in the Western Balkans. The mixed-methods approach, combining quantitative analysis with qualitative insights, provides a useful methodological framework for future studies exploring similar phenomena in different geographical and cultural contexts. Consequently, this research contributes not only to the substantive understanding of banking digitalization and employment dynamics but also to methodological development in this field.

The evolution of bank branches and employment dynamics in the era of digitalization presents a complex interplay of opportunities and challenges. By implementing the recommendations presented in this study, stakeholders can navigate this transformation in a balanced and strategic manner. These measures can contribute to the development of a resilient banking sector that effectively leverages digitalization to enhance customer experiences, promote economic growth, and ensure a sustainable and inclusive future.

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HISTORY AND TRANSLATION OF THE BASIC INSURANCE LEXICON IN ENGLISH, SERBIAN AND OTHER LANGUAGES

RADULOVIĆ Vladimir[1], COGOLJEVIĆ Vesna[2]

[1]*Faculty of Business Economics and Entrepreneurship, Belgrade (SERBIA) ORCID: 0009-0002-5606-9341*
[2]*Faculty of Business Economics and Entrepreneurship, Belgrade (SERBIA) ORCID: , 0009-0003-3072-8334*

E-mails: vladimir.radulovic@vspep.edu.rs; cogacogoljevic@gmail.com;

ABSTRACT

In this paper, we shall examine some of the basic lexemes in the English language that refer to insurance and compare them to the equivalent lexicon in Serbian and some other European languages, using historical etymological analysis and a discussion of translational semantics of the relevant terminology in order to eventually provide some guidance for practical translational problems. Insurance in the modern sense of the word largely took shape in England toward the end of and after the Middle Ages; hence, it is understandable that, due to the emergence of a completely new conceptual foundation, a major influence on the international lexicon referring to the field of insurance came from that country. In many other European countries, that lexicon has been partially adopted from English and partially locally amended. In Serbia, there has been a delayed historical development of insurance as a socio-economic phenomenon, in part due to the acquisition of independence as late as 1878. As is the case with many other terminological fields in English, when it comes to the word "insurance" itself and its most closely related lexemes, we come across Latin linguistic roots, which entered English via Old French. However, matters are further complicated by the existence of other terms which can be translated into other languages with the appropriate equivalents of "insurance": the historical "assurance" and, especially, the still often used and somewhat semantically complicated "underwrite". G. Davis showed that, as late as the middle of the twentieth century, there were still great terminological ambiguities in the Anglophone register that could be extremely confusing in everyday practice. In this work, Davis even advocated solving this issue by establishing an industrial committee of sorts for the standardization of terminology in insurance. Specifically, the notion of underwriting has proven itself to be a common cause of confusion. The objective of the initial comparative historical analysis applied in this paper is to address the question of the origin and development of English and international basic terminology in insurance, while the second, practical half of the paper applies translational semantics and aims to suggest the direction of solving translational dilemmas and other problems related to the lexicon of insurance, such as standardization. With growing market demands, closely tied to other social and technological changes, modern organizations are put in a position where they need to follow business trends in order to meet the needs and desires of customers, which entails that internal terminological confusion within the industry ought to be systematically resolved.

Keywords: *insurance, comparative lexicology, translational semantics, development of insurance, development of insurance terminology, underwriting, assurance*

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INTRODUCTION

While translating the English word *insurance* with the Serbian equivalent *osiguranje* or the French *assurance* may be seen as a given, upon closer inspection and reflection we can see that this is not always the case. In this paper, we shall examine some of the basic lexemes in the English language that refer to the modern concept of insurance, particularly its partial synonyms *assurance* and *underwriting*. We will compare these crucial terms to their equivalent lexicon in Serbian, French and some other European languages, first through a historical analysis of etymology to provide historical context, followed by an in-depth discussion of the translational semantics of the lexemes, which is intended to point out the specificities of the English lexicon relative to other languages. In the end, we reach some general practical guidelines for translation in the form of a table which uses Serbian equivalents as examples (but may be used by those who do not speak Serbian due to English descriptions of relevant equivalents), as well as some general conclusions from the preceding discussion.

Due to the specificities of historical development in insurance as a field of academic inquiry, along with the subsequent great lexical complexity, this paper will pay the greatest attention to the vocabulary of insurance in the English language in comparison to other linguistic environments. We will pay special attention to Serbian as a particular example of a language that has been somewhat influenced by the English lexicon, yet has similar gaps as most other world languages when it comes to translation from English. This paper will provide an analytical-theoretical overview of the general lexical fundamentals of insurance terminology, primarily in English and Serbian, but with reference to other related European languages, and then reach certain conclusions which will mainly address the practice of translation between English and Serbian, but also between English and other world languages, as well as some problems and solutions beyond translation.

In order to familiarise ourselves with the development of some basic terms that refer to insurance, we will first briefly apply the method of historical comparative lexicology. Certainly, the lexeme *insurance* (translated into Serbian as *osiguranje*) must represent one of the central questions of this work due to the preeminence of its usage and its historical linguistic significance. This prototypical lexeme will be analytically compared with the origins and usage of two other English terms which may be seen as partial equivalents in translation from other languages: *assurance* and *underwrite*. However, *underwrite* will be shown to be particularly problematic, not only in relation to Serbian, but also to various European languages in which we attempt to seek translational equivalents. Toward the end, we shall put the raised issues in translational semantics to work by suggesting both directly applicable translational solutions and briefly suggesting more complex social solutions in professional language standardization.

Regarding the general historical context, certainly many factors contributed to the historical reality that England may be called the cradle of modern insurance. Not the least of these is its former centuries-old hegemonic position rooted in international maritime supremacy. Whatever the previous causes, we may safely say that England's prominence in the development of modern insurance is the reason why the English lexical system has been so instrumental in establishing the modern international insurance vocabulary and has influenced many world languages as modern insurance developed further. Given the fact that the expansion of insurance as a socio-economic phenomenon occurred in the English-speaking world, it is of course no surprise that this had a great impact on the functioning and development of linguistic expressions within the English language. The consequence is that, along with the development of insurance institutions in other countries, there has been a mutual adjustment of lexicons, with terminology used in the English language constantly exerting a special level of influence. However, as we shall see in this paper, there are cases where the uniquely complex development of the English insurance vocabulary introduces difficulties in translation into other languages.

Regarding our primary language for comparison and contrast, Serbian, it is necessary to take into account the historical fact that, due to a vassal relationship with the Ottoman Empire, there was a somewhat delayed emergence of modern insurance and associated terms in Serbian. Particularly important is the fact that the passing of legislation in this field was initially scarce (Serbian Civil Code from 1844) and then became increasingly comprehensive. This is reflected in Serbian insurance terminology mostly through a more simplified vocabulary, which makes it a prime example for a study of how translation works to and from the English vocabulary, which is generally more complex in comparison to other languages. While specific equivalents in translation may differ, general conclusions about the relationship between the Serbian and English insurance lexicon may apply to many world languages, as we will see in a few comparisons with French lexicography.

As a consequence of the fact that insurance is a socio-economic activity which globally arose during the period of the Industrial Revolution, over time words and their meanings evolved further and some terminological confusion emerged. While the especially complex and culturally burdened term *underwrite* has been critically examined in the deconstructive work of the cultural critic Eric Wertheimer in its many semantic dimensions, we note that even some authors of a more practical persuasion within legal [1] and economic [2] professions concluded that the terminological and conceptual confusion which emerged in the English language over time is a real practical problem, both in the insurance industry and academia. Due to the immense global importance of the English language, as well as the global reach of insurance companies from English-speaking countries, this may have repercussions within insurance industries, as well as lexical systems, in other countries. Overcoming these hurdles and avoiding mistranslation requires special effort and methodological precision from everyone who wants to deal with these matters seriously, with linguistic and conceptual clarity and precision.

HISTORY OF THE KEY LEXEMES WITH A BRIEF COMPARATIVE REVIEW

Considering the fact that the most fundamental means of human communication, natural language, is in a constant state of change and adjustment to social developments, it is necessary to point out when these processes significantly interact with linguistic expressions. This applies to the most current and popular expressions as well as to lexical remnants of the past. Unsurprisingly, when it comes to the roots of basic insurance terminology, the widespread influence of the Latin language is of the utmost significance. We first ought to take into consideration how the relevant lexemes entered English in comparison to the most closely related languages.

In English, the morphological elements which are at the root of basic insurance-related terms are of Latin origin and, as is typical of the vast majority of English borrowings from Latin, they came to Great Britain and into the English language via Old French. The most prototypical expressions, the verb *insure* and the noun *insurance*, have their root in the adjective *sure*, which is either derived from the Old French *sur-e* or the older form *seūr-e*, the two ancestors of the modern French word *sûr* [3]. All of these words ultimately derive from the Latin *securus* [4], all denoting and connoting safety, certainty, etc.

By comparing these particular English words with expressions that convey the same meaning in other Germanic languages, e.g. German *Versicherung*, Swedish *försäkring*, German and Danish *forsikring*, all of which derive from the Old German adjective *sikur* [4], we encounter a very frequent phenomenon since the Norman invasion in 1066 – English constantly surpassing other Germanic languages in being influenced by Romance languages. It should be noted that the archaic adjective of Germanic origin *sicker*, along with the original *sikur* and its other descendants, also ultimately originates from the Latin *securus* [3]. Here, it is interesting to notice that in the development of the English vocabulary there was a period when the Norman variant *sure* competed with the Germanic *sicker* [4]. However, as we know, the Norman paradigm prevailed in the further development of the English lexicon and today we have the word *sure* and its derivatives at the root of most prototypical lexemes in insurance terminology.

However, if we make a closer comparison between the morphology of the lexeme insurance and the closest Romance equivalents, the French *assurance* and the Italian *assicurazione* (Spanish and Portuguese being further removed as their equivalents *seguro* / *seguro* have no prefix), we shall notice the difference in the prefixes: *-as* versus *-in*. It should be kept in mind that, even before *insure* was first recorded in the English language in the 15th century, there were already two other English words with similar meanings, both of which are in use to this day: *ensure* and *assure*. They were first recorded in the previous, 14th century [3]. Although homographic with the modern French term for insurance, just like the word *ensure*, *assure* in modern English vocabulary does not typically refer to a specific institutionalized legal relationship such as insurance, but most often generally describes provisions, approvals and guarantees of various kinds, even including verbal and psychological encouragement. Within the register of the legal profession, both of these words today mostly appear as a loosely defined material legal fact (e.g. *All parties to the contract shall ensure / make assurances*…).

However, the historical relationship between *insurance* and *assurance* is a little more complicated than that. Neither of these two initially represented a separate legal or economic institution, but they were used equivalently for various types of contracts, oral statements and documents that assure or guarantee some legal fact. In the 16th century, when modern insurance began to have a direct impact on English

vocabulary, the two lexemes remained equivalent expressions, but they also started to be applied more specifically to insurance in the narrower sense [3]. Unlike *assurance* and *insure*, *ensure* never acquired this specific meaning and therefore is not considered one of our key lexemes.

Over time, *insurance* gradually became the more commonly used expression for the narrower sense of a legal-economic relationship aimed at financial coverage of risk, while *assurance* increasingly returned to its general meaning. This term, however, persisted further in the names of some older insurance companies in the United Kingdom, such as, for example, the *Royal Exchange Assurance Corporation*, which was founded in 1720 and existed under that name until 1968. Today, this wording is less and less present among widely known companies, but, as of 2021, there were still 24 insurance companies in the UK with this word in their name [5]. It should be pointed out that, despite this relatively archaic status, a renowned Serbian dictionary of legal terms translates *assurance* only as *insurance* [6], precisely because its usage in the more popular modern meaning, i.e. general guarantees and confirmations, is quite informal and non-essential in modern English legal terminology.

SEMANTICS OF UNDERWRITING

The situation with this basic terminology so far may not be particularly complex, but it is further complicated by the existence of another lexeme which can, under specific circumstances, among other things, refer to the legal relationship and the act of providing insurance: the verb *underwrite* with its gerund and past participle form *underwriting* (past participle *underwritten*). These three verbs, along with their associated noun forms, are the three key lexemes in this paper – its historical, theoretical and practical focus. *Underwriting* first appears on record in a general legal context, just like the other two, in the 14th century. The etymology is clear and Germanic English in origin: it is simply a compound of *under-* and *write* [3]. In the beginning, just like the mentioned derivatives of the verb *sure*, it also had a more mundane and general meaning related to simple legal formalities, although a little more specific and concrete: it initially simply referred to the act of placing a signature on a document. Analogous lexemes in other Germanic languages exist, such as the German *unterschreiben*, which also refers to a signature [4]. Here, we can notice an analogous derivation with the Serbian *potpis*, another word for a signature which consists of elements meaning under and write: *pod-* and *pis*.

However, in the aforementioned English-Serbian dictionary of legal terms, *underwrite* is only translated as *(pomorsko) osiguranje* – (*maritime*) *insurance* [6]. This meaning is more relevant to our interests, but that translation describes the real-world application of that term in a very limited way. Here, we cannot blame the authors of a concise dictionary for this limitation, given that the distinctions between the terms *underwriting* and *insurance*, along with their use in everyday practice, are very complex. As for the historical maritime connection which is reflected in this dictionary entry, the term *underwriting* indeed first appears as a separate juridical-economic institute in the field of insurance precisely in the context of maritime insurance at the Lloyd's company [7]. Still the world's most important reinsurer in the field of shipping, but also far beyond that field, Lloyd's company probably did more than any other actor in insurance-related discourse to add many layers of meaning to the notion of *underwriting* that go beyond shipping insurance connotations.

As one example of these different possibilities, some professional Serbian translators at the Proz.com platform suggested another translation of *underwriting*: *preuzimanje finansijskog rizika* – back-translated as *taking / assuming (financial) risk* [8]. This can be a somewhat satisfactory solution for contexts where it may conveniently express a certain distinction in relation to other processes and aspects of insurance, considering that the term is often used for operations and aspects of insurance in which taking financial risk at a high level of decision-making is especially prominent. However, this solution can be equally confusing if we take into account the fact that assuming financial risk, generally speaking, is somewhat present in every insurance relationship, as well as in many other economic relationships. Thus, the potential use of this translational solution in Serbian, as well as analogous solutions in other languages, depends on the vagueness and specificity of the usage in the original text.

If we take some examples from English–French lexicography, we can observe that the Robert Collins English–French dictionary does not provide a direct, one-word French translation of the word *underwrite* itself, but it does give us partial equivalents for some specific uses. The first example that is given is *underwrite (insurance) policy*, which is given as *réassurer* – simply the French word for *reinsure* [9]. Here,

we see another possible connotation of this lexeme: *underwriting*, while far from being an exact synonym of reinsurance, is, figuratively speaking, somewhat synonymous with reinsurance – just like the company that was instrumental to the birth of both ideas of underwriting and reinsurance, Lloyd's. We shall see more of that crucial connotation and the connection with Lloyd's in further paragraphs, but first we will briefly mention some other relevant choices in this specific dictionary. *Underwrite risk* is given as *assurer contre*, *garantir*, i.e. *(to) insure against*, *(to) guarantee*; while *underwrite* amount is translated simply as *garantir* (*guarantee*). *Underwriter* is translated simply as *assureur*, back-translated as *insurer*, despite the fact that the word in practice may be used to denote some very specific types of insurers, both as individuals and legal persons [9]. However, again, these are all expected limitations for a concise bilingual dictionary and this becomes increasingly clear as we become more familiar with this word and its complex and flexible range of usage.

If we finally turn to the general lexicology of the word *underwrite* within the English language itself, a glance at the current online Oxford English Dictionary also reveals a wide range of possibilities. When it comes to the verb *underwrite*, there are only two entries: "To support by a guarantee of funds. Also transferred, to guarantee by military or other power," attested in 1430, and "To describe in too low an aspect," attested in 1724 [10]. The second meaning seems to be irrelevant to our purposes as it simply connotes *underrating* or *underappreciating* in written form, but the first one does matter and introduces complications. Between the vague generality of legal and material guarantees along the lines of *assurances* or *ensuring* and the specific connotations which the word *underwriting* has acquired in the insurance industry lies the intermediary meaning of various financial guarantees and support from one party to another. To complicate matters further, specific jobs, tasks and financial decisions within the insurance industry, but also in other financial sectors, which deal with such guarantees in general may be referred to by this multifaceted lexeme.

In fact, even what is perhaps the most useful dictionary for our current endeavour, the Oxford University Press Dictionary of Finance and Banking, cannot avoid mentioning Lloyd's when defining underwriting, as well as mentioning underwriting when defining Lloyd's [7]. Not only are these two terms used to describe each other, but the *underwriting* entry also suggests both reinsurance and maritime connotations, with arguably greater emphasis being placed on the former. In the entry on Lloyd's, regarding the famous company's complex structure and its complex member structure, it is pointed out that "most of the members of syndicates are names, underwriting members of loan capital Lloyd's who take no part in organizing the underwriting business, but who share in the profits or losses of the syndicate and provide the risk capital." [7] Here, the meaning is roughly *high-level decisions on financing by authorised actors within the insurance industry*. The entry on the verb *underwrite* is arguably even more interesting to us, as we have two descriptions of two specific uses: "1. To guarantee an issue of Commercial paper … especially by a bank." and "2. To carry out a detailed investigation of the risks involved in making a loan to a particular borrower or in offering an insurance contract, especially by a bank." [7] Here we see not one, but two connotations that are tied to banking, as indeed, even within insurance, banks are very often the institutions that are expected to engage in high-level financing decisions described by these words. This dictionary, with all its practical orientation and precision that surpasses all previously mentioned general-purpose and concise dictionaries, also gives us quite a few possibilities. Where does this confusing polysemy come from?

In describing these possible specific and practical connotations, we are only scratching the surface of the layers of meaning which accompany the somewhat elusive notion of underwriting, within and outside the field of insurance. The American cultural and literary theorist Eric Wertheimer dedicated an entire volume to a deep inspection of the text and the subtext of this lexeme and its entailed concept in Anglophone cultures, particularly in the USA. Titled *Underwriting: The Poetics of Insurance in America 1722-1872* [11], it applies deconstruction and other devices of textual and social criticism to inspect the deep ties which the author perceives between the development of discourse and value systems in early modern America and the concepts arising from the insurance industry in general. He sees the role of the word *underwrite* in these developments as especially important exactly because of its various nuanced meanings and its relatively common currency among the emerging ruling and middle classes in the British American colonies and the nascent USA in the 18th and 19th centuries.

Wertheimer shows no interest in providing a final, precise and practical definition of underwriting worthy of a dictionary or a textbook. In a manner typical of deconstruction, he highlights the inability to reach a satisfactory definition, not just of underwriting, but even of the most basic concepts like an insurance contract. This is not a case of an idle deconstruction practitioner launching a quixotic attack on the windmills of linguistic constructs, as he finds support for his claim among practically oriented, highly esteemed experts in insurance law. Professors at University College London John Lowery and P. J. Rawlings in *Insurance Law: Doctrines and Principles*, an introductory textbook in insurance law for graduate and postgraduate studies, conclude that, in Wertheimer's formulation: "defining an insurance contract is an impossible task because the concept itself distorts the set of practices it seeks to explicitly mark with inclusivity" [11]. Lamenting the lack of a determinate definition of such a basic concept, the textbook authors comment that, while legislators made little to no attempt to provide a solution, "courts have made several attempts to supply a definition" but that these attempts "tend to sacrifice clarity for inclusiveness and end up achieving neither" [1].

Approaching the topic with such a critical and cautious lens, Wertheimer notes that, as the word *underwriting* itself came to signify *insurance* in the 17th century, it began to acquire a variety of other meanings, "each adumbrating the sense of obligation and contractual warrant: *to confirm or agree by signature; to guarantee to subscribe or contribute (a certain sum of money, etc.); to guarantee or agree in writing to do something.*" [11]. While we have seen that, according to the *Oxford Dictionary of English Etymology* [3], the meaning of *signature* predates the word's use in insurance, that may be just one factual omission on Wertheimer's part. The rest of the claim does seem to withstand scrutiny – it is very likely that it was exactly within the deeply influential, socially dramatic and quintessentially modern context of insurance that much of this extensive polysemy developed.

Many social, cultural, philosophical and even religious connotations and implications of underwriting and related insurance vocabulary that Wertheimer inspects only in the introduction of his tome reach a breadth and depth that is far beyond the scope of this article. If we attempt to find a summary, one near-definition of the concept of underwriting which reflects Wertheimer's view in relative completeness, it would be as follows: "The structural design suggested by the compound term "underwriting" proclaims this: that is, written matter (a signature on an insurance contract) placed metaphorically and actually beneath some represented thing (valued property, now fully described) suggests, in the downward verticality of its logic, the cause/effect temporality of the relationship." [11] In a very general assessment, we can see *underwriting* as a term laden with hierarchical baggage, connoting a high level of decision-making and control in the field of insurance and beyond. Its nature, which inherently relates to power and status in a specific field of economics and law that is extremely difficult to define, might have been a significant factor in reaching the current lexical situation. The desire to reach new, somewhat arbitrary levels of power helped this troublesome word acquire a set of loosely related meanings with very few constraints on that acquisition. Or, to restate this in social terms, through a class of people who wanted to be the ones to underwrite a myriad of things, underwrite came to mean a myriad of things. As we shall see now, this matter of arbitrariness is not merely a linguistic problem, but one of practical importance.

While it may seem that we have become excessively focused on pure semantics and linguistic ivory tower discourse of little value to legal and economic scholarship and practical translation, let alone the insurance industry, we ought to point out that the polysemy and ambiguity of this word in relation to the general concept of insurance have been seen as a real practical problem by outspoken industry practitioners. As early as 1958, Gregg W. Davis, in his short article published in the professional journal of the American Risk and Insurance Association, ARIA [2], suggested that the general terminological ambiguity in the Anglophone register of the field of insurance is extremely confusing in everyday practice, especially when determining and distinguishing the duties and goals of individual participants working in the field. In his view, the confusion was so great that he even advocated the introduction of an industry committee of sorts in order to standardize professional insurance terminology [2].

In this article, Davis often specifically highlights various meanings of the term *underwrite(-ing)* as particularly problematic, especially in relation to different individual working positions that are referred to as *underwriters* and the associated duties described by the word [2]. Judging by the small number of recorded citations, the lack of any commission such as the one proposed by Davis, and the fact that there is still noticeably insufficient regard in professional literature for the question of consistent criteria for these distinctions, we can hardly expect the situation to be clearer and more ordered in the foreseeable future than it was at the time of his writing.

Hopefully, this passage through a knot of inconsistencies and scholarly doubts found in lexicography, textual critique, insurance law jurisprudence and the opinions of insurance industry experts has been sufficient at least to serve as a warning when encountering this complex term in the English language – whether we are speaking of underwriters and things being underwritten in an Anglophone environment or translating into Serbian and other languages.

SUGGESTIONS FOR TRANSLATION PRACTICE AND BEYOND

If we take all the knowledge introduced so far and apply it to the practice of translation, it is immediately apparent that in translating from English to Serbian the translator's challenge is somewhat less daunting due to a more simplified vocabulary. In the context that concerns us, the words *insurance*, *assurance* and *underwriting* can all be translated as one word: *osiguranje*. However, the most problematic of our key lexemes, *underwriting*, may require a more specific designation to convey the required connotations, some of them with *osiguranje* as their element, some not. Of course, Serbian should here be seen as emblematic of world languages in general, since the English vocabulary seems to be consistently richer in comparison to others. As we have seen, some offered solutions are similar in French and Serbian dictionaries, and even some of the ones that are not offered are interchangeable. Therefore, we believe these suggestions will also be of use to speakers of third languages, even if the specific solutions for the target language are unfamiliar and practically irrelevant.

However, if we turn to translation from Serbian and other world languages into English, one ought to exercise even more caution since the English language has several partially equivalent expressions, with a semantic status that varies depending on the context. The cause of this complex synonymy should primarily be sought in a more complex tradition of modern insurance rather than in the "usual suspect" for similar phenomena in English – Norman Romanization. This is especially clear if we take into account that the only English word of primarily Germanic origin that refers to the very act and relationship of insurance, *underwrite*, is, in that sense, completely unrelated to the equivalents in other Germanic languages. While in German, for example, there is a morphologically analogous word *unterschreiben*, it holds the original simple meaning of signature and has no meaning specifically related to insurance. Meanwhile, translational equivalents that do relate to insurance (e.g. *Versicherung*) have even less of a direct historical connection to the discussed English terminology.

In everyday translation practice, the terms *insurance* and *insure* are the most acceptable for the majority of situations, mostly due to their unambiguous prevalence in legal and economic texts, as well as in everyday usage, literary and other situations. Meanwhile, the other two terms can have significance in very specific contexts. The need for the variant assurance is a much rarer occurrence and is usually reduced to archaic historical usage, as well as those specific (mostly older) companies which kept the word in their name. On the other hand, the lexeme *underwrite* can appear in a larger number of situations and have more specific meanings; hence, it should be seen as a question of jargon used for certain types of insurance financing (most often related to some kind of higher-level market-based risk coverage), along with related positions of individuals and departments in the insurance industry. However, as we have seen, this distinction can have significant variations depending on the context. Therefore, when it comes to the potential usage of this term, a detailed consideration of the technical, organizational and legal context of the original text is strongly advised.

In order to make the options clearer, we present an assorted table that contains multiple possible meanings of the essential words along with selected Serbian translational equivalents (Table 1). Of course, these are only concise simplified solutions for general use. As we have hopefully illustrated in previous sections, many nuances that are beyond these rough guidelines may come into play in the actual practice of translation, especially when it comes to the recalcitrant *underwrite*.

Table 1. Various meanings of key lexemes with Serbian translational equivalents

Lexemes	Meanings	Serbian transl. equivalents
assure / assurance	to make someone believe (in) something to guarantee some legal or material fact	uveriti / uverenje, uveravanje garantovati, pobrinuti se / garancija
	assurance as insurance (historical)	osiguranje
ensure	to guarantee some legal or material fact or make sure it comes to fruition	garantovati / pobrinuti se
insure / insurance	a legal and economic relationship aimed at financial risk alleviation	osigurati, osiguranje
underwrite / underwriting	to sign a document, signature to support by a guarantee of funds to assume financial risk maritime insurance reinsurance to describe in an excessively negative way	potpisati / potpis (finansijski) garantovati preuzeti finansijski rizik / preuzimanje finansijskog rizika pomorsko osiguranje reosiguranje potceniti u opisu (lit. underappreciate in description)

Source: Previously cited lexicography with original solutions and additional entries from Đekić (2020).

CONCLUSION

Although the prerequisites for the emergence of insurance existed as early as the late Middle Ages, the emergence of insurance as a modern activity is tied to the development of natural sciences at the end of the 17th and the beginning of the 18th century, along with the relevant economic and technological progress. The development of all socio-economic fields of work, including insurance, is inevitably accompanied by the development of compatible terminology, i.e. an associated change in languages used to communicate within environments where such innovations occur. In this field, the key locus of development is England and the key language is English.

While the rich history and complex relationships of these terms ought to illuminate the general factors that led to the current state of English and other languages, practical problems demand practical solutions. Therefore, in terms of basic translation practice, the most common terms *insurance* and *insure* are the most acceptable for most uses when translating into the English language. While in many other languages, including Serbian, the translation of the historical *assurance* is not particularly troublesome, *underwriting* may pose a much greater challenge due to its complexity, as well as its modern practical relevance. This can be resolved by translators in several different ways, including borrowing the English term, simply using the most common word for *insurance* (i.e. *osiguranje* in Serbian) or somehow specifying that term (i.e. *pomorsko osiguranje* for specifically naval underwriting, etc.). This variety of options is directly correlated with the variety of semantic nuances that may distinguish underwriting from other aspects of insurance.

This terminological ambiguity within the Anglophone register unfortunately does cause some confusion in everyday practice, especially when determining and distinguishing the duties and goals of individual participants in the field of insurance. That is why we believe that, beyond these simple and compromising translational choices, a possible solution lies in returning to the suggestions of Gregg Davis and forming one or more commissions and international bodies dedicated to the question of necessary language standardization in the field of insurance, perhaps within the competent bodies of the United Nations. While the practical and organizational specifics of this endeavour certainly are not within the scope of this article, commenting on the need for such a project is undoubtedly justified.

With growing market demands, closely related to other social and technological changes, modern organizations are put in a position where they need to follow business trends in order to reach new markets and meet the needs and desires of customers. In this age when the use of artificial intelligence is gaining importance within the field of insurance, particularly when it comes to the topic of underwriting [12][13][14], the need to resolve terminological inconsistencies that arise from human social relations becomes increasingly apparent. However, allocating time to the systematic resolution of internal terminological confusion within the insurance industry is necessary if we want this process to take place in a clear and equal environment.

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PART III.

TOURISM, DESTINATION BRANDING AND AGRICULTURE

ORIGINAL SCIETNTIFIC PAPER

EDUCATIONAL MOTIVATIONS AND THEIR INFLUENCE ON RELIGIOUS TOURISM AMONG YOUNG TOURISTS

PANTOVIĆ Danijela[1], BOŠKOVIĆ Nikola[2], LUKOVIĆ Milica[3]

[1]University of Kragujevac, Faculty of Hotel Management and Tourism in Vrnjačka Banja (SERBIA), ORCID: 0000-0001-8605-8614
[2]University of Kragujevac, Faculty of Economics, Kragujevac (SERBIA), ORCID: 0000-0003-2105-6196
[3]University of Kragujevac, Faculty of Hotel Management and Tourism in Vrnjačka Banja (SERBIA), ORCID: 0000-0002-7102-0178

E-mail: danijela.durkalic@kg.ac.rs, nikolab@kg.ac.rs, milica.petrovic@kg.ac.rs

ABSTRACT

Monasteries are not only preserved cultural assets of humanity but also hold significant value for local communities, making them important both economically and as tourist destinations. In the context of modern mass tourism, religious tourism is increasingly associated with environmental concerns, sustainable and rural development, and the preservation of heritage sites. This paper explores the relationship between tourism and religious sites, which are often regarded as both cultural and natural heritage. The study focuses on the Royal Monastery of Studenica, located in the heart of the "Golija-Studenica" Biosphere Reserve in the Republic of Serbia, a UNESCO World Heritage Site. Quantitative research was conducted using a randomized questionnaire and mixed data collection methods, targeting individuals up to 35 years of age. Data were analyzed using PLS-SEM 4.0 software. The findings highlight the role of religious consciousness as a key motivational factor for tourists visiting monasteries. The research also reveals how educational motivations influence the tourist experience and identifies additional drivers of religious tourism, such as ecological, rural, and cultural interests.

***Keywords**: educational motivation, culture, religious tourism, biosphere reserve*

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INTRODUCTION

Human movement driven by religious motives is not a recent phenomenon—it has existed for thousands of years. Over time, these religious journeys have evolved and become more organized, eventually taking on characteristics associated with tourism. In fact, religious tourism is considered one of the oldest forms of tourism, originating from these early faith-based migrations [1]. Religious tourism encompasses all types of travel where religion is the primary motivation and the destination is a religious site. As noted by Raj and Morpeth [2], religious tourism typically involves voluntary, short-term, and unpaid travel. While religion remains the core reason for such trips, it is often accompanied by additional motives. The destination is usually a religious site, which may hold local, national, or international significance.

Before the Industrial Revolution and the advent of modern transportation in the 19th century, most religious pilgrims were required to travel on foot to reach their sacred destinations. Travel by horse or carriage was a luxury reserved for the wealthy. However, with the profound social and cultural changes of the past centuries—particularly advancements in transportation and the effects of globalization—pilgrimage has become one of the most widespread forms of human mobility, as highlighted by scholars [3].

Moreover, religious tourism has become an integral part of a nation's cultural heritage resources and serves as a key driver of cultural tourism [4]. The United Nations World Tourism Organization (UNWTO) recognizes religious tourism as a significant contributor to economic growth and the enhancement of tourism offerings, referring to it as a catalyst for cultural understanding [5].

The literature on religious tourism highlights that the religiosity of young people is significantly influenced by broader social trends [6]. This underscores the importance of examining the topic from a scientific perspective. The aim of this study is to explore how educational motivation influences young people's willingness to engage in religious tourism. The focus is specifically on young individuals who have visited religious sites.

Historically, the connection between tourism and religion began with pilgrimages, which eventually evolved into the modern concept of religious tourism. Religion continues to shape not only how people travel but also where they choose to go [7][8]. Many religious tourists are seen as custodians of national traditions [9], both within their home countries and abroad. Today, religion remains a defining characteristic of many populations. It is estimated that approximately 200 million people visit religious shrines annually, accounting for about one-quarter of all global tourist activity [10].

The elderly population is often regarded as the primary bearer of humanity's cultural and religious heritage. However, the widespread belief that religious tourism is associated exclusively with older people is a misconception, as it includes participants from all age groups [11]. Young people, in particular, play an important role in learning, transmitting, and preserving the cultural identity of a population. Cohen [12] paid special attention to the relationship between young people, pilgrimage, and tourism by introducing the concept of the educational pilgrimage into the literature. In order to increase young people's interest in religious tourism, various projects have been launched and routes have been created to encourage visits to religious destinations (e.g., the Route of Saints Cyril and Methodius). However, there are relatively few studies, such as that of Nieminen [13], that examine whether younger generations and women are interested in religious tourism or whether it primarily attracts older generations.

Recent studies have emphasized that young tourists are particularly receptive to meaningful and educational travel experiences. According to Blackwell (2007), young people often perceive religious sites not only as sacred spaces but also as opportunities for cross-cultural dialogue, critical reflection, and social connection. These experiences can foster greater intercultural understanding and contribute to a more nuanced appreciation of global religious diversity [14].

A growing body of literature has explored the intersection between educational motivations and religious tourism, particularly among younger populations. While traditional religious motivations—such as spiritual fulfillment, pilgrimage, and devotion—remain central, many young tourists today are also drawn to religious sites for educational and cultural enrichment [15][16].

Educational motivations in this context often include a desire to learn about history, architecture, art, and the cultural practices embedded in religious traditions. Religious sites such as monasteries, churches, mosques, and temples serve as living classrooms, providing young visitors with immersive experiences

that foster both personal and intellectual growth. This aligns with the concept of "experiential learning," where travel becomes a tool for self-development and global awareness [17].

Scholars such as Čerović, Knežević, and Simonović [18] have emphasized the importance of religious tourism as both a cultural and educational experience, particularly for the youth population. Their research highlights how Serbian monasteries serve not only as sacred spaces but also as historical and educational landmarks that attract young visitors eager to learn about the country's spiritual and cultural heritage. According to Petrović, Blešić, and Gajić [19], young people's engagement in religious tourism in Serbia is often influenced by a combination of spiritual, cultural, and educational motives, with monasteries representing places for contemplation, learning, and cultural connection.

The study by Bilim [20] investigates the motivations, perceptions, and behaviors of young Turkish tourists visiting Konya, a significant religious destination. The findings indicate that while traditional religious motives are present, many young tourists are also driven by educational and cultural interests, seeking self-actualization and learning experiences. The study by Gajić et al. [21] explores the factors influencing destination choices among Serbian youth aged 18–26. The findings reveal that educational and self-realization motives significantly influence their travel decisions, highlighting the importance of educational content in religious tourism offerings.

The literature highlights that religious tourism, as a key segment of cultural tourism, has experienced a resurgence in recent years. Since the 1990s, new forms of religious tourism have emerged that extend beyond traditional pilgrimage. These modern expressions often involve not only visits to sacred sites but also participation in social events such as religious or gospel music festivals, cultural gatherings, and educational programs aimed at spiritual enrichment. This evolving trend is commonly referred to as new religious tourism [22].

This study aims to expand current knowledge of religious tourism and raise public awareness of its significance, particularly among younger generations. The findings are expected to inform alternative strategies for improving the management of religious tourism and to emphasize the value of spiritual visits to monasteries.

MATERIALS AND METHODS

Study area

The UNESCO World Heritage List is often considered a tourism brand that enhances the visibility of destinations, increases visitor numbers, and stimulates academic interest in studying these sites [23]. In this regard, there are many sacred sites throughout Europe, but one of the most important is the Studenica Monastery in Serbia. Every nation has its place in religious culture. Through tourism, nations have the opportunity to utilize their cultural potential and transform it into a source of development [24]. The Republic of Serbia possesses an exceptional historical and religious heritage, much of which is included on the UNESCO World Heritage List. In addition, many of these resources remain insufficiently explored with regard to their potential contribution to sustainable economic development.

The Golija-Studenica Biosphere Reserve is the first biosphere reserve in Serbia, covering an area of 53,804 ha and encompassing many of the country's most valuable natural and cultural sites. It is located in southwestern Serbia and was designated a UNESCO Biosphere Reserve in 2001. This area provides an exceptional setting for learning and research, offering opportunities for knowledge exchange, tourism development, and other forms of sustainable development recognized at both the national and international levels. The designation of biosphere reserve was granted on the basis of the natural values of the Golija Nature Park, as well as the rich cultural heritage of the 12th-century Studenica Monastery, which has been included on the UNESCO World Heritage List since 1986. Bearing all of the above in mind, it is clear that this area is of interest not only to the natural sciences but also to the social sciences.

It should be noted that the majority of religious tourists visiting the Studenica Monastery are domestic visitors, and as such they represent an important part of Serbian cultural identity. Religious tourists are considered to play a significant role in maintaining, preserving, and strengthening that identity [8].

DATA COLLECTION AND MODEL

Data were collected through a field survey conducted at the Studenica Monastery, strategically positioned near the entrance to maximize visitor participation. Researchers approached visitors directly using a random interception method to ensure a diverse sample. This approach involved estimating the age of potential participants before inviting them to complete the survey, allowing the researchers to target the intended age group more effectively. The survey was conducted over a six-month period, with data collected on different days, including weekends and days of special events. This approach enabled the researchers to capture a broad range of visitors, thereby improving the representativeness of the sample. The questionnaire was available in both English and Serbian to accommodate visitors with different linguistic backgrounds. Despite these efforts, some visitors declined to participate, primarily because of time constraints.

Table 1. Demographic profile of the respondents

	Frequency (%)
Gender	
Male	27
Female	73
Age (years)	
18-25	60
26-35	40
Education	
Secondary/high school	27.5
University degree	41.4
Master's degree	19.5
PhD	11.5
Monthly income	
< 300 EUR	20.7
301 – 500 EUR	13.8
501 – 700 EUR	12.6
701 – 1000 EUR	6.9
> 1000 EUR	6.9
No statement	39.1

Source: Authors' calculation.

The sampling method employed was non-probability sampling through random interception, which was considered appropriate given the transient nature of the visitor population at the monastery. Potential participants were approached based on their presence at the entrance, an area with consistent visitor traffic, ensuring a reasonably random selection of individuals. In total, 280 visitors were initially approached, of whom 140 completed the questionnaire. The socio-demographic characteristics of the respondents revealed a notable gender imbalance, with 73% female and 27% male participants. This finding is consistent with previous research indicating that women are generally more willing to participate in surveys, particularly in the context of community and religious events, as reported by Nieminen [13].

In addition to the findings of this study, age structure is an important factor for tourism planners and destination managers, as it provides valuable information for designing tourism offerings [10]. The same author also points out that the interests of young people differ from those of middle-aged and older visitors.

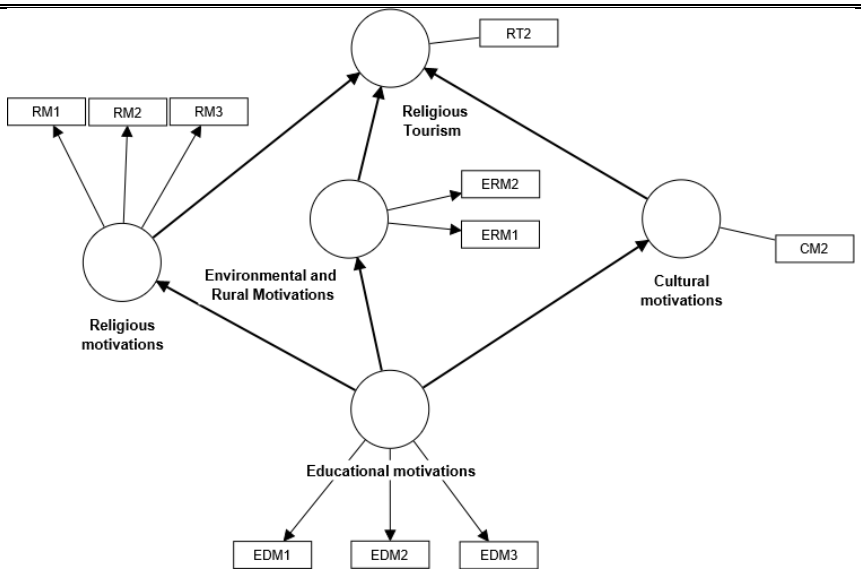

Figure 1. Research model
Source: Authors' calculation.

Partial Least Squares Structural Equation Modeling (PLS-SEM) was used for data analysis. SmartPLS uses the partial least squares estimation method and does not impose strict requirements regarding sample size. PLS-SEM is particularly suitable for studies with relatively small samples, which is an important consideration given that this study included 140 respondents. Conventional covariance-based SEM techniques generally require larger samples to achieve adequate statistical power, making PLS-SEM a more appropriate choice in this case (Hair et al., 2017) [25,26]. Version 4.0.8.3 of the SmartPLS software was used for the analysis. The analysis followed the standard two-step procedure, consisting of the evaluation of the measurement model and the evaluation of the structural model. This approach is well suited to exploratory research, allowing the assessment of complex relationships between observed and latent variables without strict distributional assumptions. Since this study aims to examine the factors influencing visitors' experiences at the monastery, PLS-SEM represents an appropriate analytical method [27,28].

Based on the reviewed literature, it can be concluded that educational motivation in religious tourism has been examined from various perspectives. However, the literature review also indicates that relatively few studies focus specifically on young people and their interest in and motivation for religious tourism. Accordingly, the following research hypotheses are proposed:

H1: Educational motivation (EDM), through religious motivation (RM), has a positive impact on religious tourism (RT) among young tourists.

H2: Educational motivation (EDM), through environmental and rural motivation (ERM), has a positive impact on religious tourism (RT) among young tourists.

H3: Educational motivation (EDM), through cultural motivation (CM), has a positive impact on religious tourism (RT).

H4: Educational motivation (EDM) positively influences religious tourism (RT) among young tourists.

RESULTS

The first part of the results presents the evaluation of the measurement model. The validity of the theoretical model of educational motivation in religious tourism among young tourists was tested using SmartPLS software. The SmartPLS software (version 4.0.8.3) is particularly user-friendly, offering robust least squares estimation without imposing stringent sample size requirements. The analysis conducted using SmartPLS involved two critical stages: evaluating the measurement model to ensure construct validity and reliability, followed by assessing the structural model to examine the relationships among the latent variables [29].

Internal consistency and convergent validity were assessed using confirmatory factor analysis (CFA). Cronbach's alpha coefficient [30] was used to assess internal consistency. The Cronbach's alpha values for the latent variables are presented in Table 2.

Nunnally [31] suggests that values ≥ 0.7 are considered acceptable, while Churchill [32] proposes that a value of 0.6 is also acceptable, indicating that the internal consistency requirement of the proposed model has been satisfied. In addition, convergent validity was confirmed (AVE ≥ 0.5), as all factor loadings were statistically significant ($p < 0.1$, $p < 0.05$) [33]. Table 2 presents the values of construct reliability and validity.

Table 2. *Results for convergent validity and internal consistency reliability*

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Educational Motivations	0.860	0.865	0.915	0.782
Environmental and Rural Motivations	0.794	0.795	0.907	0.829
Religious Motivations	0.697	0.702	0.831	0.621

Source: Authors' calculation.

In the following stage, further statistical analysis was performed to obtain the values of the indicators included in the proposed structural model.

During the evaluation of the structural model, model fit indices were not considered because, although covariance-based SEM (CB-SEM) relies heavily on model fit, this is much less important in PLS-SEM [27]. As Westland [34] points out, researchers may incorrectly conclude that PLS-SEM is not suitable for theory testing and confirmation. Therefore, researchers should exercise caution when considering the applicability of model fit measures in PLS-SEM [35]. The latent variables and the questionnaire used in this study were developed based on the research of Robina Ramírez and Fernández Portillo [36], with the questionnaire adapted to the geographical context investigated in this study.

Following the recommendations of Hair [27], bootstrapping with 5,000 subsamples was performed. During the initial iteration, the measurement model did not satisfy the required criteria because of a low AVE value. Therefore, two indicators (RT1 and CM1) were removed from the model. After the revised model satisfied all requirements for internal consistency and convergent validity, the PLS algorithm was applied.

Table 3. *PLS algorithm after bootstrapping*

Path	Path coefficient (β)	*P* values	Inference
Cultural Motivations -> Religious Tourism	0.190	0.125	Not confirmed
Educational Motivations -> Cultural Motivations	0.224	0.069	Not confirmed
Educational Motivations -> Environmental and Rural Motivations	0.304	0.000	Confirmed
Educational Motivations -> Religious Motivations	0.702	0.000	Confirmed
Environmental and Rural Motivations -> Religious Tourism	0.138	0.197	Not confirmed
Religious Motivations -> Religious Tourism	0.460	0.000	Confirmed
Total Indirect Effect			
Educational Motivations -> Religious Tourism	0.309	0.000	Confirmed

Source: Authors' calculation.

In order to validate the model, it is necessary to examine the outer loading values presented in Table 4. It is generally recommended that these values exceed 0.7. As shown in the table, all outer loadings for the observed construct variables are above the recommended threshold. Furthermore, all outer loading values are statistically significant ($p = 0.000$).

Table 4. *Outer loadings*

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	*P* values
CM2 <- Cultural Motivations	1.000	1.000	0	0	0.000
EDM1 <- Educational Motivations	0.869	0.870	0.033	26.429	0.000
EDM2 <- Educational Motivations	0.936	0.935	0.015	62.455	0.000
EDM3 <- Educational Motivations	0.845	0.844	0.037	22.781	0.000
ERM1 <- Environmental and Rural Motivations	0.915	0.914	0.038	23.864	0.000
ERM2 <- Environmental and Rural Motivations	0.906	0.899	0.048	18.681	0.000
RM1 <- Religious Motivations	0.822	0.819	0.051	16.137	0.000
RM2 <- Religious Motivations	0.768	0.768	0.051	15.137	0.000
RM3 <- Religious Motivations	0.774	0.773	0.057	13.521	0.000
RT2 <- Religious Tourism	1.000	1.000	0	0	0.000

Source: Authors' calculation.

Figure 2 presents the path coefficients, indicating the direct and indirect effects of different types of motivation on religious tourism. The path coefficients for the relationships between educational motivation and all latent variables included in the model are positive, indicating that educational motivation has a positive effect on religious motivation, environmental and rural motivation, and cultural motivation.

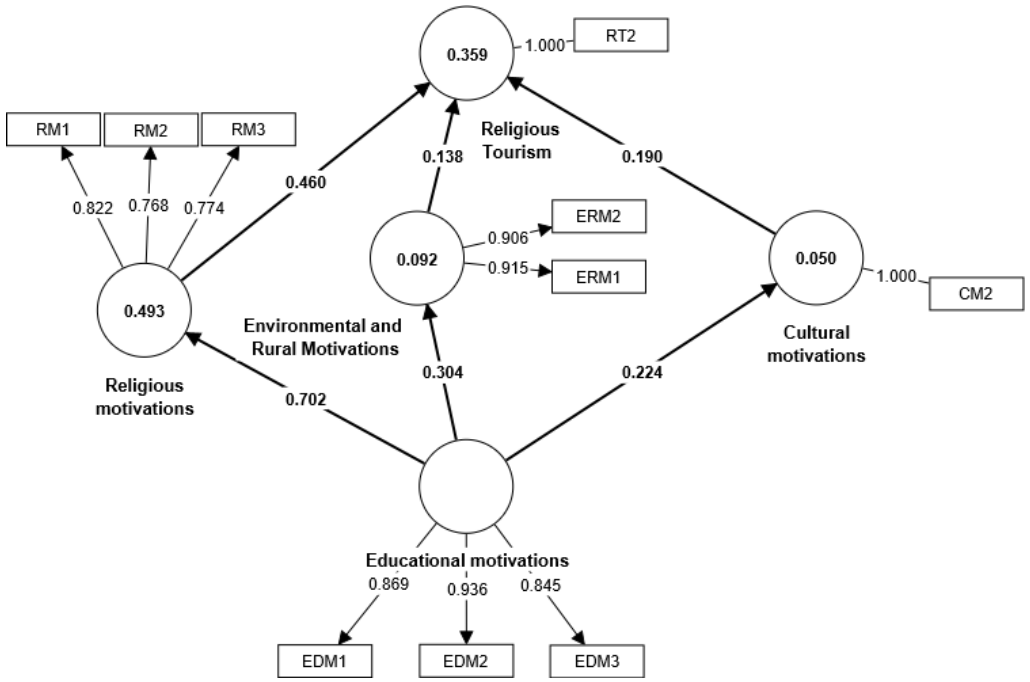

Figure 2. *Path coefficients (β) of the proposed model*
Source: Authors' calculation.

According to the proposed hypotheses, educational motivation has a strong and positive indirect effect on religious tourism through religious motivation. The relationship between educational motivation and religious motivation is strong ($\beta = 0.702$) and statistically significant ($p < 0.01$), while religious motivation also has a positive and statistically significant effect on religious tourism ($\beta = 0.460$; $p < 0.01$). These findings indicate that an increase in educational motivation contributes positively to religious tourism. Therefore, H1 is supported. These results are consistent with previous studies indicating the positive effects of religious motivation while emphasizing the importance of including extrinsic tourism motivations as well [37].

Furthermore, educational motivation (EDM) has a positive effect on environmental and rural motivation among young tourists, as indicated by a statistically significant path coefficient ($\beta = 0.304$, $p < 0.01$). Environmental and rural motivation also shows a positive effect on religious tourism ($\beta = 0.138$); however, this relationship is not statistically significant ($p = 0.197$). Therefore, H2 cannot be fully confirmed. Although educational motivation significantly influences environmental and rural motivation, the indirect effect on religious tourism is not statistically significant. These findings are consistent with those of Gambhir [38], who states that tourism in rural areas may be partially or entirely motivated by religious factors.

Regarding the relationship between educational motivation (EDM) and cultural motivation (CM), a positive relationship ($\beta = 0.224$) was identified among young respondents; however, it was not statistically significant ($p = 0.069$). Similarly, the positive effect of cultural motivation on religious tourism ($\beta = 0.190$) was also not statistically significant ($p = 0.125$). Therefore, H3 is rejected. Moaven [39] explains this finding by suggesting that other variables, such as modern communication and information technologies, may exert a stronger influence on religious tourism.

Finally, the PLS algorithm revealed a significant total indirect effect, indicating a positive relationship ($\beta = 0.309$) between educational motivation and religious tourism among young tourists. This relationship is statistically significant ($p = 0.000$), providing support for H4. Similar findings have been reported by several previous studies [9,36,40]. As Bilim and Düzgüner [41] concluded, the effects associated with religious tourism are predominantly positive, promoting peace and tolerance rather than negative outcomes.

Overall, the path analysis confirms the statistical significance of two hypotheses. Specifically, H1 and H4 are supported, H2 is partially supported, whereas H3 is not statistically significant and is therefore rejected.

CONCLUSION

This study represents a valuable scientific contribution to the academic literature on educational motivation and religious tourism, particularly through the perspective of young people. It is important to clarify that the focus of this paper is not on religion as a concept or on different religions, but rather on how young people perceive the relationship between education and religious tourism.

In the theoretical part of the paper, the authors focused on religious tourism, its definition and significance, as well as on the role of motivation among young people. Regardless of the different academic perspectives on pilgrims and tourists, this study identified a common finding: the positive influence of educational motivation on religious tourism among young people. The paper also highlights the importance of education for preserving national identity, which is transmitted and reinforced through tourism.

The findings of this research underscore the potential of religious tourism to serve as a vehicle for education, cultural awareness, and the strengthening of national identity among young people. Educational motivation can enhance the tourism experience, making it more meaningful and enriching. By incorporating educational elements into religious tourism, providers can not only attract a younger audience but also foster more informed and engaged visitors who respect and appreciate cultural heritage. Moreover, the inclusion of educational programs in religious tourism can stimulate local economies and encourage sustainable tourism practices. As educated tourists often seek deeper connections with their destinations, religious tourism sites can benefit from increased visitor satisfaction and, consequently, repeat visits. Additionally, these educational efforts can reinforce the historical and cultural significance of sites such as the Studenica Monastery, helping to ensure their preservation and relevance for future generations.

Despite the valuable contributions of this study, several limitations should be acknowledged. The territorial focus on a single monastery in the Republic of Serbia may limit the generalizability of the findings. Furthermore, the sample size of 140 respondents suggests the need for broader data collection to obtain a more comprehensive understanding of young people's perceptions and motivations.

Future research could expand on these findings by conducting comparative analyses of youth religious tourism and silver tourism. Such comparisons could reveal differences in motivations and perceptions across age groups and ultimately support the development of more targeted strategies within the religious tourism sector. In addition, policymakers should consider the findings demonstrating the positive influence of educational motivation on religious tourism. Destination managers should develop programs that incorporate educational components, such as workshops or guided tours emphasizing the historical significance and cultural context of religious sites, to ensure that the benefits and costs of tourism remain balanced [42,43]. This approach can enrich the visitor experience while better addressing the interests of younger tourists.

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ORIGINAL SCIETNTIFIC PAPER

SPECIFICITIES OF HUMAN RESOURCE MANAGEMENT IN HEALTH TOURISM INSTITUTIONS IN COMPARISON WITH TRADITIONAL HEALTHCARE INSTITUTIONS IN THE REPUBLIC OF SERBIA

KRSMANOVIĆ Stefan[1], MILUTINOVIĆ Olivera [2], GARABINOVIĆ Dušan [3]

[1] ALFA BK University, Belgrade (SERBIA) ORCID 0009-0007-0155-3538

[2] Educons University, Faculty of Pharmacy Belgrade, Belgrade (SERBIA)ORCID 0000-0002-9677-9025

[3] Higher Business School of Vocational Studies "Prof. dr Radomir Bojković", Kruševac (SERBIA)ORCID 0000-0002-6247-3060

E mail: stefan.krsmanovic@alfa.edu.rs, olivera.milutinovic@ffbg.edu.rs, dusan.garabinovic.032@gmail.com

ABSTRACT

The subject of this paper is the specificities of human resource management in health tourism institutions in comparison with traditional healthcare institutions in the Republic of Serbia. The aim is to establish whether the situation is better in health tourism institutions compared to traditional healthcare institutions in the Republic of Serbia regarding: a) the number and qualifications of human resources, b) relationships among staff (including both employees and managers), c) staff attitudes towards assets, d) relationships between patients and staff, and e) patients' attitudes towards assets. During June and July 2024, research was conducted using a printed questionnaire. Respondents rated their agreement with the statements using a five-point Likert scale. The respondents (107) were individuals familiar with the concept and characteristics of health tourism, who additionally had either education in the field of healthcare or experience working in the healthcare sector. Generally speaking, the results showed that, in health tourism institutions compared to institutions in the field of traditional healthcare, the situation is better in terms of the number of human resources, mutual relationships among staff, staff attitudes towards assets, relationships between patients and staff, and patients' attitudes towards assets. It is concluded that the inclusion of traditional healthcare institutions in health tourism activities can lead to improvements in the state of human resources and their management. The recommendation is that healthcare institutions should be encouraged to engage in health tourism.

***Keywords**: human resource management, health tourism, traditional healthcare institutions, employees, managers, patients*

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INTRODUCTION

Human Resource Management (HRM) is characterized by specificities when it comes to activities that are based on human work, i.e. activities that are labour intensive. Such activities are, among others, tourism and healthcare, and therefore also health tourism.

Health tourism management involves the integration of two different fields of management. These are: a) healthcare management and b) tourism management. In the first case, it refers to the specificities of management in terms of striving to preserve and improve health, as well as managing human resources that include doctors, but also other medical and non-medical staff. In healthcare management, the focus is on healthcare system management. In the second case, it refers to the specificities of management resulting from the existence of different factors of tourism and hospitality. Precisely because of the complexity that characterizes tourism, the complexity of tourism management also arises. [1]

Within the framework of health tourism, based on the characteristics of health and tourism, the role of the human factor and the services provided by that factor are particularly highlighted. For the above reason, human resources and their management are singled out as a special element of the management process in tourism, and thus also in health tourism. [2]

Analysing papers on the topic of HRM in tourism and hospitality (Web of Science – WoS), it was found that among the most frequently studied topics (keywords) are "job satisfaction, hospitality, tourism, HRM, and work engagement" [3]. The growing interest in HRM in tourism and hospitality has also been established in other papers. The most important research topics are "performance", "tourism", "job satisfaction", "commitment", and "antecedent". Three clusters were also formed [4]:

- Tourism, job satisfaction, impact, attitudes, management, quality, perceptions, gender, and industry;
- Service quality, model, satisfaction, mediating role, performance, and commitment;
- Consequences, antecedents, work, emotional labour, and service.

An analysis of the Scopus database highlights the importance of the following topics – "HRM, hospitality, tourism, organizational culture, talent management, and training" [5]. Hosen et al. (2022) highlight the following "streams": "training design and work performance, individual factors and work performance, job satisfaction as a mediator, and qualitative reviews of the hospitality and tourism HRD literature" [6]. According to [7], the most significant subtopic is the "behavioural dimension". This is followed by "management and leadership" and "occupational health and safety" [7]. "Performance evaluation", "training", "development and career", "health workforce", "industry 4.0 – artificial intelligence", "communication", "job evaluation and wage management", and "bureaucratic procedures" are less present [7]. Quantitative research methods dominate [7].

Practices that affect the "well-being and mental health" of employees were also investigated. These are: "working time flexibility", "support from superiors and colleagues", "career development opportunities", "organizational justice and compensation policies", "healthy and safe work environment", "acknowledgment of achievement", and "participation and decision-making opportunities". [8]

Interest in HRM in healthcare is growing. Research topics are grouped into clusters: "performance, hospital/COVID-19, job satisfaction, human resource management, occupational/mental health, and quality of care". The most represented co-occurring keywords are: "human resource management, job satisfaction, nurses, hospitals, health services, quality of care, COVID-19, and nursing". The most important "research orientations" are: management, nursing, health policy services, and healthcare sciences services [9].

Factors influencing HRM in healthcare are: external environment ("economic conditions, government policies, industry competition, and technological advancements") and internal environment ("workforce demographics, technological advancements, and human resource quality") ([10], pp. 1229-1230). It is necessary to understand the role that HRM plays in healthcare services and adapt HRM strategies accordingly. [10]

In the mentioned field [10]:

- The main challenges are:
    - Lack of manpower;
    - Uneven distribution of healthcare workers;
    - Insufficient training opportunities.

- Key additional issues are:
  - Inadequate training programs;
  - Bureaucratic obstacles;
  - Administrative inefficiency.

Emotional intelligence (EI) is of great importance in HRM of healthcare institutions. EI should be viewed from the perspective of its impact on the competitive advantage of healthcare institutions [11]. Also, it is necessary to encourage employees to speak up [12].

Analysing the literature, Karimivand (2023) proposes a model in which job satisfaction is influenced by the nature of the job, wages, workplace conditions, human relations in the workplace, career promotion opportunities, organizational justice, and organizational climate [13]. Organizational climate is influenced by ethical climate and organizational support. There is a bidirectional influence between job satisfaction and organizational commitment. Organizational commitment influences organizational loyalty and organizational citizenship behaviour. Organizational loyalty affects organizational behaviour. Job satisfaction affects organizational loyalty and organizational citizenship behaviour.

When it comes to the situation in the Republic of Serbia, it is important to point out that human resources represent one of the sources of potential development of health tourism on its territory ([14], [15]). Also, it was established that "culture dimensions are predictors of entrepreneurial orientation dimensions" [16].

Garabinović & Nikitović (2024) analysed the number of employees in health and social work, the number of doctors, and the number of dentists based on data from the Statistical Office of the Republic of Serbia. In the period from 2001 to 2022, the number of employees in the field of health and social work in the Republic of Serbia increased by an average of 84.7, i.e. 0.1% compared to 2001. When it comes to chain changes, the number of employees increased by 79.6 on average, i.e. by 0.1% per year. The maximum change in the number of employees was recorded in 2015, when looking at the base and chain change, while the minimum change was recorded in 2020 (base), and in 2006 (chain). [1]

When discussing the number of doctors, in the mentioned period, the average total number of doctors was 20,432.6, general practitioners 3,218.4, doctors in specialist training 2,389.8, and specialists 14,824.4. The total number of doctors, general practitioners, and doctors in specialist training increased on average, while the number of specialist doctors decreased. [1]

In the period from 2006 to 2022, the average number of dentists was 1,945.9. The maximum number was recorded in the first year and the minimum in the last year of the observed period. On average, the number of dentists decreased by 546.2 per year, i.e. 22.2% compared to 2006, and by 60.2, i.e. 3.0%, when observing chain changes. [1]

The results showed that the majority of respondents who have education in the field of healthcare or work/have worked in that field, and who are also familiar with the topic of health tourism, want to work in the territory of the Republic of Serbia, in an urban area, in a state-owned institution, in an institution that provides some of the standard forms of healthcare (as opposed to health tourism), as an employee of a business entity. Health tourism as a main or additional activity is the preference of about 28% of respondents. The most important motives for working in institutions dealing with health tourism are (present in most respondents in order of decreasing importance): higher basic salary, opportunities for rest and recreation of employees, attractive location, and contact with people from other parts of Serbia and the world. They have the highest level of knowledge (high, but not very high) about spa, wellness, and aesthetic tourism, while regarding health tourism in general, as well as medical and dental tourism separately, their knowledge is neither low nor high. They rated their managerial competencies as high. Within the scope of managerial competencies, they rated their organizational competencies the highest. This is followed by planning, controlling, and leading. On a five-point scale from very bad to very good, they have only a good command of the English language. Their knowledge of German is neither good nor bad. Respondents believe that the elements of the healthcare system are highly attractive for the development of health tourism. The most important is dental practice. This is followed by institutional accommodation with medical care, specialist medical practice, hospital activities, general medical practice, and other healthcare services. According to the current state of development of health tourism in certain elements of the healthcare system, only dental practice shows a high level of development. Other elements are neither low nor high. Many non-financial effects of entering the field of health tourism have also been observed. [17]

The subject of this paper is the specificities of human resource management in health tourism institutions in comparison with traditional healthcare institutions in the Republic of Serbia. The aim of this paper is to establish whether the situation is better in health tourism institutions compared to traditional healthcare institutions in the Republic of Serbia when it comes to:

- The number and qualifications of human resources,
- Relationships among staff (this term includes both employees and managers),
- The attitude (in the following text, this term refers to the cognitive, emotional, and behavioural disposition towards the use and management of institutional assets) of staff towards assets,
- The relationship between patients and staff, and
- The attitude of patients towards assets.

METHODOLOGY

The research was based on a questionnaire that was administered to respondents in printed form. The research implementation period was June–July 2024. In addition to general questions about the person completing the survey, other questions were grouped into four units:

- Number and qualifications of human resources,
- Mutual relations among staff,
- Attitudes of staff towards assets, and
- Patients' relationships with employees and their attitudes towards assets.

The questions in the mentioned units were created in the form of statements. The respondents' agreement with these statements was determined using a five-point Likert scale:

- 1 – I completely disagree,
- 2 – I disagree,
- 3 – I neither agree nor disagree,
- 4 – I agree, and
- 5 – I completely agree.

The sample of respondents consisted of individuals who are familiar with the concept and characteristics of health tourism. In addition to the stated basic condition, respondents could be persons who additionally meet at least one of the following conditions regarding education and employment:

- Education in the field of healthcare – secondary and/or higher.
- Employment in the field of healthcare – currently and/or in the past.

The number of questionnaires that were taken into consideration was 107. Figure 1 contains data on the structure of the sample of respondents.

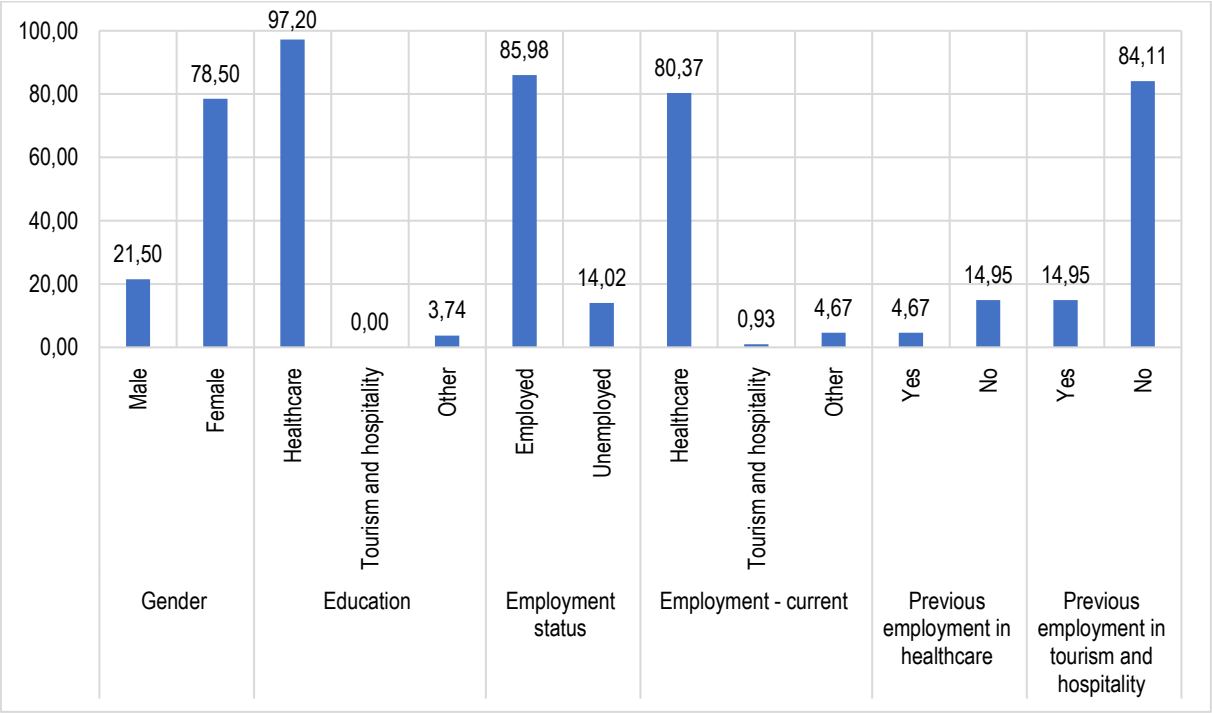

Figure 1. Sample structure of respondents (authors)

The majority of respondents have secondary/higher education in the field of healthcare (97.20%), are employed (85.98%), are currently employed in healthcare (80.37%), were not previously employed in tourism and hospitality (84.11%), and are female (78.50%).

RESULTS AND DISCUSSION

Table 1 shows respondents' agreement with statements about the number and qualifications of human resources.

Table 1. The number and qualifications of human resources in institutions dealing with health tourism are better compared to traditional healthcare institutions (authors)

	Rating of agreement with statements											
	I completely disagree		I disagree		I neither agree nor disagree		I agree		I completely agree		Average score	
Elements*	No.	%	No.	%	No.	%	No.	%	No.	%	No.	Description
Number of employees	4	3.74	13	12.15	24	22.43	44	41.12	22	20.56	3.63	I agree
Number of medical employees	2	1.87	9	8.41	22	20.56	49	45.79	25	23.36	3.80	I agree
Number of non-medical employees	2	1.87	11	10.28	43	40.19	35	32.71	16	14.95	3.49	I neither agree nor disagree
Expertise of employees	3	2.80	9	8.41	50	46.73	34	31.78	11	10.28	3.38	I neither agree nor disagree
Expertise of medical employees	7	6.54	8	7.48	43	40.19	40	37.38	9	8.41	3.34	I neither agree nor disagree
Expertise of non-medical employees	4	3.74	9	8.41	45	42.06	43	40.19	6	5.61	3.36	I neither agree nor disagree
Number of persons in management positions	3	2.80	6	5.61	41	38.32	44	41.12	13	12.15	3.54	I agree

	Rating of agreement with statements											
	I completely disagree		I disagree		I neither agree nor disagree		I agree		I completely agree		Average score	
Elements*	No.	%	No.	%	No.	%	No.	%	No.	%	No.	Description
Expertise of managers of institutions	3	2.80	7	6.54	34	31.78	48	44.86	15	14.02	3.61	I agree
Expertise of managers of organizational units	3	2.80	6	5.61	37	34.58	44	41.12	17	15.89	3.62	I agree
Notes: * The elements of human resources.												

Respondents agree that the state regarding the number of employees and, separately, the number of medical employees is better in the field of health tourism. Unlike medical employees, the respondents had a neutral opinion regarding the number of non-medical employees. When discussing the expertise of employees, the attitude of the respondents is also neutral.

Respondents agree that the number of persons in management positions, as well as the expertise of managers of institutions and managers of organizational units, is better in the field of health tourism compared to traditional healthcare institutions.

Table 2 presents the respondents' agreement with statements regarding relationships among staff in institutions involved in health tourism, in comparison with those in traditional healthcare institutions.

Table 2. Relationships among staff are better in institutions dealing with health tourism compared to traditional healthcare institutions (authors)

	Rating of agreement with statements											
	I completely disagree		I disagree		I neither agree nor disagree		I agree		I completely agree		Average score	
Statements*	No.	%	No.	%	No.	%	No.	%	No.	%	No.	Description
Employees	3	2.80	5	4.67	29	27.10	43	40.19	27	25.23	3.80	I agree
Medical and non-medical staff	3	2.80	11	10.28	42	39.25	37	34.58	14	13.08	3.45	I neither agree nor disagree
Medical staff	3	2.80	5	4.67	25	23.36	53	49.53	21	19.63	3.79	I agree
Medical staff of the same organizational unit	3	2.80	6	5.61	24	22.43	53	49.53	21	19.63	3.78	I agree
Medical staff of different organizational units	3	2.80	3	2.80	24	22.43	62	57.94	15	14.02	3.78	I agree
Non-medical staff	3	2.80	3	2.80	47	43.93	39	36.45	15	14.02	3.56	I agree
Non-medical staff of the same organizational unit	3	2.80	5	4.67	48	44.86	30	28.04	21	19.63	3.57	I agree
Non-medical staff of different organizational units	3	2.80	8	7.48	44	41.12	39	36.45	13	12.15	3.48	I neither agree nor disagree
Persons in management positions	3	2.80	0	0.00	30	28.04	60	56.07	14	13.08	3.77	I agree
Managers of organizational units	3	2.80	4	3.74	31	28.97	55	51.40	14	13.08	3.68	I agree
Managers of organizational units and managers of healthcare institutions	4	3.74	4	3.74	27	25.23	60	56.07	12	11.21	3.67	I agree
Persons in management positions and employees	3	2.80	3	2.80	29	27.10	48	44.86	24	22.43	3.81	I agree

	Rating of agreement with statements											
	I completely disagree		I disagree		I neither agree nor disagree		I agree		I completely agree		Average score	
Statements*	No.	%	No.	%	No.	%	No.	%	No.	%	No.	Description
Managers of organizational units and their employees	3	2.80	8	7.48	26	24.30	51	47.66	19	17.76	3.70	I agree
Managers of healthcare institutions and their employees	3	2.80	9	8.41	30	28.04	52	48.60	13	12.15	3.59	I agree
Notes: * Relationships between the specified staff elements.												

Respondents agree that the relationship between employees is better in health tourism institutions compared to traditional healthcare institutions. The position regarding the relationship between medical and non-medical staff is neutral. A better relationship is noted among medical staff, both within the same and between different organizational units. Better relations are also present among non-medical staff, especially within the same organizational unit, compared to relations between different organizational units (neutral).

The relationship between persons in management positions is better, both among managers of organizational units and between managers of organizational units and managers of healthcare institutions.

There is also progress in the relationship between persons in management positions and employees. The stated situation is better between managers of organizational units and their employees compared to the relationship between managers of healthcare institutions and their employees.

Table 3 presents the respondents' agreement with statements about staff attitudes towards assets in institutions involved in health tourism, in comparison with those in traditional healthcare institutions.

Table 3. Staff attitudes towards assets in institutions dealing with health tourism are better compared to traditional healthcare institutions (authors)

	Rating of agreement with statements											
	I completely disagree		I disagree		I neither agree nor disagree		I agree		I completely agree		Average score	
Statements*	No.	%	No.	%	No.	%	No.	%	No.	%	No.	Description
Employees – Fixed assets	3	2.80	2	1.87	30	28.04	47	43.93	25	23.36	3.83	I agree
Employees – Current assets	2	1.87	6	5.61	31	28.97	54	50.47	14	13.08	3.67	I agree
Persons in managerial positions – Fixed assets	3	2.80	2	1.87	31	28.97	53	49.53	18	16.82	3.76	I agree
Persons in managerial positions – Current assets	3	2.80	5	4.67	29	27.10	50	46.73	20	18.69	3.74	I agree
Notes: * The attitudes of different categories of staff towards various types of assets.												

Respondents agree that the attitude of employees towards fixed and current assets is better in health tourism institutions compared to traditional healthcare institutions. Also, respondents agree that the attitude of persons in managerial positions towards fixed and current assets is better in health tourism institutions compared to traditional healthcare institutions. When it comes to the attitudes of employees and managerial staff, both groups show a more favourable attitude towards fixed assets.

Table 4 presents respondents' agreement with statements regarding the relationship between patients and employees, as well as their views on patients' attitudes towards assets in institutions involved in health tourism, compared to those in traditional healthcare institutions.

Table 4. The relationship between patients and employees, and patients' attitudes towards assets in institutions dealing with health tourism are better compared to traditional healthcare institutions (authors)

	Rating of agreement with statements											
	I completely disagree		I disagree		I neither agree nor disagree		I agree		I completely agree		Average score	
Statements*	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**Description**
Patients – Employees	6	5.61	3	2.80	17	15.89	43	40.19	38	35.51	3.97	I agree
Patients – Medical employees	3	2.80	4	3.74	16	14.95	55	51.40	29	27.10	3.96	I agree
Patients – Non-medical employees	4	3.74	5	4.67	28	26.17	48	44.86	22	20.56	3.74	I agree
Patients – Fixed assets	2	1.87	5	4.67	37	34.58	43	40.19	20	18.69	3.69	I agree
Patients – Current assets	3	2.80	3	2.80	32	29.91	51	47.66	18	16.82	3.73	I agree
Notes: * The relationship between patients and the specified type of staff, as well as patients' attitudes towards the specified type of assets.												

Respondents agree that relationships between patients and employees in institutions dealing with health tourism are better than in traditional healthcare institutions. Patient relations are better with medical employees compared to non-medical employees. Respondents also agree that, in institutions dealing with health tourism, patients' attitudes towards assets are better, primarily towards current assets and then fixed assets.

CONCLUSION

The research established that staffing levels are better in health tourism institutions compared to traditional healthcare institutions. The situation is similar when it comes to medical employees, while the attitude regarding non-medical employees is neutral. When discussing the expertise of employees, respondents neither agree nor disagree. The number and expertise of managers of institutions and organizational units are better.

The relationship between employees is better in health tourism institutions compared to traditional healthcare institutions. This was observed in the relationship between medical employees within the same, but also between different organizational units. The assessment of the relationship between medical and non-medical staff is neutral. The relationship between non-medical staff is better, which is reflected in the relationship of these staff members within the same organizational unit, while the relationship between different organizational units is neutral.

The relationship between persons in management positions is better, including the relationship between managers of organizational units, as well as the relationship between managers of organizational units and managers of healthcare institutions. The relationship between managers and employees is better, especially when it comes to managers of organizational units.

The attitude of employees and managerial staff towards assets is more favourable, especially towards fixed assets.

The relationship between patients and employees (especially medical employees) is better, as is the attitude of patients towards assets (especially current assets).

It is concluded that health tourism institutions have a better situation in terms of the number of human resources, mutual relationships between employees, relationships between employees and assets, relationships between patients and employees, and relationships between patients and assets. Therefore, the subject and aim of this paper have been achieved.

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URBAN AGRICULTURE AND SUSTAINABLE DEVELOPMENT

MARKOVIĆ Milan[1], SIMONOVIĆ Zoran[2], MARJANOVIĆ Ivana[3], TSAPLES Georgios[4]

[1] Innovation Centre of the University of Niš, Niš (SERBIA), ORCID 0000-0002-9617-6697
[2] Institute of Agricultural Economics, Belgrade (SERBIA), ORCID 0000-0002-2769-6867
[3] Faculty of Economics, University of Niš, Niš (SERBIA), ORCID 0000-0002-9526-0467
[4] Department of Business Administration, University of Macedonia, Thessaloniki (GREECE), ORCID 0000-0002-6979-3884

E-mails: markovicmilan89@gmail.com; zoki@medianis.net; ivana.veselinovic@eknfak.ni.ac.rs; gtsaples@uom.edu.gr

ABSTRACT

Urban agriculture is a concept that is becoming increasingly important in ensuring food security in urban areas. Global disruptions and accelerating urbanization have raised concerns among citizens and policymakers about maintaining a continuous and sufficient food supply for cities. In addition, climate change and the decreasing number of green spaces in cities highlight the need for environmental solutions to build more resilient cities. Unlike rural agriculture, whose primary objective is profit, urban agriculture focuses more on the social and environmental dimensions of sustainable development. This paper demonstrates the socio-economic benefits of this concept, which has been extensively studied in the scientific and professional literature and is increasingly being implemented in the practices of larger cities.

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INTRODUCTION

The 2020 pandemic brought numerous challenges to economies within a short period, including a health crisis, economic difficulties, and social problems (including poverty). One of the major consequences of the spread of the virus was disruptions in supply chains, which made it difficult to meet basic human needs. In particular, there were risks associated with insufficient production and food insecurity (a food crisis), primarily in large cities. As cities are highly dependent on food supplies, the risk of food insecurity can be mitigated through urban farming practices and mechanisms [1]. The diversification of food sources is also necessary to reduce economic and social risks. Urban agriculture serves as an additional source of food, especially in rapidly growing cities. Abdoelah et al. (2023) highlight the significance of the FAO's urban strategies, which can contribute to increasing food availability and overall food security [1].

Home gardening and urban agriculture practices have become crucial tools for securing the urban food supply during the COVID-19 crisis [8]. Moreover, this approach to food production offers advantages in other types of crises, such as wars, trade restrictions, and global political turmoil (e.g., the Russo-Ukrainian conflict) [17]. Based on the experiences of cities, urban agricultural activities are most often related to crop production (vegetables and fruits), while, in terms of animal husbandry, beekeeping is the dominant branch of livestock production. Consumers, producers, and the entire local community can benefit from urban agriculture. It provides healthy, fresh, and high-quality food to the urban population, provided that it is produced on suitable land and in areas where pollution levels are acceptable. Through this concept, consumers have access to fresh, readily available products at affordable prices due to reduced transportation costs, while producers can generate additional income, as urban agriculture often provides an important source of revenue for economically disadvantaged groups. Promoting health and healthy lifestyles, supporting education, and fostering a socially responsible community are among the key social benefits of urban agriculture [19; 15]. Overall, it is a concept that supports the ecological, social, and economic development of cities.

Urban agriculture stands out as one of the approaches to achieving the goals of sustainable and more resilient cities. Although it has existed for a long time, it has attracted increasing attention in scientific and professional circles over recent decades. Given its links with numerous disciplines, this concept attracts researchers from various fields, including economics, urban planning, agricultural policy, and sociology. This stems from the fact that the implementation of nature-based solutions requires the engagement of experts from different disciplines. Urban agriculture is becoming an increasingly important component of urban development strategies, and its practices and solutions are being implemented more frequently, particularly in large cities around the world.

Since 2007, the number of people living in urban areas has exceeded the number living in rural areas [14]. It is estimated that this number will continue to grow [7]. Developing countries are particularly affected by rapid urbanization, as the number of people wishing to live in larger urban centres continues to increase [8]. Although this process has contributed to strong economic growth, it has also brought negative consequences, such as declining air quality, land degradation caused by deforestation, and the loss of urban flora and fauna. This paper aims to clarify the benefits and challenges associated with the implementation of urban agricultural practices, as their application in developing countries is still at an early stage. The paper is intended to assist: (a) local communities in strategically planning urban development, (b) organizations addressing environmental challenges, and (c) scholars from various social science disciplines.

THE IMPORTANCE OF THE CONCEPT OF URBAN AGRICULTURE

Urban agriculture includes the cultivation of plants and the raising of animals in homes, on homesteads, or on plots in urban and suburban areas [14]. In most cases, it is associated with primary crop production, but it also includes animal husbandry, beekeeping, and other branches of agriculture. Urban agriculture is based mainly on the production of vegetables and fruits that are marketed to the local population through shops and restaurants. This provides fresh food of proven origin and reduces the risk of spoilage because long-distance transportation is not required. The importance of urban agriculture becomes particularly evident during crises such as the recent pandemic. In such situations, it can help overcome bottlenecks in supply chains and plays an important role in ensuring food security. However, urban agriculture cannot serve as the primary source of food for the urban population but can only complement the food supply provided by rural agriculture.

There are also certain indirect macroeconomic effects of this type of agriculture, such as contributing to gross domestic product and ensuring national food security [20]. An increased food supply in cities allows: (a) a reduction in overall costs, which can lead to financial savings at all levels; (b) a reduction in food prices and better control of inflation; and (c) the replacement of imported agricultural commodities with domestic substitutes [12]. In addition, products from rural agriculture can be exported to a greater extent, which, at the macroeconomic level, contributes to the stabilization of the balance of payments by increasing exports and generating higher foreign exchange inflows. At the same time, dependence on agricultural imports is reduced.

All forms of urban agriculture promote organic food, as well as food from verified production systems that do not rely on agricultural practices harmful to the environment. The resulting products are subject to strict quality control, which can have a positive impact on public health. Unlike conventional (intensive) agriculture, urban agriculture tends to preserve rare plant varieties, indicating certain similarities with organic production. Furthermore, this type of production can contribute to improving air quality by increasing urban greenery. The environment can also be preserved because this concept focuses on expanding green spaces and even creating urban forests. Benedetti et al. (2024) point out that urban agriculture seeks to promote a healthy environment, improve habitat quality, and build fairer and more sustainable cities [2]. Urban agriculture also has important social significance because it promotes social inclusion by creating opportunities for social interaction in landscaped public spaces (e.g., urban gardens).

There are many forms through which urban agriculture is implemented, the best known being urban plots created by converting abandoned land into arable land near city centres (urban gardens), rooftop gardens (green roofs), and communal, social, or residential gardens located between buildings within cities. Urban agriculture encompasses all spaces in or around urban areas where edible and inedible vegetation can be grown [4]. Urban gardens can be either private or public. It should be emphasized that home gardens (as well as gardens on the terraces of individual apartments or houses) are usually not considered forms of urban agriculture because food is produced primarily for household consumption or for neighbours, relatives, and friends rather than for sale. Public gardens, on the other hand, are typical examples of urban agriculture, and their establishment depends on compliance with local regulations. Local authorities (city governments) play a leading role in their development.

Urban gardens can be established within various educational, social, and healthcare institutions. In schools, as representative educational institutions, gardens have educational value. Their purpose is to connect practical knowledge with theory and the subjects that pupils study. In this way, pupils can learn through hands-on experience. In hospitals and other healthcare institutions (e.g., nursing homes), gardens can have therapeutic value. Urban agricultural activities also have significant social and cultural importance in areas surrounding churches or cultural monuments. Rooftop gardens are another specific form of urban agriculture that can improve the efficiency of stormwater management through the use of rainwater. These practices are particularly widespread in areas seeking alternative solutions to the problem of limited land availability for urban agriculture. Various herbs can be cultivated on rooftop gardens, while vegetables and fruits are traditionally grown in community gardens as well as in gardens located in suburban areas.

URBAN AGRICULTURE AND THE DIMENSIONS OF SUSTAINABLE DEVELOPMENT

The principles underlying sustainable development can be achieved through the agricultural sector [11]. This paper focuses on urban agricultural production and highlights all the dimensions of sustainable development that can be achieved through this approach. In short, urban agriculture contributes to the overall well-being of urban residents.

The role of urban agriculture in the economic dimension of sustainable development includes the diversification of food supply sources and the resulting reduction of risks, the generation of additional income for individuals, the reduction of supply costs (transportation and storage costs), the development of urban tourism, and increased employment. Lower costs can lead to lower product prices, which, in turn, can reduce poverty in cities, given that low-income households spend a large proportion of their income on agri-food products. Although certain economic benefits can be achieved, the primary objective of urban agriculture is not predominantly economic. Meeting household needs, increasing the level of food self-sufficiency among the urban population, and strengthening the connection with the natural environment are certainly more important. In urban agriculture, social and environmental benefits are equally important.

The social benefits are reflected in the interaction among all actors involved in this type of production and consumption, as well as in increased social inclusion. Urban agriculture satisfies the need for food as a basic human need and provides opportunities for social interaction, recreation (both physical and mental), and relaxation (stress reduction). Moreover, it enables interactions among different individuals through the exchange of knowledge and experience and by encouraging others to engage in urban farming. If urban gardens are established within schools, they can provide additional educational opportunities by linking practical activities with various subjects (biology, ecology, chemistry), fostering work habits, and developing environmental awareness. Accordingly, urban agriculture has an educational role because it promotes learning about healthy and traditional lifestyles and work. There are also health benefits associated with consuming fresh, high-quality (organic) food, which is the most common product of urban agriculture. Tourists can enjoy a variety of attractions associated with urban gardens, contributing to their relaxation regardless of whether they come from other parts of the country or from abroad. Consequently, urban gardens can be promoted as an attractive tourism product, enabling cities to compete with rural tourism. It is evident that urban agriculture can serve as a means of improving the quality of life in cities. Moreover, it enables urban residents to reconnect with nature (which is particularly important in large cities), encourages their participation in society (social activism), and promotes cooperation among local stakeholders [5]. Work in urban gardens can also be offered to unemployed individuals, thereby contributing to social justice and the development of more inclusive cities.

On the other hand, the environmental functions of this concept are highly visible. Greening urban areas, reducing the carbon footprint, and contributing to climate change mitigation are clear benefits for environmental and ecosystem protection. In addition, urban agriculture contributes to the improvement of the urban environment because it often involves repurposing neglected public spaces within cities, while its environmental benefits are further enhanced by the organic methods used in food production. Another important benefit of urban agriculture is the enhancement of biodiversity. In urban areas, biodiversity loss and landscape degradation are growing concerns. Therefore, through the cultivation of various plant species, urban agriculture can contribute to biodiversity conservation. In addition, it improves the visual appearance of cities and promotes environmental awareness. Urban agriculture can also help reduce food waste, which is often associated with the long-distance transportation of food from rural and other areas. This is particularly important given the increasing amount of waste generated in cities and the global trend of rising food prices [13]. All of these benefits contribute to the creation of more sustainable and resilient cities.

Todorov (2024) states that sustainable development is associated with the application of ethical principles as well as with environmental valuation; in this context, urban agriculture plays an invaluable role [18]. Accordingly, green cities are emerging as a means of protecting natural resources, mitigating climate change, ensuring the efficient use of natural resources (land, water, and energy), and improving socio-economic conditions in urban areas [18]. Urban agriculture, as one of the ecosystem services, supports the sustainability of cities, which can also have positive effects on attracting tourists who are becoming increasingly environmentally conscious [3].

THE MULTIFUNCTIONAL CHARACTER OF URBAN AGRICULTURE

Agriculture has always been considered the main source of food for humanity, thereby satisfying basic human needs [20]. This has traditionally been its primary function, while its other (developmental) effects have often been unjustifiably neglected. With the development of the industrial and service sectors, the impression has often been created that agriculture has only minor economic importance within the economic structure of countries, particularly developed ones. However, the crises that began in 2008 led to a redefinition of the role of the agricultural sector, which proved to be relatively resilient to adverse global shocks and even helped reduce the negative effects of crises on certain macroeconomic indicators [10]. Additionally, there is growing evidence of the contribution of this sector to supporting related activities (e.g., tourism), as well as to the development of more inclusive and sustainable cities through urban agriculture [6]. The concept of urban agriculture has attracted considerable attention from researchers in economics, spatial and urban planning, and environmental protection over recent decades. Researchers have examined the role of urban agriculture in achieving food security in cities, reducing carbon emissions, protecting urban flora and fauna, and fostering local biodiversity.

The process of intensive urbanization has brought numerous challenges for the urban population. Concerns about increasing migration to major cities continue to grow due to rising pollution, food insecurity, and inadequate urban planning. Investors are often motivated by the desire to maximize profits, while local governments are primarily concerned with generating tax revenues. As a result, opportunities to preserve and expand green spaces in cities are frequently reduced. Urban agriculture is a nature-based solution (ecosystem service) that can help address some of the problems faced by urban communities [2]. It is particularly important from the perspective of improving air quality, mitigating climate change, and addressing social issues such as education, recreation, and mental health. Through its multifunctional character, this type of production directly contributes to improving the quality of the urban environment. Urban agriculture provides numerous benefits, including food self-sufficiency, social benefits, the conservation of agrobiodiversity, climate change mitigation, and the provision of ecosystem services [9].

Table 1 provides an overview of the multidimensional nature of urban agriculture. It presents its links with different scientific disciplines, all dimensions of sustainable development, and various stakeholder groups. Furthermore, urban agriculture practices generate multiple positive effects across different dimensions and aspects of social life. In high-income and economically developed countries, urban agriculture primarily realizes its cultural, environmental, and social functions, whereas in less developed countries its primary role is to provide an additional source of food (economic significance) [15].

Table 1. The multidimensional character of urban agriculture

Connection with the sciences/scientific fields	Dimensions of sustainable development	Benefits of urban agriculture	Stakeholders
Economy Urban/spatial planning Agriculture Environmental protection Sociology	Economic Ecological/ Environmental Social	Food self-sufficiency Connection with nature High-quality, fresh food Waste reduction Healthy environment Social interactions Relaxation and leisure Education Poverty reduction Additional income generation Increased exports	Population (producers and consumers) Local self-government Economic, social, and environmental policymakers NGOs Other local stakeholders

Source: Authors' contribution

The implementation of urban agriculture also brings certain challenges:

- The issue of regulating land ownership, as plots are mostly located on public or communal land in or around larger cities;
- The existence or absence of legal regulations governing the cultivation of plants and the raising of animals on such plots;
- Concerns about the possible increased use of pesticides and the occurrence of pests;
- High land prices in cities and the limited availability of land for agricultural purposes in urban areas.

Therefore, there is a need for adequate public policies at both the national and local levels that are complementary and effectively regulate urban agriculture. Local governments play a vital role in providing public spaces for urban agriculture and making them available for lease. Citizens can also participate in identifying suitable areas within their local communities when invited to do so.

Nevertheless, urban agriculture faces several additional challenges:

- Potential theft and vandalism, particularly in less developed countries where public awareness of the environmental and social importance of urban agriculture remains limited;
- The presence of animals;
- Air pollution (airborne particles can reduce the quality of leafy vegetables such as cabbage and lettuce) and soil contamination (particularly affecting root vegetables) in urban environments. One solution to reducing the exposure of vegetable production to harmful atmospheric pollutants is indoor cultivation in greenhouses [20];
- The distribution of products in cases of joint ownership.

Finally, it is essential to increase the interest and engagement of all stakeholders in urban agriculture, given its considerable potential. At the same time, traditional forms of agricultural production should not be neglected, as rural agriculture will undoubtedly remain the primary producer and supplier of food in the foreseeable future.

CONCLUSION

The growing importance of urban agriculture has become particularly evident during and after the global pandemic that affected the entire world. This crisis has increasingly highlighted the issue of food security (self-sufficiency), especially in urban areas. Difficulties in food transportation, disrupted supply chains, and reduced food production have all emphasized the importance of urban agriculture practices, given the justified concerns about shortages of agricultural and food products. In the event of future pandemics, this concept can play a significant role in promoting social sustainability. In addition, the continuous increase in food prices provides a compelling reason for greater reliance on this type of production.

The concept of urban agriculture is based on achieving the following objectives: producing healthy and safe food, providing faster and more direct access to fresh food for people living in cities, protecting urban fauna (butterflies, bees, birds), encouraging organic production, and promoting biodiversity. Urban and community gardens can serve as places where people gather, enjoy recreational activities, and relax, making them important for socio-cultural sustainability as well. This concept is closely related to urban development and is consistent with all dimensions of sustainable development [16]. Urban agriculture practices contribute to several Sustainable Development Goals, including sustainable cities and communities, zero hunger, and no poverty. In addition, they also support the goals related to responsible consumption and production and climate action.

The importance of the analysed concept is expected to increase due to the continuing rise in food prices and the growing frequency of global crises. Although urban agriculture may involve relatively high costs, its socio-ecological benefits for cities are substantial. To maximize these benefits, further education and the promotion of this type of production are needed through the joint efforts of scientific research institutions and governmental and non-governmental organizations.

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ATTITUDES ANALYSIS TOWARDS GENETICALLY MODIFIED FOOD

Ozren Kronja[1], Tamara Marković [2], Helena Šlogar[3]

[1]*Algebra Bernays University, Zagreb, Croatia – Europe ORCID 0009-0003-5171-5727*
[2] *City of Zagreb, Zagreb, Croatia ORCID 0009-0009-6558-1292*
[3] *University of Rijeka, Faculty of Economics and Business, Rijeka, Croatia, ORCID 0000-0002-7240-1140*

E-mails: ozren.kronja@algbera.hr, tamara.markovic@zagreb.hr, helena.slogar@uniri.hr

ABSTRACT

Hunger, food safety, and unsustainable agriculture are currently among the main global issues. Agricultural technology is focused on making agriculture and the food industry sustainable and profitable. Healthy diets, food waste, and food origin are issues that concern European citizens, with Croatians having general mistrust towards genetically modified food. The research problem was to determine Croatian citizens' attitudinal dimensions and differences towards genetically modified food considering the level and method of obtaining information. Quantitative, descriptive research was conducted using an online survey. The questionnaire was forwarded to respondents via digital channels (snowball sampling method). The results have shown the existence of three factors that group attitudes towards genetically modified food using exploratory factor analysis: (1) impact on health & general acceptance, (2) impact on the environment, and (3) impact on the economy. Overall agreement considering the positive effect of genetically modified foods on all three factors is moderate to low, with the "health & general acceptance" factor scoring the lowest. There was no statistically significant difference for any factor considering whether respondents were informed about genetically modified food, source of information (scientific vs. non-scientific), and time of informing; although there are tendencies for more positive attitudes towards genetically modified food among informed respondents, especially when they gathered information via scientific sources.

***Keywords**: genetically modified food, GMO, informing, attitudes, ecology, economy, health*

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INTRODUCTION

Hunger, food safety, and unsustainable agriculture are currently among the main global issues. Today, every 9th person in the world is malnourished (795 million). By 2050, the world's population will reach 9.1 billion, 34% higher than today. Annual cereal production will need to rise to about 3 billion tonnes from 2.1 billion today, and annual meat production will need to increase by over 200 million tonnes to reach 470 million tonnes [17]. Agritech (agricultural technology) is focused on making agriculture and the food industry sustainable and profitable, and it is also one of the fastest-growing industries in the world. Between 1996 and 2014, crop biotechnology was responsible for the additional global production of 158.4 million metric tons of soybeans and 321.8 million tons of corn. The technology has also contributed an extra 24.7 million tons of cotton lint and 9.2 million tons of canola [3].

An increasingly worrisome challenge is climate change, affecting developing countries disproportionately. A third challenge that has emerged with the rise in energy prices is the rapid increase in the use of agricultural feedstock for biofuels, causing additional scarcity in food and feed markets [17]. This will lead to the usage of mostly renewable and still non-renewable sources from earth, sea, and oceans by transforming waste into valuable resources and sustainable food/biological products, and bioenergy. Bioeconomy is key in transforming society from fossil fuel dependency through changes in the way we use resources in all aspects of everyday life. The wellbeing of future European citizens is dependent on this transformation. In accordance with the UN Sustainable Development Goals, the European Commission proposes a decrease in food waste as part of the "farm to table" strategy [8].

The Special Eurobarometer Food Safety in the European Union report from 2019 reveals the general mistrust of Croatians towards genetically modified food, with it being the shared second top concern when it comes to food safety after food poisoning from bacteria. It also showed that TV is the most prominent media channel for obtaining information and that scientists are the most trusted sources of information [15].

The research problem in this paper is to determine Croatian citizens' attitudinal differences towards genetically modified food considering their level of information about it. The problem can be further operationalized through four goals: 1. Determine fundamental factors in attitudes towards genetically modified food; 2. Analyse attitudinal differences between persons who informed themselves about genetically modified food vs. those who never did; 3. Analyse attitudinal differences considering sources of information (scientific vs. non-scientific); and 4. Analyse attitudinal differences considering information recency.

The following hypotheses are set for each research problem: H1: attitudes towards genetically modified food have three fundamental factors: (1) health, (2) economy, and (3) environment; H2: persons who informed themselves about genetically modified food have a more positive attitude towards it than persons who are not informed at all; H3: persons who used scientific sources to gather information have more positive attitudes towards genetically modified food than persons who used only non-scientific sources; and H4: persons who were recently informed about genetically modified food have more positive attitudes towards it.

The paper is structured in the following way: firstly, we present an overview of existing research considering attitudes and information about genetically modified food, followed by methodology details and research results, ending with discussion and conclusions.

LITERATURE OVERVIEW

At the end of the 20th century, the world became more familiar with genetic engineering, and in 1983, tobacco resistant to antibiotics was developed, which was used only for experimental purposes [14]. Food with non-naturally occurring (DNA) modifications is called "genetically modified food", and the process is usually called "genetic engineering". In most cases, this is done by introducing genes from another organism. Today, most genetically modified food comes from plants, but in the future, we can expect genetically modified microorganisms and animals. Nowadays, genetic modification is mostly done to improve crop yield by introducing genes that are resistant to plant diseases or more tolerant to herbicides. The World Health Organization and the Food and Agriculture Organization collaborate on the Codex Alimentarius Commission in the development of guidelines, standards, codes of practice, and different recommendations concerning food and genetically modified organisms [32].

Advantages of genetically modified food include increased quality of plants, which improves their production, and lower use of pesticides due to the inclusion of insect-resistant genes. Genetically modified crops can increase yield and produce higher amounts of food in shorter periods, which is important in terms of the growing world population and limited arable land. Genetic engineering has also enabled fruit and vegetable production in laboratories during off-seasons. In the future, it will be possible to use GMO technology in the production of vaccines and other medicines [2]. On the other hand, due to genetic modification of food, insects and vermin could become immune to different pesticides, or even some viruses could become more virulent due to contact with new genes. Finally, it is possible that genetically modified organisms negatively impact biodiversity or jeopardize human health [18].

Better productivity and higher efficiency gained due to genetic modification technology have had a significant and positive impact on farms' incomes. Between 1996 and 2020, the economic benefits have been significant for farms using genetically modified technology, with their income having increased by $261.3 billion US dollars, i.e., in the mentioned period, the average farm income gain for all genetically modified crops increased by about $112/hectare. In 2020, farm income gains were $18.8 billion (average of $103/ha). Cumulative farm income gains have been divided between 52% for farms in developing countries and 48% for farms in developed countries [5].

Food Safety in the European Union, Special Eurobarometer – Wave EB91.3 study on 27,655 respondents from the European Union reveals that 43% of Croatians are personally interested in the topic of food safety, similar to the European Union 28 average (41%). A total of 69% of Croatians state that food safety is most important to them (the most frequently mentioned item). When obtaining information, television is the most prominent channel (77%), followed by word of mouth (52%) and newspapers and magazines (34%), while scientists are the most trusted sources regarding food risks (75% of Croatians would agree) [15]. Data for the whole European Union shows that "genetically modified ingredients in food or drinks", which was the fourth issue respondents were most worried about in the 2010 survey, has been identified as a concern by 27% of respondents. General mistrust of Croatians towards genetically modified food is also evident. A total of 12% of respondents mentioned genetically modified ingredients in food or drinks when thinking of a top concern regarding food safety, making it the (shared) second top reason mentioned after food poisoning from bacteria. Second place is shared with concerns about antibiotic, hormone, or steroid residues in meat and diseases found in animals [15].

There has been much research connecting socio-economic and demographic variables, including knowledge, utility perception, and attitudes towards genetically modified food [11]. Considering consumer behaviour theory, higher knowledge leads to higher acceptance. Additionally, a consumer who is well informed is usually concerned with a lack of knowledge [24]. Consumers state that they are not aware which products are genetically modified because of a lack of information on product packaging labels [23]. Accordingly, it is the consumer's right to demand labelling of genetically modified products, independent safety testing, environmental impact assessment, and liability for any damage connected with genetically modified food [22].

In a study by Barrena and Sanchez [4], they found that risk perception of food products, health effects of food, age, and income are the main factors affecting consumers' decisions. Information about genetically modified food obtained from different sources, for example, the media, the Internet, and other sources, is potentially worrying for most respondents [33]. In Chinese research by Kim et al. [19], the results show that 58.8% of respondents believe that genetically modified food is dangerous for human health, while only 5.8% of respondents have a positive attitude towards it. Research by Cui and Shoemaker [10] showed that with a lower understanding of genetically modified technology, respondents were more hesitant in accepting genetically modified food. The results also highlight the impact and importance of the study on the public perception of science in China [10].

Genetically modified organisms are the subject of debate in European countries, especially because their risk-benefit ratio is considered particularly unfavourable and because the public often distrusts their promoters and the regulatory process [6]. Most English consumers believe that genetically modified food is unsafe. With the decline in demand for genetically modified food in many UK supermarkets, such products have been phased out. European consumers are demanding labelling and independent safety testing for all genetically modified food [27]. The Special Eurobarometer Food Safety in the European Union report from 2019 showed that 59% of Croatians changed their consumption behaviour permanently or temporarily after reading or hearing information about food risk [15]. Research by Luntulwandile and Karodia [26] emphasises that information about genetically modified food and a higher level of education influence attitudes.

A study by Erjavec et al. [16] investigated the attitudes and knowledge of Slovenian citizens towards genetically modified organism technology. Correlation analysis showed that respondents with more objective knowledge had more flexible and positive attitudes towards the health impact of genetically modified organisms, while respondents with lower knowledge had more rigid and negative attitudes.

Komoto et al. [20] conducted an international comparative study, and the results show that consumers in France and Japan have greater resistance to genetically modified food than those in the US and the UK. Japanese consumers have shown greater fear of the dangers of genetically modified food than consumers in any other country. Respondents who answered that they were willing to buy genetically modified food demanded a discount of 20%, while in Japan a discount of 30% was demanded, thus showing their negative perception towards the consumption of such food. Consumers in every country are asking for assurance through scientific data, which would prove that genetically modified food is safe. Until then, consumers in each country are more likely to seek additional information to form their perceptions and attitudes about genetically modified foods [20].

In the study by Rzymski and Krolczyk [28], the attitudes of citizens of the Republic of Poland about the possibilities, limitations, risks, and advantages of using genetically modified organisms were examined. The results show that 79.9% of respondents think that genetically modified food is not discussed enough in the media, and 53.1% of respondents do not have enough knowledge about genetically modified organisms. The surveyed group believes that genetically modified food is unsafe for people (61.1%) and the environment (64.7%). Most respondents admitted that they are afraid of genetically modified food (82.2%) and perceive it as less healthy than traditionally produced food (67.7%). It is important to emphasize that 50% of respondents support the medical use of genetically modified organisms, but also that over 1/3 of respondents do not support the use of genetically modified food for any purpose [28].

In China, research was conducted on 160 companies in the food, seed, animal feed, and chemical industries. It was found that 55% of managers oppose the consumption of genetically modified food, 20% support genetically modified food, and 25% were neutral. Only 13% of managers in chemical companies support the commercialization of genetically modified crops, while as many as 87% were against it. Regarding attitudes towards genetically modified food, managers in the food and seed industries had more positive attitudes than those in the chemical and animal feed industries [13].

Chagwena et al. [7] conducted research in Zimbabwe about attitudes towards genetically modified food technology among respondents who were informed exclusively via mainstream media or who were self-informed. A total of 54% of respondents consumed genetically modified food, and 38% of them did not know if it was genetically modified. They stated that genetic modification does not improve flavour (60%) or nutritive value (52%). The study showed that negative attitudes are related to lower intention regarding the consumption and production of genetically modified food. Health risks, environmental pollution, and manipulation by large corporations for profit gains are the main reasons for rejection. Although the results show familiarity with genetically modified food technology, general respondent knowledge is low, which can be improved through educational activities and stronger campaigns [7].

Research in Turkey about attitudes towards genetically modified food, knowledge level, behaviour, and acceptance considering age, gender, and marital status showed statistically significant differences. Furthermore, the results show a generally unfavourable attitude towards genetically modified food; 42.1% believe that genetically modified food is not good for health, 39.6% are convinced that consuming genetically modified food will have adverse health effects, and 43.5% are worried about warnings regarding harmful health effects of genetically modified food. Still, 50.7% of men and 49.3% of women buy genetically modified food. The results showed that married respondents have greater knowledge about genetically modified food than single respondents, and men have more positive attitudes than women [29].

The study by Abedi and Alemzadeh [1] in Iran analysed the perception and attitudes of the public towards the risks and benefits of genetically modified food. Most respondents were not familiar with biotechnological methods (70%), and most of them (70%) were not aware of any risks and benefits. Respondents with higher education had more knowledge about biotechnology and genetically modified organisms in general compared to respondents with lower education. The results also showed that 60% of respondents do not have any knowledge about genetically modified food specifically and its purpose [1].

Das and Sumit [12] conducted a cross-sectional survey with a closed-ended questionnaire in the four largest districts of Bangladesh, where the respondents were over 18 years of age and had completed at least a secondary level of education. It was observed that out of a total of 614 respondents, 24.8% had no

knowledge of GM food. Of the remaining 462 respondents, 41.8% had some knowledge, and 30.7% had a positive attitude. The level of knowledge and attitude varied significantly depending on the respondents' gender, occupation, monthly income, educational status, etc. Logistic regression analysis showed that respondents with higher monthly incomes and higher education were more likely to have better knowledge and a more positive attitude [12].

The Pew Research Center [25] conducted a survey on the attitudes of the American public about genetically modified foods as part of its ongoing survey of public attitudes about scientific and technological developments. The majority of respondents believe that genetically modified food is likely to lead to health problems for the population (53%) or create problems for the environment (58%). At the same time, 44% of respondents also stated that such food is likely to help increase the global food supply, and 56% stated that genetically modified food will result in more affordable food [25].

Kunyanga et al. [21] collected data on the threats and effects of the GMO ban and the status of the Biosafety Act and the Cartagena Protocol on Biosafety implementation in Kenya. A cross-sectional survey was conducted with 216 purposively sampled participants and additional in-depth interviews with 16 key informants in a qualitative survey. The results were triangulated using data from the literature review. A total of 57% of respondents indicated that genetically modified organisms and genetically modified food are the solution to food security in Africa. Most believe that the introduction of genetically modified technology and the use of genetically modified food are beneficial (52.3%). Fifty-five percent of respondents stated that genetically modified food is safe. The majority of respondents (>90%) stated that there is a low threat of genetically modified technology to the environment, human health, and animal health. Respondents (54.3%) agreed that the Cartagena Protocol is well endorsed.

Shami [30] conducted research to assess people's knowledge of genetically modified food and evaluate its health risks. An online survey was conducted to assess consumer knowledge about genetically modified foods. The survey showed that 74.3% of respondents know what genetically modified food is. A total of 43.7% believe that the risk of genetically modified food for the environment and human health exists. Most respondents believe that the risk of genetically modified food is greater than its benefit. Some respondents believe that there is an influence of genetically modified food consumption on their genes, although expert knowledge of the exact scientific issues surrounding genetically modified foods is still relatively limited [30].

METHODOLOGY

INSTRUMENTS

To gather results about the level of information and attitudes towards genetically modified food, the authors programmed an online survey via the Google Forms tool. The questionnaire includes an elimination question, which serves to exclude respondents who are not familiar with the genetically modified food concept. All respondents were asked whether they were familiar with the concept and whether they knew what genetically modified food is. Those who were not familiar were not asked any further questions.

The questionnaire is structured into four parts. The screening part, at the beginning, includes basic demographic questions (gender and age) and an elimination question (familiarity with genetically modified food). The second part contains questions about the frequency and source of information regarding genetically modified food. The third module contains questions about attitudes towards genetically modified food. The last part contains additional demographic questions.

The third module contains 19 items, designed by the authors, which examine attitudes towards genetically modified food that can be divided into 3 pillars considering the effect on: (1) health, (2) nature and environment, and (3) economy. The respondents' task was to evaluate their agreement with each item on a scale from 1 to 5, where 1 denotes "completely disagree" and 5 "completely agree". We chose the Likert scale because its construction is relatively simple, and the interpretation of results is straightforward. Items used in this research were derived from literature reviews and have been shown to generally correspond to the above-mentioned pillars across different research papers. Initially, the authors created 24 items, but after the review process to check for clarity, straightforwardness of meaning, and whether the statements were in a clear positive or negative form, only 19 items were included in the final research.

PROCEDURE

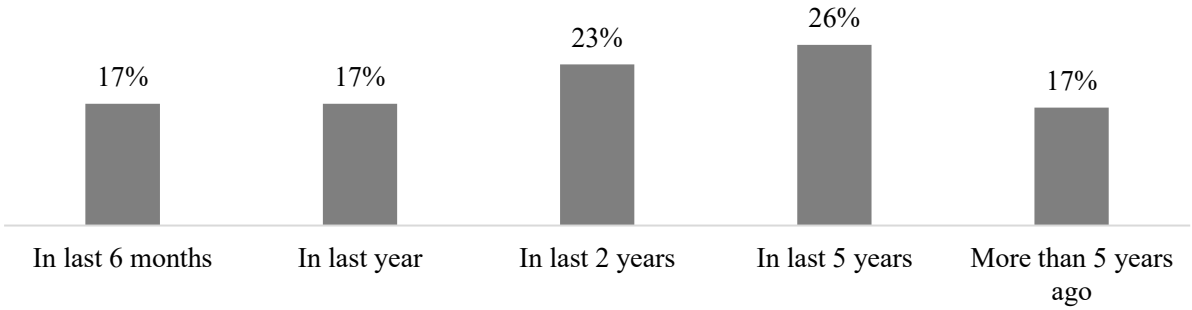
A convenience sampling procedure was used for acquiring respondents, specifically the snowball method. The questionnaire was forwarded to respondents via e-mail and social media. Participants were asked to further forward the questionnaire to their acquaintances and share it on their social platforms. At the beginning of the questionnaire, respondents were informed about the purpose of this research and guaranteed anonymity. Data gathering was conducted during June and July 2021. Multivariate analysis (FA) and analysis of differences between groups (t-test, ANOVA) were used to answer the research problem.

SAMPLE

The target population included all Croatian citizens aged 16 years or older who are at least familiar with the concept of genetically modified food. The questionnaire was completed by 344 respondents; 4 of them were not familiar with the concept, hence they were eliminated from further analysis. Out of 340 respondents who were included in the analysis, 108 (31.8%) were male and 232 (68.2%) were female. A total of 13.4% of respondents were between 16 and 25 years old, 29.1% between 26 and 35, most (38.4%) were in the age group between 36 and 45 years old, 16% between 46 and 55 years, and only 3.2% were older than 55. Higher education qualifications were held by 75.6% of respondents, while the rest had high school education and one respondent was an unskilled worker. Most of the respondents were employed (83.8%).

RESEARCH RESULTS

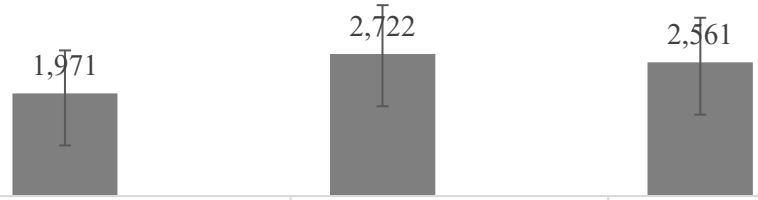
Out of all respondents, 52% informed themselves about genetically modified food in some way. Time of informing shows a negatively skewed distribution, i.e., there are fewer respondents who informed themselves recently (Graph 1).



Graph 1. Time of informing (those who informed themselves about genetically modified food)
Source: Authors

Examining the source of information, 19% used scientific sources, such as scientific articles, internet portals, blogs, and posts on social media, while 32% used non-scientific sources, and 49% consulted both scientific and non-scientific sources. When we combine the data, it is evident that 68% of respondents used scientific sources (among others).

Attitudes towards genetically modified food are shown in three dimensions (which are explained in the following text). Overall agreement considering the positive effect of genetically modified foods on (1) “health & general acceptance”, (2) “ecology”, and (3) “economy” is moderate to low, with “health & general acceptance” having the lowest score. Average scores (mean) and the dispersion measure (standard deviation) for each dimension are visualized in Graph 2. Testing of means shows significant differences among all factors, with “ecology” being scored the highest, followed by “economy”, and with the “health and general acceptance” factor scoring the lowest ($p<0.05$).



	Health & general acceptance	Ecology	Economy
Mean	1,971	2,722	2,561
Std. Deviation	,82147	,93877	,85819

Graph 2. Attitudes towards genetically modified food (shown in three dimensions)
Source: Authors

The following statistical analyses were conducted to test the research hypotheses. Exploratory factor analysis was used to determine underlying factors in attitudes towards genetically modified food. T-tests were calculated to determine differences between those who informed themselves about genetically modified food and those who did not, and to test differences between those who used scientific sources vs. non-scientific (popular) sources when obtaining information. ANOVA was used for determining differences between the time passed since obtaining information about genetically modified food and attitudes towards it.

Exploratory factor analysis was calculated for the first hypothesis – attitudes towards genetically modified food have three fundamental factors: (1) health & general acceptance, (2) ecology, and (3) economy. The KMO and Bartlett test indicate that attitudinal items are adequate for calculating factor analysis – intercorrelations are high, and the correlation matrix is significantly different from the identity matrix, i.e., items are grouped into higher factors (Table 1). Exploratory factor analysis with the criterion eigen = 1 and varimax rotation produced three factors and explained 63.8% of variance (Table 2). Factors were named using semantic analysis of items that saturate each factor, and they concur with the stated 1st hypothesis with some specifics (Table 3). The first factor named "health & general acceptance" is described with items connected to the health of an individual and with items promoting the production and consumption of genetically modified food. The second factor, "ecology", is saturated with items connected to the impact of genetically modified food on nature, the environment, and humanity in general. The third factor, "economy", is explained with items on how genetically modified food impacts the economy and industry.

Scales with average (mean) scores on all items were calculated for all three extracted factors. They were named the same as the extracted factors: "health & general acceptance", "ecology", and "economy". The item "Risk of genetically modified food is smaller than other everyday risks" was not included due to similar saturation with factors 1 (health & general acceptance) and 3 (economy). Five items needed to be rotated so that a higher score would coincide with a positive attitude towards genetically modified food, namely: (1) "genetically modified food is harmful to the environment", (2) "genetically modified food threatens the natural order", (3) "genetically modified food will cause a global natural catastrophe", (4) "genetically modified food presents a specific danger to human health", and (5) "consumption of genetically modified food leads to different diseases". For each factor, Cronbach's alpha measure was calculated, and the results show satisfactory reliability ("health", total 8 items = 0.928; "ecology", total 5 items = 0.857; "economy", total 5 items = 0.800). Average scores in each scale were used in testing other hypotheses. Descriptive analysis indicated a normal distribution of the "ecology" scale (skewness = 0.123) and "economy" scale (skewness = 0.007), while the "health & general acceptance" scale had a positively skewed distribution (skewness = 0.828), indicating a more negative distribution of attitudes towards genetically modified food when considering health impact and promoting genetically modified food production compared to economy or ecology. Considering the sample size and data characteristics, using parametric statistics in testing group differences is justified.

Table 1. Kaiser-Meyer-Olkin and Bartlett's test (1st hypothesis)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.932
Bartlett's Test of Sphericity	Approx. Chi-Square	3823.127
	df	171
	Sig.	0

Source: Authors

Table 2. Factor analysis – Total variance explained (1st hypothesis)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Var.	Cumul. %	Total	% of Var.	Cumul. %	Total	% of Var.	Cumul. %
1	8.16	42.9	42.92	8.16	42.9	42.9	5.72	30.1	30.1
2	2.69	14.2	57.08	2.69	14.2	57.1	3.33	17.5	47.6
3	1.28	6.76	63.84	1.28	6.76	63.8	3.08	16.2	63.8

Extraction Method: Principal Component Analysis.

Source: Authors

Table 3. Factor analysis – Rotated component matrix (1st hypothesis)

	Component		
	1	**2**	**3**
Genetically modified food is safe for my health	0.819		
Genetically modified food is as safe for my health as natural food	0.817		
Genetically modified food is safe for the health of my family	0.79		
It is necessary to encourage the import of genetically modified food	0.774		
Genetically modified food is safe for future generations	0.772		0.308
Production of genetically modified food needs to be stimulated	0.748		
Production of genetically modified food needs to be allowed in Croatia	0.74		
There is no risk in the consumption of genetically modified food	0.656		
The risk of genetically modified food is smaller than other everyday risks	0.547		0.527
Genetically modified food is harmful to the environment		-0.82	
Genetically modified food threatens the natural order		-0.8	
Genetically modified food will cause a global natural catastrophe		-0.78	
Genetically modified food presents a specific danger to human health		-0.75	
Consumption of genetically modified food leads to different diseases	0.301	-0.75	
Genetically modified food is good for the economy	0.319		0.749
Genetically modified food would solve the food shortage problem in developed countries	0.403		0.744
Consumption of genetically modified food will reduce world hunger	0.377		0.738
Genetically modified food brings economic prosperity to all	0.362		0.593
Genetically modified food will completely replace natural food			0.558

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

Source: Authors

The second hypothesis – people who informed themselves about genetically modified food have a more positive attitude towards it than persons who did not inform themselves at all – was tested with an independent samples t-test for all three factors. There were no statistically significant differences between people who informed themselves and those who did not in attitudes towards genetically modified food across all three scales (Tables 4 and 5).

Table 4. Descriptive statistics for informing status and attitudes towards genetically modified food (2nd hypothesis)

		N	Mean	Std. Deviation	Std. Error Mean
Health & general acceptance	Informed	179	1.979	.82613	.06175
	Not informed	161	1.962	.81873	.06453
Ecology	Informed	179	2.714	.92916	.06945
	Not informed	161	2.730	.95217	.07504
Economy	Informed	179	2.612	.86509	.06466
	Not informed	161	2.503	.84944	.06695

Source: Authors

Table 5. Independent samples t-test for differences between informed and not informed respondents in attitudes towards genetically modified food (2nd hypothesis)

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Health & general acceptance	Equal variances assumed	0.183	0.669	0.191	338	0.848
	Equal variances not assumed			0.191	334.83	0.848
Ecology	Equal variances assumed	0.311	0.577	-0.161	338	0.872
	Equal variances not assumed			-0.161	332.32	0.872
Economy	Equal variances assumed	0.044	0.833	1.172	338	0.242
	Equal variances not assumed			1.173	335.4	0.242

Source: Authors

The third hypothesis – persons who used scientific sources for obtaining information have more positive attitudes towards genetically modified food than persons who used only non-scientific sources – was also tested with an independent samples t-test for all three factors. There were no statistically significant differences in attitudes considering health & general acceptance, ecology, and economy between respondents who informed themselves via scientific sources and those who used only other sources (Tables 6 and 7).

Table 6. Descriptive statistics for source of information and attitudes towards genetically modified food (3rd hypothesis)

		N	Mean	Std. Deviation	Std. Error Mean
Health & general acceptance	Scientific	121	2.031	.81622	.07420
	Non-scientific	58	1.871	.84324	.11072
Ecology	Scientific	121	2.764	.86987	.07908
	Non-scientific	58	2.610	104.255	.13689
Economy	Scientific	121	2.662	.88921	.08084
	Non-scientific	58	2.516	.80978	.10633

Source: Authors

Table 7. Independent samples t-test for differences between respondents informed via scientific and non-scientific sources in attitudes towards genetically modified food (3rd hypothesis)

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Health & general acceptance	Equal variances assumed	0.03	0.862	1.217	177	0.225
	Equal variances not assumed			1.203	109.23	0.232
Ecology	Equal variances assumed	3.014	0.084	1.033	177	0.303
	Equal variances not assumed			0.97	96.295	0.335
Economy	Equal variances assumed	0.736	0.392	1.129	177	0.260
	Equal variances not assumed			1.167	122.49	0.245

Source: Authors

For the fourth hypothesis – persons who were recently informed about genetically modified food have more positive attitudes towards it – analysis of variance (ANOVA) was used because the answer to the question regarding the time of obtaining information had 5 possible answers ("in the last 6 months"; "in the last year"; "in the last 2 years"; "in the last 5 years"; "more than 5 years ago"). There were no statistically significant differences across all three genetically modified food attitude scales (Tables 8 and 9).

Table 8. Descriptive statistics for time of obtaining information and attitudes towards genetically modified food (4th hypothesis)

		Health & general acceptance	Ecology	Economy
In last 6 months	Mean	1.935	2.632	2.452
	N	31	31	31
	Std. Deviation	.84093	112.321	.93946
In last year	Mean	1.956	2.671	2.806
	N	31	31	31
	Std. Deviation	.84320	.83034	.89664
In last 2 years	Mean	2.046	2.805	2.556
	N	41	41	41
	Std. Deviation	.81382	.82884	.85617
In last 5 years	Mean	1.976	2.730	2.748
	N	46	46	46
	Std. Deviation	.77890	.89663	.77796
More than 5 years ago	Mean	1.963	2.693	2.447
	N	30	30	30
	Std. Deviation	.92624	103.155	.87680

Source: Authors

Table 9. ANOVA differences between respondents' time of obtaining information and genetically modified food attitudes (4th hypothesis)

		Sum of Squares	df	Mean Square	F	Sig.
Health & general acceptance	Between Groups	.267	4	.067	.096	.984
	Within Groups	121.217	174	.697		
	Total	121.484	178			
Ecology	Between Groups	.628	4	.157	.179	.949
	Within Groups	153.047	174	.880		
	Total	153.675	178			
Economy	Between Groups	3.766	4	.942	1.266	.285
	Within Groups	129.447	174	.744		
	Total	133.213	178			

Source: Authors

DISCUSSION

The sampling process (convenience, snowball sampling method) using the applied data collection method (respondents via e-mail and social media) created an unbalanced sample structure, especially considering education level, limiting the generalization of results. Hence, the following conclusions are limited to more educated, digitally active Croatian citizens from major cities.

Previous research in the field indicates that attitudes towards genetically modified food are mostly negative and that the majority of respondents believe it is not good for their health. The Special Eurobarometer Food Safety in the European Union report from 2019 showed general mistrust of Croatians towards genetically modified food, with it being the second top concern when it comes to food safety [15]. In the study by Kim et al. [19], 58.8% of respondents from the Republic of Korea stated that genetically modified food is dangerous for human health, while only 5.8% have a positive attitude towards it. Respondents in this research have even more negative attitudes – 71.8% believe that genetically modified food is not good for their health [19].

According to Želježić [34], possible harmful effects on the environment due to the production of genetically modified food are increased soil toxicity and disturbed ecosystem balance. A total of 41.5% of respondents in this study believe that genetically modified food is dangerous for the environment, while only 21.5% believe it is not.

With faster and larger food production with the help of genetically modified technology, it is possible to tackle world hunger, especially in developing countries. However, although they are affected by different challenges and food shortages, developing countries, including Zimbabwe, Zambia, Mozambique, and Malawi, have declined help in the form of genetically modified food from the United States and the World Food Program [7].

Similarly, this study showed that Croatians are sceptical towards genetically modified food considering its effect on health, ecology, and economy, with the most negative attitudes towards genetically modified food's effect on health.

Most studies recognize three dimensions in attitudes towards genetically modified food: (1) considering the influence on health, (2) on nature and the environment, and (3) on the economy. Exploratory factor analysis in this research revealed three factors in line with the predicted hypothesis, but with some specifics. The first factor, "health & general acceptance", is connected to the influence of genetically modified food on health, but also with general acceptance and promotion of genetically modified food production. The second factor, "ecology", is connected to the influence of genetically modified food on nature and the environment, but also on human health in general. The third factor, "economy", is described with attitudes towards the influence of genetically modified food on the economy and industry (Table 10). Three derived factors correspond to results in other countries and different studies, with the exception of the "health & general acceptance" factor. The derivation of a new dimension ("health & general acceptance") indicates that the perception of the effect of using and consuming genetically modified food on health is highly connected with the acceptance of policies facilitating the usage of this genetically modified technology.

Table 10. Hypotheses status

H1	Attitudes towards genetically modified food have three fundamental factors: (1) health, (2) economy, and (3) environment	**partly confirmed**
H2	Persons who informed themselves about genetically modified food have a more positive attitude towards it than persons who did not inform themselves at all	**rejected**
H3	Persons who used scientific sources for obtaining information have more positive attitudes towards genetically modified food than persons who used only non-scientific sources	**rejected**
H4	Persons who were recently informed about genetically modified food have more positive attitudes towards it	**rejected**

Source: Authors

Past research confirms that gaining information about genetically modified food and the level of education can influence attitudes [11], [24], [7]. The education level in this study is specific (most respondents have finished college) and homogeneous; hence, it is difficult to find differences between them, especially when investigating constructs such as attitudes. Although the results are not statistically significant at the $p<0.05$ criterion, differences in attitudes towards genetically modified food on the economy scale, between those who informed themselves and those who never did, show a somewhat lower p-value ($p=0.242$). We can assume that with a larger, nationally representative sample, i.e., one that would include more respondents with lower education levels, the hypothesis would be confirmed – there would be a more positive attitude towards the impact of genetically modified food on the economy among respondents who informed themselves. Similarly, a somewhat lower p-value is also evident on the economy scale when analysing differences in the time of obtaining information ($p=0.285$). However, the distribution of results does not clearly show a more positive attitude with more recent information.

Information about genetically modified food can be obtained via different sources (TV, radio, print media, the Internet, etc.); however, most respondents believe that genetically modified food is potentially worrisome [33]. Consumers state that they are not aware which items are genetically modified due to a lack of information on labels [23]. Public attitudes toward GM food are formed through a reasoning mechanism that starts from trust in science and public authorities, ultimately determining consumers' final purchasing decisions [9]. Familiarity with the concept of genetically modified organisms is low. Namely, most respondents (82.5%) believe that they do not have enough information and would like more, 3.5% are not interested and do not have an opinion, and only 10.5% stated that they have enough information and knowledge about genetically modified food [31]. Even though the research did not show statistically significant differences in attitudes considering the source of information, there are some clear indications that using scientific sources is connected to more positive attitudes towards the impact of genetically modified food on health & general acceptance, ecology, and economy, i.e., for all dimensions (p-values around 0.3 or lower).

CONCLUSION

Strong growth in biotechnology and genetic engineering leads to progress in agriculture, science, and medicine. Genetic engineering, i.e., genetically modified organisms and food, are becoming more present in the everyday diet of the human population, food production, and medicine, improving human lives, but simultaneously creating dangers and risks of malpractices and abuses of this technology. Attitudes towards genetically modified food are contrasting. It is believed that when there is full acceptance of genetically modified food, it will completely replace conventional food, and with possible risks and dangers connected to biotechnology, caution is necessary.

The study has shown that Croatian citizens do not differ significantly in attitudes and perceptions from citizens of other countries. The literature review has shown similar tendencies in not accepting the technology of genetically modified food and organisms in general for consumption and production. The results have shown rejection and fear due to health risks of consuming genetically modified food, concern for the environment due to producing genetically modified food, and lack of belief that producing genetically modified food would help the economy or alleviate world hunger. The main reason found in

other research and indicated in this one is the lack of personal knowledge about genetically modified food technology and insufficient information available in the public space. Positive attitudes toward genetically modified technology have been shown to be greatly connected to the perception of genetically modified food and its impact on health.

The research problem consisted of four research goals and hypotheses. Multivariate analysis (FA) and group differences testing (t-test, ANOVA) were used to answer research goals/test hypotheses. The results have shown the existence of three underlying factors/dimensions that affect attitudes towards genetically modified food: (1) "health & general acceptance", described as attitudes towards the effect of genetically modified food on the health of individuals and general tendency to accept or not accept genetically modified food; (2) "ecology", attitudes towards the effect of genetically modified food on nature, the environment, and human health in general; and (3) "economy", attitudes towards the impact of genetically modified food on the economy and industry. Of special importance is the derivation of a new dimension ("health & general acceptance"), which indicates that the perception of the effect of using and consuming genetically modified food on health is highly connected with the acceptance of policies facilitating the usage of this genetically modified technology. This suggests that any government or European Union level programs must address this issue first and foremost, and that improving perceptions of genetically modified food regarding the general health of individuals and their close ones (family, friends, etc.) should be connected to higher overall acceptance of genetically modified technology.

The results did not show differences in attitudes towards genetically modified food underlying factors for all research goals. Attitudes towards genetically modified food do not differ between respondents who informed themselves or did not about the topic, those who used scientific vs. non-scientific sources of information, nor considering the recency of obtaining information. Although there were no statistically significant results, the research did show indications that respondents who informed themselves about genetically modified food using scientific sources could have more positive attitudes towards its impact on the economy. Additionally, using scientific sources could also lead to more positive attitudes towards all attitudinal dimensions considering genetically modified food. It is important to emphasize that by using exclusively scientific sources, governments, organizations, and institutions are limiting message reach to only part of the population, which, we could argue, is already informed about the effects of genetically modified technologies. Our analysis showed that even in a sample which is biased towards higher education, 32% do not use scientific sources and an additional 49% use both scientific and non-scientific sources when obtaining information about genetically modified food. Hence, other media channels and formats play an important role in facilitating positive attitudes and general acceptance of genetically modified food and related technologies.

Sample limitations, the overrepresentation of respondents with a higher education level and its size, are probable reasons for rejecting hypotheses dealing with differences in attitudes between groups who were differently informed (at all, and considering time and source). Additional research, which would control the mentioned factors, with a larger and more representative sample and quota control, could possibly prove the mentioned indications as statistically significant.

Nonetheless, the contribution of this study is evident in proving the existence of three underlying factors in attitudes towards genetically modified food (health & general acceptance, ecology, and economy), especially the identification of a new underlying factor which connects general positive attitudes towards using and consuming genetically modified food with policies and their perceptions regarding individuals' health. This research also recognizes tendencies for greater acceptance of the technology behind genetically modified food with higher knowledge and by obtaining information about it, especially via scientific sources. The research showed that attitudes towards genetically modified food among Croatian citizens do not differ significantly from attitudes of citizens in other countries, especially in the European Union, which indicates the possibility for a global or European Union synergistic strategy in managing attitudes towards genetically modified food by alleviating current fears and increasing knowledge about its benefits. This strategy must primarily take into account how individuals today perceive the usage of genetically modified food regarding their health and address it by providing scientific results in a more understandable and "common man-friendly" manner using different media formats, i.e., using mainstream media channels with simplified messages about how genetically modified food and related technology are not dangerous for individuals' health and how they can improve economic status and help the environment. By encouraging acceptance of genetically modified food, we will make a step towards a more sustainable future.

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ORIGINAL SCIETNTIFIC PAPER

IMPACT OF LOVEFEST ON THE IMAGE AND BRAND OF THE TOURIST DESTINATION OF VRNJAČKA BANJA

MAKULJEVIĆ Đorđe[1], RADIVOJEVIĆ Nikola[2], FILIPOVIĆ Nemanja[3], PETROVIĆ RADIVOJEVIĆ Slavica[4]

[1]Fontana, Vrnjačka Banja, Serbia; ORCID 0009-0003-5467-4860
[2]Academy of Applied Studies Šumadija, Kragujevac, Serbia, ORCID 0000-0002-6137-4431
[3]Academy of Applied Studies Šumadija, Kragujevac, Serbia, ORCID 0000-0002-6261-0213
[4]Menmo Academy, Vienna, Austria; ORCID 0009-0000-4799-1567

E mail: djordje@fontanabanja.com, radivojevic034@gmail.com, nfilipovic@asss.edu.rs, office@menmo.at

ABSTRACT

This paper examines the impact of the Lovefest summer festival on the image and brand of the tourist destination of Vrnjačka Banja. The research results show that the attractiveness of Lovefest has a positive impact on the image of the festival itself but does not affect the image or brand of the destination. The research also shows that there is a negative image transfer between the festival's image and the destination's image. This finding points to a potential problem of insufficient alignment between the festival and the destination.

Keywords: *Lovefest, festival image, destination image, destination brand, Vrnjačka Banja*

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INTRODUCTION

In the last two decades, tourist events have become an important instrument in strengthening the image and brand of tourist destinations. This is because participation in tourist events affects tourists' perception of the destination by eliciting rational engagement. Similarly, tourist events promote emotional engagement by giving tourists the opportunity to transition from passive observers to active participants and shape their unique experiences (Vivek et al., 2012). Therefore, events play a crucial role as instruments for strengthening and emotionally connecting visitors with the place where they are held (Getz and Page, 2016). As such, they are an effective means of strengthening the brand of a tourist destination. In this way, tourist events act as catalysts that contribute to leveraging the potential of other elements of the tourist offer at the destination and enhancing their attractiveness (Čavić, 2023; Čavić et al., 2023).

Although tourist events are typically associated with specific natural attractions and other unique resources of a destination, ranging from tradition and folklore to gastronomic specialties and unique cuisine, it is not uncommon for events to be organized at destinations that are not closely related to the event itself or to the local community. The organization of mega-sports events is the most common example of such events. However, certain empirical studies show that small events can provide greater added value for tourists and contribute more to the economic and social development of a destination than mega-events (Lima et al., 2016). The effectiveness of such events is particularly emphasized when they are based on local culture and tradition, as they increase the rational and emotional engagement of destination visitors (Laing, 2018; Folgado-Fernández et al., 2021), and when they are organized in smaller places that are not characterized by significant tourist attractions (Gibson and Connell, 2016). Such events not only contribute to attracting tourists to the destination and, consequently, to the economic development of the local community, but also to improving the image of the destination brand, one of the key elements of destination branding (Lai et al., 2017). This is because Cai (2002) and Boo et al. (2009) point out that destination brand identity and destination brand image are key elements of branding.

However, in recent years, tourist events that are not closely related to the local culture and customs of the local population have increasingly been organized at tourist destinations. Music festivals often serve as an example of such events. These are tourist events that have the potential to attract a large number of visitors to a destination (Sia et al., 2015), while at the same time not requiring significant infrastructure investments. According to Thomas (2019), these are unique cultural events that are continuously held at a specific place and time. Music festivals are often sponsored by certain brands. Unlike the conventional organization of events at a destination, where the main goal is to transfer the event's image to the destination's image (Deng & Li, 2014) or to achieve co-branding (Carrillat et al., 2010), the primary goal of brand-sponsored music festivals is to utilize the destination's potential to connect brands with their target audience. This is particularly evident when the event's audience aligns with the brand's target market. In this case, sponsorship helps build relationships and increase brand affinity among potential consumers. Sponsoring such events at a destination allows brands to provide tourists with a unique experience, contributing to the formation of a positive opinion about the brand. The question that arises is whether organizing such events also contributes to strengthening the image and brand of the tourist destination. This question becomes particularly significant considering that organizing events at a destination can also have negative effects. It is true that tourist events are an effective means of attracting tourists to a destination. However, the downside is the additional exploitation of destination resources, which, in the context of limited resources, represents a negative effect. For this reason, it is important to consider not only the economic justification but also the ecological sustainability of such events (Čavić, 2023; Čavić et al., 2023). The negative effects of organizing such events may cause greater long-term damage to the image and brand of the destination than the short-term economic benefits they generate. This is especially important when events are not closely related to the destination's attractions and local culture. Organizing such events may negatively affect tourists who have come to the destination primarily because of its natural attractions and local cultural offerings. The next question is whether organizing music events that are not based on local culture and attractions affects the identity of the destination. It is well known that when based on local culture, tourist events simultaneously represent both the result and the means of promoting the cultural identity of the destination (Elias-Varotsis, 2006), as a cultural expression of the people living in that area. However, when events are not based on the local cultural identity, the question arises whether they also contribute to strengthening the destination's brand and, if so, to what extent. Therefore, the aim of this paper is to answer this question.

According to the Associative Network Memory Model (ANMM), every time a specific event is organized at a destination, the event's image should be transferred to the destination's image. This occurs because, in human memory, symbols and meanings associated with one entity become linked to another. However, according to categorization theory (Rosch & Mervis, 1975), such a transfer requires a high degree of congruence between the two entities. In the context of organizing a music festival, this means that there must be a high degree of congruence between the festival and the destination. In other words, the festival and the destination must share certain common values that are important to both destination tourists and festival visitors. This is the case when the festival is based on local culture and attractions. If this is not the case, the question arises whether image transfer actually occurs, that is, whether organizing the festival contributes to strengthening the destination's brand.

THEORETICAL FOUNDATIONS OF THE RESEARCH

For the past three decades, in professional and academic circles in the field of sponsorship, the mechanism of image formation has been successfully explained using the ANMM model. Specifically, according to the ANMM model, human memory consists of a network of informational nodes in which information related to a specific entity is stored, and these nodes are interconnected by links. These links represent the strength of associations between information and entities. Every time a node is activated, information is retrieved from memory, and the process of association occurs. In this way, the destination's image is formed. There are three ways to activate information stored in memory, or to activate the process of association (Keller, 1993):

1. through the consumer's direct experience with the product or service
2. through information transmitted by communication channels
3. by linking brand associations with another entity.

In this way, the brand is identified with another entity. This is achieved because indirect links, or secondary associations, are established between the brand and another entity. These arise from the primary attributes related to the entities being linked. By linking entities in this way, not only are new associations established, but existing ones are also strengthened. This is precisely the foundation on which sponsorship is based. In the field of event sponsorship, this is known as image transfer. As previously stated, this implies that a positive image of the event will transfer to the destination's image. However, as already pointed out, according to categorization theory, for this process to occur, there must be a high degree of congruence between the entities. Therefore, in the context of examining the significance of Lovefest for the image of Vrnjačka Banja as a tourist destination, the validity of hypothesis H1 should be tested: after visitors attend Lovefest, does the festival's image positively affect the image of Vrnjačka Banja as a tourist destination?

Unlike the study of the process of forming a destination's image, which is mostly based on intuitive insights, the study of branding has, from the very beginning, been based on consumer cognition models derived from psychological theory. The consumer is viewed as a rational participant who evaluates a product in order to maximize the value of its consumption. Therefore, the effect is the result of the value gained from consuming a particular product and arises from the cognitive (rational) assessment of the value that the product offers to the consumer, or at least what the consumer believes it offers. In this context, the brand is viewed as a sublimated expression of these benefits and values, while the phrase "brand image" refers to the attributes, the advantages these attributes provide, and the benefits associated with those attributes in relation to consumer values (Calip & Costa, 2005).

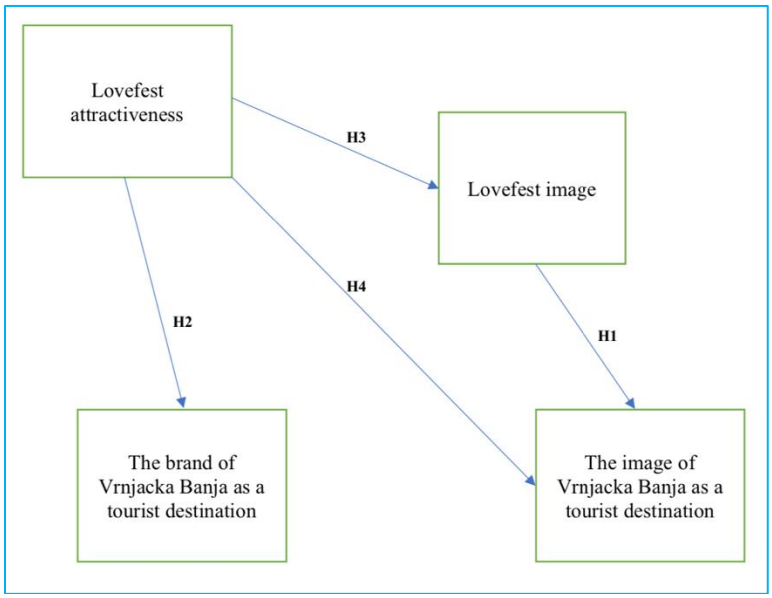
Although it is still not entirely clear whether the dimensions inductively derived in destination image studies are suitable substitutes for brand attributes—because the paradigm from which the dimensions of destination image arise differs significantly from the consumer psychology paradigm that underpins brand image studies—it is evident that destination attributes and destination image share a common goal: each aims to represent what is in the consumer's mind. In this sense, it is not unreasonable to expect that the two are connected, even if they are not isomorphic. What the concept of destination branding offers is a more detailed specification of the relationships among attributes, advantages, values, and consumer choice.

In the context of efforts to model the effects of events on visitors' perceptions of destinations, the attractiveness of an event, as a cognitive perception of attributes or of the utility and value that a visitor expects to gain from attending the event, can simultaneously be treated as an attribute of the destination.

This applies both to the destination's brand image and to the beliefs and knowledge that tourists have about the destination's attributes within the cognitive component of the destination image formation process defined by Gartner (1994). This implies that the attractiveness of the event should have a positive impact on both the festival's image and the destination's image (or at least on their cognitive component), as well as on the destination's brand. However, since the destination's image represents a mental construct that reflects the brand's identity (Burmann et al., 2009), the question arises as to whether a tourist event that is not closely related to the identity of the tourist destination can have a positive impact on the destination's brand. Therefore, in the context of examining the significance of Lovefest for the brand of Vrnjačka Banja as a tourist destination, the validity of hypothesis H2 should be tested: whether the attractiveness of Lovefest has a positive impact on the brand of Vrnjačka Banja as a tourist destination. Considering the previously discussed theoretical foundations, two additional hypotheses can be formulated: H3, whether the attractiveness of Lovefest has a positive impact on the festival's image; and H4, whether the attractiveness of Lovefest has a positive impact on the image of Vrnjačka Banja as a tourist destination.

The conceptualization of the previously presented analysis can be graphically illustrated by the following research model (Figure 1).

Figure 1. Research Model



Source: Authors

VARIABLES AND RESEARCH METHODOLOGY

Vrnjačka Banja is one of the most visited tourist destinations in the Republic of Serbia. Annually, this destination is visited by around 200,000 tourists and records approximately 700,000 overnight stays, of which about 86.3% are domestic tourists and the remainder are foreign tourists (RZS, 2023). Vrnjačka Banja is known as a health resort, attracting a significant number of so-called "medical tourists." However, in addition to medical tourism, the destination also offers other attractions. To enhance the tourist offer of the destination, a significant number of events and cultural manifestations are organized throughout the year. To promote urban youth culture, Lovefest has been organized in the destination since 2007. Initially conceived as a party for young people, Lovefest quickly became one of the most sought-after music events in Central Serbia, characterized by a rich program designed to promote equality, solidarity, and tolerance.

The research was conducted on a sample of 1,562 event attendees. Visitors were surveyed during the event. The sample size was determined based on the population size and an acceptable margin of error for a 95% confidence level. The gender distribution among the respondents was almost equal. A total of 86.5% of the respondents were between 20 and 40 years of age and had average monthly incomes at the national level in the Republic of Serbia. About half of the respondents stated that this was not their first time attending the festival and that they spent an average of around 30 euros per day during the festival.

Data were collected using a structured questionnaire developed on the basis of relevant statements proposed in the scientific literature. The validity of the questionnaire was tested using Principal Component Analysis (PCA), because a high value of Cronbach's alpha coefficient does not necessarily indicate high reliability, as it may simply result from a large number of items included in the analysis. Respondents rated the statements in the questionnaire on a five-point Likert scale, ranging from (1) "strongly disagree" to (5) "strongly agree." The questionnaire items are presented in Table 1. Sample adequacy was assessed using the Kaiser-Meyer-Olkin (KMO) test. The KMO value was 0.802, indicating that the sample was adequate for the research. The results of the PCA are presented in Table 1, with oblique Promax rotation applied. The PCA results indicate that the questionnaire items were grouped as expected, meaning that the questionnaire can be reliably used in further analyses. The collected data were processed using the Gretl statistical package and AMOS software for structural equation modeling.

MODEL PARAMETER ASSESSMENT AND DISCUSSION OF THE OBTAINED RESULTS

Before assessing the parameters of the AMOS model shown in Figure 1, a correlation analysis was performed among the obtained variables. This is because the valid application of factor analysis and structural equation modeling requires a sufficiently high correlation among the variables (Radivojevic et al., 2023). The results of the correlation analysis are presented in Table 2. Table 2 also presents the Average Variance Extracted (AVE), the values of Cronbach's alpha coefficient for each construct, as well as the goodness-of-fit indices of the structural equation model.

Table 2. Goodness-of-Fit Indices, AVE, and Square Correlation Coefficients among the Obtained Variables

	AL	IL	ID	BD
AL	1			
IL	0.549	1		
ID	0.448	0.482	1	
BD	0.433	0.448	0.503	1
AVE	0.616	0.627	0.621	0.613
Reliability	0.712	0.729	0.741	0.799
RMSEA (root mean square error of approximation)				0.044
RMSR (root mean square residual)				0.05
NNFI (non-normed fit index)				0.927
AGFI (adjusted goodness-of-fit index)				0.903

Source: Authors

The analysis was conducted at a 95% confidence level. All correlation coefficients are statistically significant and indicate the existence of correlations among the obtained variables. The AVE values are higher than the corresponding squared correlation coefficients, indicating the discriminant validity of the model. The values of Cronbach's alpha coefficient are above 0.70 for all constructs, indicating an acceptable level of reliability. In addition, construct reliability is further supported by the fact that all AVE values exceed 0.50. The goodness-of-fit indices indicate that the proposed AMOS structural model provides a good fit to the data.

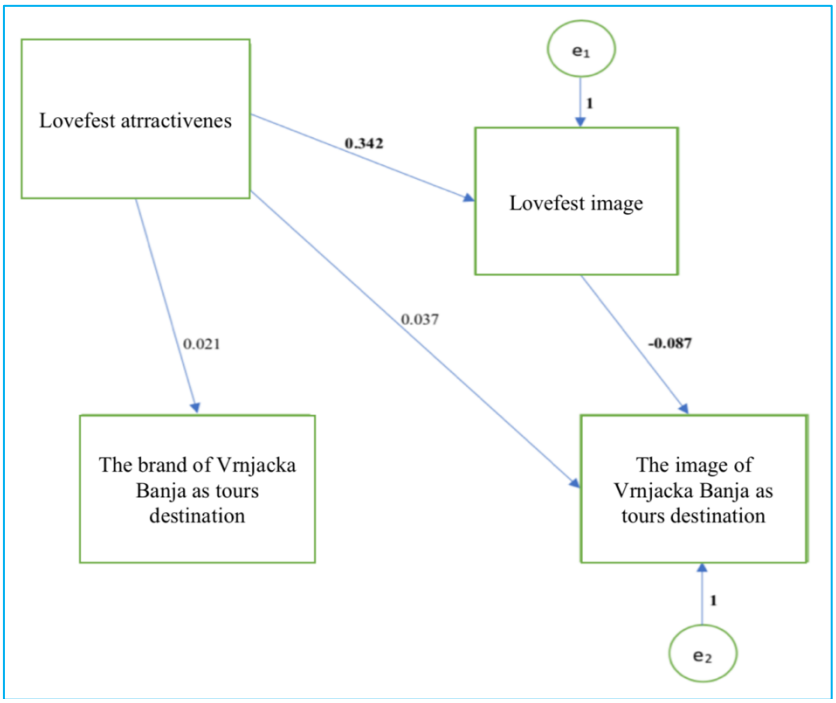
Table 1. Questionnaire for Lovefest

Variables	Statements	Factor Loadings				Adapted From
		AL	IL	ID	BD	
Attractiveness of Lovefest (AL)	Lovefest is well known at the local and national levels.	0.753				Folgado-Fernández et al. (2017)
	Lovefest reflects the identity of the local community.	0.674				
	Lovefest offers an authentic experience.	0.654				
	When I think of music festivals, Lovefest comes to mind.	0.498				
	The event exceeded my expectations.	0.639				
Lovefest Image (IL)	The festival staff are friendly and well trained.		0.435			Deng & Li (2014)
	The programs at Lovefest are fun and authentic.		0.438			
	The programs at Lovefest are diverse.		0.408			
	Visiting Lovefest satisfies my curiosity.		0.411			
Destination Image (ID)	The destination has a good reputation.			0.349		Yang et al. (2020)
	I enjoy visiting the destination.			0.332		
	The destination offers a unique experience.			0.328		
	The destination offers a diverse range of attractions.			0.313		
	The destination offers authentic experiences.			0.389		
Destination Brand (BD)	The destination matches my personality.				0.582	Chi et al. (2020)
	Visiting the destination enhances my social status.				0.599	
	The destination's image aligns with my self-image.				0.606	
	Visiting the destination reflects who I am.				0.619	

Source: Authors

Results of the confirmatory factor analysis are shown in Figure 2 and Table 3.

Figure 2. Assessment of the AMOS Model Parameters



Source: Authors

Table 3. Results of Hypothesis Testing

Variable	Estimate	Standard Error	Critical Value	p-value	Result
IL ← *ID*	-0.087	0.036	-2.420	0.046	H1 rejected
BD ← *AL*	0.021	0.053	0.400	0.316	H2 rejected
ID ← *AL*	0.037	0.046	0.800	0.232	H3 accepted
BD ← *AL*	0.021	0.053	0.400	0.316	H4 rejected

Source: Authors

From the perspective of econometric analysis, the results shown in Figure 2 and Table 3 indicate that only hypothesis H3 can be accepted, while the remaining hypotheses cannot be confirmed. This is because the regression coefficients are statistically significant at the 0.05 significance level and have the expected direction of effect. Hypothesis H1 cannot be accepted because the regression coefficient has the opposite sign from the one expected. The other two hypotheses, H2 and H4, cannot be accepted because the obtained coefficients are not statistically significant. However, caution should be exercised when interpreting the results related to hypothesis H4, as hypothesis H3 was confirmed. This suggests that the attractiveness of Lovefest does not have a direct impact on the destination's image but has an indirect impact through its influence on the festival's image.

From the perspective of destination management and marketing, as well as from that of the organizers of Lovefest, the obtained results are highly significant but rather complex to interpret. This complexity stems both from the theoretical foundations on which they are based and from the perspective of formulating recommendations for the creators of the tourist offer at the destination. For this reason, the interpretation of the obtained results starts with the confirmation of hypothesis H3.

The finding that the attractiveness of the festival has a positive impact on the festival's image suggests that the more attractive the music event is, the more positive visitors' perceptions and opinions of the event itself will be. As a result, visitors will become loyal to the event and share their positive experiences with others, thereby positively influencing the attraction of new potential visitors. However, the finding that the attractiveness of the festival does not affect the image of the destination primarily suggests that visitors come to the destination solely because of the festival and that the destination's other attractions do not appeal to them. In other words, the festival's target audience does not primarily correspond to the destination's target market. This may be due to a mismatch between the festival and the destination. Consequently, the attractiveness of the festival does not influence Lovefest visitors' perceptions or opinions of the destination. This is primarily because they are attracted by values that do not represent the essence of the destination's identity. Although Lovefest is based on one of the destination's attractions, the Bridge of Love, this attraction is not the primary motive for attracting tourists to the destination. This means that tourists primarily visit the destination for other reasons.

The interpretation of the results is further complicated by the finding that there is a negative image transfer between the festival and the destination, which, on the one hand, indicates an indirect influence of the festival's attractiveness on the destination's image and, on the other hand, points to a misalignment between the festival and the destination. Therefore, in addition to the lack of congruence between the festival and the destination—that is, the fact that they do not share common values that influence visitors' perceptions of the destination—the findings also warn of potential negative effects of holding the festival on the destination's primary target market. The fact that festival visitors do not value the destination's core attractions enough to change their attitude toward the destination suggests that the short-term effects of attracting festival visitors may negatively affect the destination's primary target market. For example, due to the full occupancy of accommodation facilities during the festival, many tourists belonging to the destination's primary target market may choose an alternative destination. Therefore, if visitors come solely because of the festival and do not perceive the destination as a place worth enjoying after the festival ends, does this mean that the festival does not lead to longer stays but instead, due to the occupancy of accommodation capacities, contributes to redirecting tourists to other destinations? This raises another important question concerning the timing of the festival. Holding the festival during the peak tourist season, when demand from the destination's primary target market is highest, may not be the most rational solution. This also raises the issue of the marketing mix during the festival. There are well-known examples of destinations deliberately discouraging tourist arrivals during certain events. The best-known example is Davos, Switzerland, where, during the World Economic Forum, tourists are discouraged from visiting for skiing and recreation because of high prices (Filipović, 2023). This reduces pressure on the destination's resources and infrastructure and prevents dissatisfaction among the primary target market segment. Finally, the finding that the attractiveness of the festival has no impact on the destination's brand suggests that the values offered by the destination outside participation in the festival are not perceived as sufficiently valuable to justify the additional expenditure required to extend the stay or revisit the destination for other purposes.

CONCLUSION

This paper examines the impact of Lovefest on the image and brand of the tourist destination of Vrnjačka Banja. Specifically, Vrnjačka Banja is one of the most visited tourist destinations in the Republic of Serbia. It primarily specializes in medical and health tourism, although over the past few decades it has also invested considerably in the development of entertainment, wellness, spa, and congress tourism. Since 2007, Lovefest, a music festival aimed at promoting urban culture among young people, has been held in the destination. It is well known that tourist events are an effective instrument for strengthening the image and brand of a destination, as they have the potential to attract a large number of visitors without requiring significant investments. Tourist events are also an effective instrument for destination branding because they simultaneously represent and promote the identity, customs, culture, habits, and lifestyles of the people living in that area. For this reason, they are typically based on the local system of values, norms, and behaviors that characterize a particular place. In such situations, it is well known that events can be successfully used to strengthen the image and brand of a destination, either through image transfer or through co-branding. However, the effects of organizing events that are not closely related to the destination's identity or that are based on attractions that are not of primary importance to the destination's main target market remain insufficiently explored. This is the case with Lovefest, which is based on a secondary attraction of Vrnjačka Banja.

To answer this question, the paper tests four hypotheses derived from theories and concepts predominantly used in image and branding research. The research results show that the attractiveness of Lovefest has a positive impact on the image of the festival itself, but not on the image or brand of the destination. The results also show that there is a negative image transfer between the festival's image and the destination's image. This finding points to a potential problem of insufficient alignment between the festival and the destination. The findings have several important implications for the creators of the tourist offer at the destination. Like any research, however, this study also has certain limitations that should be taken into account when interpreting the results. At the same time, both the complexity of the issue addressed and the obtained findings point to the need for further research, primarily by expanding the study to include tourists visiting the destination who are not festival attendees, as well as members of the local population. Further research should also include the analysis of data that were not covered by this study, such as accommodation occupancy rates during the festival, the length of stay of festival visitors, the frequency of repeat visits by festival attendees outside the festival period, the number of canceled reservations during the festival, visitor spending during the festival, expenditures outside the festival itself, and similar indicators. The analysis of such data would provide a more detailed understanding of the short-term and long-term effects of hosting the festival, as well as the justification for its timing.

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ORIGINAL SCIETNTIFIC PAPER

DETERMINANTS OF THE BEHAVIOR OF GENERATIONS X, Y, AND Z AS CONSUMERS IN TOURISM

GUZOVSKI, Marina [1] GEDŽIĆ, Kata [2]

[1]*Libertas International University, Zagreb (CROATIA); ORCID: 0000-0002-2365-503X*
[2]*Libertas International University, Zagreb (CROATIA); ORCID: 0009-0005-1397-9355*

E-mail: mguzovski@libertas.hr, katagedzic1702@gmail.com

ABSTRACT

One of the most evident changes can be observed in travel behaviour, as each consumer generation requires a different approach from the tourism industry. The study analyses the tourism preferences and behaviour of Generations X, Y, and Z in the Croatian tourism market. It examines travel habits, motivations, decision-making processes, and the role of digital technologies and social networks in travel planning. Based on a study of 150 respondents, significant differences between generations were identified in travel behaviour patterns. Generation X consumers still rely on traditional media and structure their travel plans in a more systematic way; however, they have also shifted, although to a lesser extent than younger generations, toward the use of various digital tools in recent years. Generation Y travellers are highly travel-oriented, emphasizing the use of digital platforms and social media for planning and booking trips. On the other hand, Generation Z, which is highly connected through social media, prefers spontaneity and unique experiences, while planning trips based on social media content and user-generated reviews. The findings emphasize the need for digitalized tourism offers, particularly for Generations Y and Z, which consider online platforms an integral part of the decision-making process. This paper contributes to understanding shifts in tourism behaviour across generations, thereby offering insights to stakeholders on how to align their products with the evolving needs of consumers. Future research should include a larger sample of respondents and apply more advanced statistical methods to better examine how generational travel behaviour evolves over time.

Keywords: *generation X, generation Y, generation Z, consumer behaviour, tourism preferences*

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INTRODUCTION

The development of modern tourism is the result of several key factors, including technological progress, socio-economic changes within societies, such as greater availability of leisure time and increased income, as well as the global liberalization of economic relations. Tourism represents a complex form of demand and consumption by foreign visitors, which stimulates the production of various goods and services in destination countries [1]. Knowledge of consumer behaviour can greatly contribute to understanding consumer behaviour, which is highly individual, as not all consumers under the same conditions react in the same way to the influence of various factors. The behaviour of tourist consumers differs significantly from that of other consumers due to several distinctive characteristics, including [2]: intangible and immeasurable purchases, non-impulsive purchases, comprehensive purchase planning, and advance purchases. In the field of tourism, consumer behaviour is even more complex. Tourist services are highly complex, giving rise to certain specific characteristics. The needs that motivate tourists (the need to travel, spend quality leisure time, experience new cultures, have fun, etc.) are not considered basic human needs and depend not only on financial means but also on a person's character, lifestyle, and many other factors. Since consumer behaviour in tourism is influenced by a complex set of elements, studying this type of consumer behaviour is more demanding than in areas where the relationship between needs and consumer behaviour is simple, direct, and clearly observable [3]. Tourist needs are highly diverse and can only be satisfied outside the usual living environment [4]. These include psychological and physical satisfaction, emotional and spiritual enrichment, health, movement, meeting other people (and nations), getting to know other regions and destinations, food, transport, accommodation, entertainment, leisure, and others. Tourist needs arise only after lower-level needs have been satisfied [5]. Tourist demand refers to the number of people who participate in tourist travel or wish to do so by using services outside their everyday environment [6]. A tourist is a consumer who is unique in that they primarily purchase an experience rather than a physical product. This experience directly affects their level of satisfaction. Some of the factors influencing satisfaction can be controlled by the tourist (e.g. the choice of destination or travel companions), others by tourism service providers (e.g. the quality and diversity of the offer), while some cannot be influenced by either the tourist or the provider (e.g. illness during the trip or adverse weather conditions) [3]. Tourist behaviour can only be understood by identifying the factors that influence travel decisions. These decisions are largely affected by forces outside the individual, including the influence of other people. The pressure exerted by others is referred to as social influence [7].

THEORETICAL BASIS AND LITERATURE REVIEW

The tourism sector remains one of the most dynamic markets worldwide, and the decision-making process of tourists is a key factor influencing the market. Every stakeholder within the tourism industry, including destinations, travel agencies, and providers of diverse services, considers understanding tourists' travel decision-making to be of paramount importance. To properly understand this process, theories of consumer behaviour, socio-economic factors, together with the role of media and digital technologies in shaping tourists' decisions, must be studied. Consumer behaviour theories provide appropriate frameworks for studying tourists' decision-making processes. Among the best-known models in this discipline is the Theory of Planned Behaviour. This model holds that decisions are based on three important factors: attitudes toward a behaviour, subjective norms, and perceived behavioural control [8]. The application of this theory to tourism suggests that tourists' decisions depend on their attitude towards a destination (for example, the attractiveness or safety of the destination), social pressure (for example, what their friends and family say about the destination), and their perception of their ability to travel (for example, in terms of financial resources or access to information). The travel decision-making process is often described as a multi-phase process consisting of need recognition, information gathering, evaluation of alternatives regarding destinations and services, decision-making, and post-purchase evaluation [9]. Generational cohorts are groups that share birth years, historical experiences, and characteristics shaped by those experiences, resulting in different patterns of behaviour and preferences. Therefore, when discussing generations, it is important to first determine which groups of people belong to which generation and identify their general characteristics. Generation X was born into a world marked by political and economic upheavals, including the Cold War and the global economic downturn of the 1970s and 1980s. This led to the development of specific values and priorities. Members of Generation X were raised in households

with working parents and became some of the first independent thinkers and pragmatists. Compared to older generations, Generation X is more educated, although not to the same extent as Generations Y and Z. Generation X represents the digital pioneers but grew up with traditional media, such as television and radio. Hence, as a "technological bridge" generation, they plan their trips online and through digital platforms; however, their traditional values make them prefer personal recommendations and conducting thorough research before making travel decisions [10]. All generations have reportedly increased their online purchases of travel products, but the largest increase has been recorded among Generation X [11]. Generation X's motivations for travel are largely based on balancing professional life, family obligations, and personal interests. Research shows that tourists from this generation are motivated by a combination of the need to escape everyday stress, spend quality time with their families, and pursue personal enrichment through cultural and educational experiences [12]. Although they are more financially stable than millennials, Generation X carefully considers the price-quality ratio when choosing travel packages. They also prefer safety and comfort and are less inclined to take risks. Therefore, destinations that are safe and offer a high level of service quality are often among their preferred choices [13]. Destinations offering natural beauty, such as national parks or coastal regions, together with adequate infrastructure that ensures comfort and safety, are also popular [14]. What is characteristic of Generation X is their tendency to share their experiences with family and friends, although they are less active on social media than younger generations. This generation prefers more private communication and values personal recommendations more than public reviews on platforms such as TripAdvisor or Booking.com. However, although they are less active in sharing reviews, online reviews remain an important factor in their travel decisions [13]. Promotion through a combination of online and offline channels allows for more effective targeting of this market segment, as Generation X uses both types of media for information gathering and decision-making [13]. Generation Y, also known as millennials, includes people born between the early 1980s and the mid-1990s. This generation grew up in an environment of rapid technological change, globalization, and social media, which has greatly shaped their habits and values. A key characteristic of millennials is their connection with technology; they are the first generation to grow up with the internet, mobile phones, and social media, which has significantly influenced the way they communicate, learn, and spend their leisure time. Millennials are also known for their high level of education and career ambitions. As a market segment in tourism, millennials exhibit unique characteristics in terms of their travel motivations, destination preferences, the role of digital technology in the decision-making process, and interactions with tourism brands. Their approach to travel is driven by a desire for authentic experiences, sustainability, and the use of digital tools to plan and document their trips. Research shows that millennials value authentic experiences and interactions with local communities more than traditional tourist attractions or luxury accommodation [15]. Millennials often travel to "connect" with a destination and its people, gaining a deeper understanding of new cultures [10]. Social media plays a key role in documenting and sharing experiences, which shapes their travel preferences. Research shows that this generation is more sensitive to environmental issues and tends to choose destinations and services that have a positive environmental and social impact [16]. According to research conducted by the UNWTO on millennials, they are open to combining business with leisure while travelling, creating a form of travel known as "bleisure," which helps them balance their professional and personal lives [17]. Research conducted by Expedia states that millennials expect a high level of personalization, both in terms of services and communication. They do not seem to appreciate brands that fail to provide personalized experiences based on their preferences [18]. Generation Z refers to people born from the late 1990s to the early 2010s and is frequently described as the first generation to have truly grown up in a fully digital environment. Their relationship with technology distinguishes them from millennials, whose formative years coincided with the emergence of smartphones, social media, and streaming platforms [19]. A distinctive feature of Generation Z is their adaptability and strong problem-solving skills. They have grown up facing global challenges such as economic crises and climate change; therefore, they are practical and action-oriented. Compared with previous generations, they show greater acceptance of diversity and inclusion. They value individuality and embrace different cultural, ethnic, and gender identities [20]. They value opportunities for continuous learning and personal development in an environment that encourages flexibility and innovation [21].

One of the most striking characteristics of Generation Z's behaviour in tourism is their strong connection with technology. They use digital platforms to plan, book, and share their trips, often relying on apps such as Google Maps, Airbnb, Instagram, and TikTok [22]. Their travel behaviour includes a high level of engagement on social media, where they share their experiences and reviews, creating user-

generated content that often influences the decisions of other travellers. According to a survey conducted by Booking.com, 87% of Generation Z members use social media to plan their trips, and 70% report that the content they see on social media influences their choice of destination [23]. Research shows that more than 60% of Generation Z members prefer environmentally responsible travel options, including sustainable accommodation, green tours, and eco-friendly activities [24]. Research also shows that young people from this generation often choose destinations that are not overrun with tourists, seeking to avoid mass tourism and find authentic and original experiences [25]. They are also inclined to actively participate in travel, whether through volunteering, adventure tourism, or cultural exchange programmes. This generation does not prefer rigidly structured travel arrangements but instead seeks flexibility that allows them to create their own itineraries. They often book flights, accommodation, and activities online, preferring digital platforms that allow them to change plans quickly and easily [17]. Research shows that Generation Z values destinations that use innovative technologies, as this allows them to better prepare for and plan their trips [26].

RESEARCH METHODOLOGY

The research was conducted on a convenience sample of 150 respondents, evenly distributed across three age groups: Generation X (50 respondents), Generation Y (50 respondents), and Generation Z (50 respondents), in the Republic of Croatia during the period from August 25 to September 14, 2024. Data were collected through an online survey questionnaire created using Google Forms and distributed via social networks and email. The survey questionnaire was developed based on a literature review and previous research and was structured into the following parts: general travel habits, the use of social networks in the context of travel, preferences for active holidays and gaining experiences while travelling, the use of digital technologies in travel planning and the travel process, and socio-demographic characteristics of the respondents, including age, gender, level of education, employment status, and personal monthly income. The questions were structured as closed-ended questions and statements to which respondents indicated their level of agreement using a Likert scale.

The paper sets out three hypotheses:

- H1: The behaviour of Generations X, Y, and Z in the tourism market of the Republic of Croatia differs with respect to their specific lifestyles and preferences.
- H2: Generation Y shows a greater tendency to travel compared to Generations X and Z, with a stronger interest in digital technologies and more active use of social networks in travel planning.
- H3: Generation Z prefers short, spontaneous trips that offer challenges and unconventional experiences, unlike Generation X, which shows a greater tendency towards traditional tourist destinations and travel planning through traditional media.

The data collected through the questionnaire were analysed using descriptive statistics. Using the SPSS statistical software, mean values were calculated for each generational group according to the analysed variables (general travel habits, use of social networks in the context of travel, preferences for active holidays and gaining experiences while travelling, the use of digital technologies in travel planning, and the travel process). Reliability analysis, measured by Cronbach's Alpha, confirmed strong internal consistency across all constructs. "General Travel Habits" ($\alpha = 0.703$) reflects travel frequency, trip duration, destination preferences, spontaneity, and seasonal choices, although it shows slightly greater variability. "Detailed Travel Preparation and Booking Process" ($\alpha = 0.754$) demonstrates good reliability, covering information sources, online bookings, reviews, and discount tracking. "Use of Social Media in Travel" ($\alpha = 0.733$) consistently captures the influence of social media on travel inspiration, experience sharing, and decision-making. "Preference for Active Travel and Experience-Gathering" ($\alpha = 0.749$) reflects engagement in cultural, outdoor, and wellness activities with solid reliability. The highest internal consistency was found for "Use of Digital Technologies in Travel" ($\alpha = 0.835$), indicating a consistent reliance on apps, digital maps, reviews, online payments, and free Wi-Fi. All constructs exceeded the acceptable threshold ($\alpha > 0.7$), confirming their suitability for further statistical analyses, such as ANOVA.

The obtained results were then compared across generations to determine statistically significant differences.

RESEARCH RESULTS

The demographic data reveal a balanced generational distribution, with each group (Generation X, Y, and Z) comprising 33.3% of the sample, allowing for equal comparisons across age cohorts (Table 1).

Table 1. Demographic data

Generation					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
	Gen X (1965-1980)	50	33,3	33,3	33,3
	Gen Y (1981-1996)	50	33,3	33,3	66,7
	Gen Z (1997-2012)	50	33,3	33,3	100,0
	Total	150	100,0	100,0	
Gender					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
	Male	87	58,0	58,0	58,0
	Female	63	42,0	42,0	100,0
	Total	150	100,0	100,0	
Education					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
	High School	57	38,0	38,0	38,0
	Undergraduate study	39	26,0	26,0	64,0
	Graduate study	38	25,3	25,3	89,3
	Postgraduate study	16	10,7	10,7	100,0
	Total	150	100,0	100,0	
Employment status					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
	Employed	104	69,3	69,3	69,3
	Self-Employed	6	4,0	4,0	73,3
	Unemployed	13	8,7	8,7	82,0
	Student	21	14,0	14,0	96,0
	Retired	6	4,0	4,0	100,0
	Total	150	100,0	100,0	

In terms of gender, the sample is slightly male-dominated (58.0% male and 42.0% female), indicating a moderate gender imbalance. Regarding education, the majority of respondents (38.0%) completed secondary education, followed by 26.0% with an undergraduate degree, 25.3% with a graduate degree, and 10.7% with postgraduate education, reflecting a relatively well-educated sample. Employment status indicates that most respondents (69.3%) are employed, followed by students (14.0%), unemployed individuals (8.7%), self-employed respondents (4.0%), and retirees (4.0%).

Table 2. Tourist travel purpose among generations

	Gen X		Gen Y		Gen Z	
	N	%	N	%	N	%
Relaxation and stress relief	13	26,0	2	4,0	9	18,0
Exploring a new culture and tradition	18	36,0	21	42,0	12	24,0
Visiting family and/or friends	6	12,0	7	14,0	16	32,0
Adventure	6	12,0	10	20,0	12	24,0
Business	5	10,0	4	8,0	1	2,0
Broadening horizons	2	4,0	1	2,0	50	100,0

The data on the purpose of tourist trips across generations reveal notable differences in travel motivations. Generation X primarily travels for cultural exploration (36.0%) and relaxation and stress relief (26.0%), with fewer respondents citing adventure (12.0%) or visiting family and/or friends (12.0%) as their primary motivation. Generation Y exhibits a strong preference for cultural exploration (42.0%), followed by adventure (20.0%) and visiting family and/or friends (14.0%), while relaxation and stress relief appear to be significantly less important (4.0%). Generation Z, in contrast, shows the greatest diversity in travel motivations, with a notably high proportion (32.0%) prioritizing visiting family and/or friends, followed by cultural exploration (24.0%), adventure (24.0%), and relaxation and stress relief (18.0%). Business-related travel is most common among Generation X (10.0%), declines in Generation Y (8.0%), and is almost absent among Generation Z (2.0%). Interestingly, all Generation Z respondents (100%) also selected "broadening horizons" as a travel purpose, distinguishing them from the older cohorts. Overall, the results highlight generational differences in travel motivations, with Generation X placing

greater emphasis on relaxation and business-related travel, Generation Y on cultural experiences, and Generation Z on family connections, adventure, and broadening their horizons.

ANOVA and post hoc tests were conducted to determine whether statistically significant differences exist in simple travel habits among Generations X, Y, and Z. Since these generational groups exhibit distinct lifestyles, preferences, and travel behaviours, it was necessary to determine whether these differences were statistically significant rather than occurring by chance (Table 3).

Table 3. Analysis of Generational Differences in Simple Travel Habits – Descriptive Statistics, ANOVA, and Post Hoc Comparisons

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Gen X (1965-1980)	50	3,3429	,59429	,08405	3,1740	3,5118	2,43	4,57
Gen Y (1981-1996)	50	3,8462	,47879	,06771	3,7101	3,9823	2,71	4,71
Gen Z (1997-2012)	50	3,8971	,42520	,06013	3,7763	4,0180	2,71	4,71
Total	150	3,6954	,56034	,04575	3,6050	3,7858	2,43	4,71

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9,386	2	4,693	18,447	,000
Within Groups	37,398	147	,254		
Total	46,784	149			

Tukey HSD

(I) Generation		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Gen X (1965-1980)	Gen Y (1981-1996)	-,50333*	,10088	,000	-,7422	-,2645
	Gen Z (1997-2012)	-,55429*	,10088	,000	-,7931	-,3154
Gen Y (1981-1996)	Gen X (1965-1980)	,50333*	,10088	,000	,2645	,7422
	Gen Z (1997-2012)	-,05095	,10088	,869	-,2898	,1879
Gen Z (1997-2012)	Gen X (1965-1980)	,55429*	,10088	,000	,3154	,7931
	Gen Y (1981-1996)	,05095	,10088	,869	-,1879	,2898

*. The mean difference is significant at the 0.05 level.

Tukey HSD[a]

Generation	N	Subset for alpha = 0.05	
		1	2
Gen X (1965-1980)	50	3,3429	
Gen Y (1981-1996)	50		3,8462
Gen Z (1997-2012)	50		3,8971
Sig.		1,000	,869

The results indicate statistically significant differences in simple travel habits across generations, as confirmed by the ANOVA test ($F(2,147) = 18.447$, $p < 0.001$). Generation X ($M = 3.34$, $SD = 0.59$) exhibits the lowest mean, suggesting that individuals from this cohort engage less frequently in simple travel habits than younger generations. In contrast, Generation Y ($M = 3.85$, $SD = 0.48$) and Generation Z ($M = 3.90$, $SD = 0.42$) demonstrate significantly higher levels of engagement in these habits. Post hoc Tukey HSD tests reveal that Generation X differs significantly from both Generation Y and Generation Z ($p = 0.000$), while no statistically significant difference is observed between Generation Y and Generation Z ($p = 0.869$). This pattern is further supported by the homogeneous subsets analysis, which places Generation X in a separate group from Generations Y and Z, indicating that the two younger generations display similar travel behaviours, whereas the older generation shows significantly lower engagement. These findings suggest a generational shift, with younger cohorts adopting a more active approach to travel and engaging more frequently in simple travel habits than their older counterparts.

Table 4. Analysis of Generational Differences in Use of Social Networks in the Context of Travel – Descriptive Statistics, ANOVA, and Post Hoc Comparisons

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Gen X (1965-1980)	50	3,3400	,71425	,10101	3,1370	3,5430	2,33	4,83
Gen Y (1981-1996)	50	3,5267	,63116	,08926	3,3473	3,7060	2,33	4,67
Gen Z (1997-2012)	50	3,8233	,46341	,06554	3,6916	3,9550	2,50	4,67
Total	150	3,5633	,63974	,05223	3,4601	3,6666	2,33	4,83

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5,941	2	2,971	7,934	,001
Within Groups	55,041	147	,374		
Total	60,982	149			

Tukey HSD

(I) Generation		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Gen X (1965-1980)	Gen Y (1981-1996)	-,18667	,12238	,282	-,4764	,1031
	Gen Z (1997-2012)	-,48333*	,12238	,000	-,7731	-,1936
Gen Y (1981-1996)	Gen X (1965-1980)	,18667	,12238	,282	-,1031	,4764
	Gen Z (1997-2012)	-,29667*	,12238	,043	-,5864	-,0069
Gen Z (1997-2012)	Gen X (1965-1980)	,48333*	,12238	,000	,1936	,7731
	Gen Y (1981-1996)	,29667*	,12238	,043	,0069	,5864

*. The mean difference is significant at the 0.05 level.

Tukey HSD[a]

Generation	N	Subset for alpha = 0.05	
		1	2
Gen X (1965-1980)	50	3,3400	
Gen Y (1981-1996)	50	3,5267	
Gen Z (1997-2012)	50		3,8233
Sig.		,282	1,000

The results reveal statistically significant differences in the use of social networks for travel-related purposes among Generations X, Y, and Z, as confirmed by the ANOVA test ($F(2,147) = 7.934$, $p = 0.001$). Generation X ($M = 3.34$, $SD = 0.71$) exhibits the lowest level of engagement with social media in the context of travel, while Generation Z ($M = 3.82$, $SD = 0.46$) demonstrates the highest, with Generation Y ($M = 3.53$, $SD = 0.63$) positioned between the two. Tukey HSD post hoc tests indicate that Generation X and Generation Z differ significantly ($p = 0.000$), as do Generation Y and Generation Z ($p = 0.043$), whereas no statistically significant difference is found between Generation X and Generation Y ($p = 0.282$). This suggests that while Generations X and Y demonstrate comparable engagement with social media for travel purposes, Generation Z relies significantly more on social networks for travel planning, decision-making, and experience sharing. The homogeneous subsets analysis further supports this finding by grouping Generations X and Y together in one subset, while Generation Z forms a separate category. These results highlight a generational shift, with younger travellers (Generation Z) using social networks significantly more than older cohorts, reinforcing the need for digital marketing strategies tailored to younger audiences who rely on social media for travel inspiration and planning.

Table 3. Analysis of Generational Differences in Preference for Active Vacations and Gaining Experience While Traveling – Descriptive Statistics, ANOVA, and Post Hoc Comparisons

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Gen X (1965-1980)	50	3,5920	,65895	,09319	3,4047	3,7793	2,40	5,00
Gen Y (1981-1996)	50	3,8600	,57605	,08147	3,6963	4,0237	2,40	5,00
Gen Z (1997-2012)	50	4,2720	,54475	,07704	4,1172	4,4268	2,60	5,00
Total	150	3,9080	,65441	,05343	3,8024	4,0136	2,40	5,00

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	11,733	2	5,866	16,559	,000
Within Groups	52,078	147	,354		
Total	63,810	149			

Tukey HSD

(I) Generation		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Gen X (1965-1980)	Gen Y (1981-1996)	-,26800	,11904	,066	-,5499	,0139
	Gen Z (1997-2012)	-,68000*	,11904	,000	-,9619	-,3981
Gen Y (1981-1996)	Gen X (1965-1980)	,26800	,11904	,066	-,0139	,5499
	Gen Z (1997-2012)	-,41200*	,11904	,002	-,6939	-,1301
Gen Z (1997-2012)	Gen X (1965-1980)	,68000*	,11904	,000	,3981	,9619
	Gen Y (1981-1996)	,41200*	,11904	,002	,1301	,6939

*. The mean difference is significant at the 0.05 level.

Tukey HSD[a]

Generation	N	Subset for alpha = 0.05	
		1	2
Gen X (1965-1980)	50	3,5920	
Gen Y (1981-1996)	50	3,8600	
Gen Z (1997-2012)	50		4,2720
Sig.		,066	1,000

The results demonstrate statistically significant differences in preferences for active holidays and experiential travel across Generations X, Y, and Z, as indicated by the ANOVA test ($F(2,147) = 16.559$, $p < 0.001$). Generation X ($M = 3.59$, $SD = 0.66$) shows the lowest preference for active and experience-oriented holidays, while Generation Z ($M = 4.27$, $SD = 0.54$) exhibits the highest, with Generation Y ($M = 3.86$, $SD = 0.58$) positioned between the two. Tukey HSD post hoc tests confirm that Generation X differs significantly from Generation Z ($p = 0.000$), and Generation Y also differs significantly from Generation Z ($p = 0.002$). However, the difference between Generation X and Generation Y is not statistically significant ($p = 0.066$), indicating that these two groups share similar travel preferences, although Generation Y shows a slightly stronger tendency toward experience-oriented holidays.

The homogeneous subsets analysis further reinforces this distinction by grouping Generations X and Y together, while Generation Z forms a separate category, highlighting its significantly stronger preference for active and immersive travel experiences. These findings suggest a generational shift toward adventure-based and experiential tourism, particularly among Generation Z, which seeks unconventional, engaging, and activity-driven travel experiences. This underscores the importance of tailoring tourism products and marketing strategies to meet the evolving demands of younger travellers, who increasingly prioritize dynamic, hands-on experiences over traditional leisure travel.

Table 4. Analysis of Generational Differences in Use of Digital Technologies in Travel Planning and the Travel Process – Descriptive Statistics, ANOVA, and Post Hoc Comparisons

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Gen X (1965-1980)	50	3,9775	,70153	,09921	3,7781	4,1769	2,88	5,00
Gen Y (1981-1996)	50	4,1300	,84589	,11963	3,8896	4,3704	2,38	5,00
Gen Z (1997-2012)	50	3,8525	,37939	,05365	3,7447	3,9603	2,75	4,50
Total	150	3,9867	,67635	,05522	3,8775	4,0958	2,38	5,00

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1,931	2	,966	2,143	,121
Within Groups	66,229	147	,451		
Total	68,161	149			

Tukey HSD

(I) Generation		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Gen X (1965-1980)	Gen Y (1981-1996)	-,26800	,11904	,066	-,5499	,0139
	Gen Z (1997-2012)	-,68000*	,11904	,000	-,9619	-,3981
Gen Y (1981-1996)	Gen X (1965-1980)	,26800	,11904	,066	-,0139	,5499
	Gen Z (1997-2012)	-,41200*	,11904	,002	-,6939	-,1301
Gen Z (1997-2012)	Gen X (1965-1980)	,68000*	,11904	,000	,3981	,9619
	Gen Y (1981-1996)	,41200*	,11904	,002	,1301	,6939

*. The mean difference is significant at the 0.05 level.

Tukey HSD[a]

Generation	N	Subset for alpha = 0.05
		1
Gen X (1965-1980)	50	3,8525
Gen Y (1981-1996)	50	3,9775
Gen Z (1997-2012)	50	4,1300
Sig.		,100

The ANOVA test ($F(2,147) = 2.143$, $p = 0.121$) indicates that there are no statistically significant differences among Generations X, Y, and Z in their use of digital technologies for travel planning and the travel process. The mean scores suggest slight variations, with Generation Y ($M = 4.13$, $SD = 0.85$) reporting the highest level of engagement, followed by Generation X ($M = 3.98$, $SD = 0.70$) and Generation Z ($M = 3.85$, $SD = 0.38$). However, the p-value exceeds the 0.05 threshold, indicating that these differences are not statistically significant and may have occurred by chance. Since the ANOVA test does not confirm a statistically significant difference, the Tukey HSD post hoc test results should be interpreted with caution. Although the test indicates that Generation Z differs from both Generation X ($p = 0.000$) and Generation Y ($p = 0.002$), the overall ANOVA result suggests that these differences are not sufficiently robust to be considered statistically meaningful. Furthermore, the homogeneous subsets analysis places all three generations within the same statistical subset, reinforcing the conclusion that their use of digital technologies in travel planning is relatively similar.

These findings suggest that the use of digital technologies in travel is widespread across all generational groups, with no statistically significant differences among them. Although younger generations (Generations Y and Z) are generally expected to rely more heavily on digital tools, the results indicate that Generation X also actively integrates technology into the travel planning process, thereby reducing generational differences in this area. This suggests that digitalization in tourism has become a universal trend rather than a generational distinction, emphasizing the importance of digital marketing and technological adaptability for travellers of all age groups.

DISCUSSION

The study results reveal considerable generational differences in travel motivations, social media engagement, and preferences for active holidays, while also indicating a trend toward convergence in the use of digital technologies for travel planning across generations. These findings are consistent with previous studies but also provide new insights into changing travel behaviour. Generational differences are particularly evident in travel motivations. While Generation X primarily seeks cultural exploration combined with relaxation, Generation Y demonstrates a stronger preference for cultural engagement

combined with adventure. In contrast, Generation Z exhibits a broader range of motivations, including adventure, personal growth, and visiting family and friends. These findings support previous studies suggesting that Generation X is more interested in cultural and heritage tourism [27,28], while Millennials (Generation Y) tend to be more active travellers with diverse destination preferences and greater engagement with local cultures [29]. The results also support the view that Generation Z seeks dynamic, interactive, and authentic experiences that often extend beyond conventional tourism [30,31]. A clear generational gap is also evident in travel planning and the use of social media. Generation Z relies most heavily on social media when making travel-related decisions, followed by Generation Y, whereas Generation X continues to rely more on other sources of information. These findings are consistent with previous research highlighting Generation Z's dependence on influencers, peer reviews, and digital content when choosing travel destinations [32,33]. Previous studies have also shown that Millennials rely more on user-generated content than on traditional advertising when making travel decisions [34]. These findings suggest that future digital marketing strategies should primarily target younger travellers by emphasizing social media engagement, influencer marketing, and user-generated content related to destinations and accommodation. Another notable generational difference is the preference for active and experience-based holidays. The results indicate that Generation Z demonstrates the strongest preference for adventure tourism and experiential travel, whereas Generations X and Y show comparatively lower levels of interest in these activities. These findings are consistent with previous research suggesting that younger travellers seek unconventional, hands-on experiences that promote personal growth and adventure [35]. Consequently, the tourism industry should continue to adapt by developing more interactive and immersive travel experiences designed specifically for younger travellers.

Despite clear generational differences in travel motivations and the influence of social media, the results reveal no statistically significant differences in the use of digital technologies for travel planning. Previous studies have identified Generation Z as the most digitally oriented group of travellers [30,36]. In contrast, the findings of this study suggest that digitalization in tourism has become a universal phenomenon rather than a generational characteristic. The absence of statistically significant differences indicates that travellers of all generations now incorporate digital technologies into their travel planning process. These findings have important implications for the tourism industry. Although younger generations continue to shape new travel trends through their preference for adventure and their intensive use of social media, the increasing digital literacy of older generations highlights the need for tourism businesses to adopt comprehensive digital strategies that address the needs of all age groups. The results further emphasize the importance of flexible marketing strategies that combine immersive travel experiences with social media promotion and user-generated content to attract younger travellers while ensuring that older generations have easy access to the digital tools used throughout the travel planning process. Understanding these evolving travel behaviours can help the tourism industry better respond to the changing preferences of contemporary travellers.

CONCLUSION

The findings of the study confirm that there are generational differences in the travel behaviour, preferences, and digital engagement of Generations X, Y, and Z in the Croatian tourism market. The findings provide empirical support for the proposed hypotheses through a comprehensive analysis of travel motivations, social media use, engagement with digital technologies, and preferences for active holidays, while also challenging certain assumptions regarding digitalization in travel planning. The first hypothesis (H1), which proposed that the behaviour of Generations X, Y, and Z in the tourism market differs according to their lifestyles and preferences, is strongly supported. Significant differences were identified in travel motivations, with Generation X showing a preference for cultural exploration and relaxation, Generation Y favouring cultural experiences and adventure, and Generation Z demonstrating a broader range of motivations, including personal growth and visiting family and friends. These differences further support H1, as younger generations differ significantly from older generations in their use of social media for travel. The findings also indicate that younger travellers show a stronger preference for active and experience-based tourism, reinforcing the assumption that each generation travels differently according to its values, preferences, and technological influences. The second hypothesis (H2), which proposed that Generation Y has a greater tendency to travel compared to Generations X and Z, together with a stronger inclination toward digital technologies and active use of social networks in travel planning, is only partially

supported. While Generation Y remains highly travel-oriented, the present study shows that it is particularly attracted to cultural and adventure travel. Generation Z is equally active in travelling and demonstrates a strong preference for alternative travel experiences and adventure-based activities. Although Generation Y makes extensive use of digital technologies and social media, the findings indicate that the use of social media for travel purposes is even greater among Generation Z. Whereas members of Generation Y actively use the internet for travel planning, Generation Z's stronger reliance on influencers and digital interactions challenges the assumption that Generation Y is the most digitally engaged cohort in terms of travel behaviour. These findings suggest that although Generation Y remains highly active in travelling, the growing dominance of Generation Z in digital engagement and spontaneous travel habits means that this hypothesis is only partially supported. The third hypothesis (H3), which proposed that Generation Z prefers short, spontaneous trips that offer challenges and unconventional experiences, whereas Generation X is more likely to choose traditional tourist destinations and rely on traditional media when planning trips, is largely supported. The findings indicate that Generation Z strongly prefers adventure-oriented, spontaneous, and experience-based travel, actively seeking unique and unconventional tourism activities. In contrast, Generation X generally prefers more structured travel planning and established tourist destinations. However, the assumption that Generation X primarily relies on traditional media for travel planning is only partially supported, as the results indicate that digital technologies are now widely used across all generations. Although Generation Z remains the most active in using social media for travel planning, the findings also show that Generation X incorporates digital tools into the travel planning process, although to a lesser extent. Therefore, while the hypothesis successfully distinguishes the two generations in terms of travel preferences, it also demonstrates that older generations have become increasingly proficient in the use of digital technologies in tourism. Overall, this study highlights the evolving nature of generational travel behaviour, emphasizing the growing role of digital engagement and changing travel motivations. Although traditional generational differences remain evident, particularly in travel preferences and the use of social media, the convergence observed in the use of digital technologies suggests a broader trend toward the universal digitalization of tourism. These findings have important implications for the tourism industry, emphasizing the need for adaptive marketing strategies that appeal both to the adventure-seeking, digitally native Generation Z and to the more structured, yet increasingly digitally engaged, Generation X. Understanding these generational differences will enable tourism stakeholders to better tailor their products and services to the diverse and continuously evolving preferences of contemporary travellers. When interpreting the findings, the limitations of the study should be taken into consideration. The sample of respondents was limited in terms of demographic characteristics. Although members of Generations X, Y, and Z were included, the sample may not fully reflect the diversity within each generation in a broader context. The study relied on descriptive statistics for data analysis and was conducted at a single point in time. To obtain more representative results, future research should include a larger sample within each generational group and be conducted over longer periods, allowing changes in travel behaviour to be monitored, compared, and analysed using more advanced statistical methods. This study may serve as a basis for future research using appropriate variables and more sophisticated statistical approaches. The aforementioned limitations highlight the need for further research that will provide a deeper and broader understanding of generational differences in tourism behaviour.

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Sub-subsection: Guidelines for Abbreviations and Acronyms

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Do not use abbreviations in the title or heads unless they are unavoidable.

Sub-subsection: Guidelines for Figures and Tables

Tables, figures, and graphics should be centred, numbered and accompanied by a legend. Figure captions should be below figures; table heads should appear above tables. Insert figures and tables after they are cited in the text. Use the abbreviation “Figure 1”, even at the beginning of a sentence.

Sub-subsection: Guidelines for Page numbers and Footnotes

Please, do not add any kind of pagination anywhere in the paper. Avoid using headers and use footnotes only within the page margins (2,5 cm of white margins).

Sub-subsection: Guidelines for References

The list of the references should be given at the end of the paper. References are numbered in brackets by order of appearance in the document (e.g. [1], [2], [3]). The same reference can be cited more than once in the text with the same reference number.

Section

Use as many sections and subsections as you need (e.g. Introduction, Methodology, Results, Conclusions, etc.) and end the paper with the list of references.

REFERENCES [Times New Roman, 12-point, bold, left alignment]

Einstein, A. (1916). General Theory of Relativity. Annalen der Physik 49(7), pp. 769-822

LIST OF THE REVIEWERS

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Full Professor Edita Kastratović, PhD, *Faculty of Business Economics and Entrepreneurship, Belgrade, Serbia*
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Assistant Professor Biljana Dimitric, PhD, Faculty of Psychology, University of Bijeljina, Bosnia and Herzegovina
Research Associate Miroslav Nedeljković, PhD, Institute of Agricultural Economics, Belgrade, Serbia