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# ENTREPRENEURSHIP AND SUSTAINABILITY ISSUES

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## PECULIARITIES OF ART MANAGEMENT IN A DIGITAL CONTEXT – CASE STUDY OF POLAND

**Michał Szostak**

*University of Social Sciences, ul. Łucka 11, 00-842 Warsaw, Poland*

*E-mail: [mszostak@san.edu.pl](mailto:mszostak@san.edu.pl)*

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**Abstract.** The digitalisation of the aesthetic experience affects the level of artistry and creativity transfer by the artwork and the quality of participation in the arts. Due to cultural differences between Poles and other countries' citizens in perception qualities, this study assesses the effect of the participation form (in-real or digital) in the aesthetic situation by receivers on artistry and creativity potential. The quality of participation in five arts types (musical, performing, literary, audio-visual, visual) was assessed using ten criteria. Data analysis, based on a worldwide sample (38 countries,  $n = 221$ ). The participation form in arts determines participation quality in the aesthetic situation differently by Polish and non-Polish receivers. Furthermore, there are noteworthy cultural variances among Polish and non-Polish art receivers of particular types of arts and particular forms of participation in arts. The study outcomes may interest: art creators looking for the optimal way of delivering artworks among receivers from Poland and other countries; art managers and marketers for deeper understanding of Polish art receivers' viewpoints and their preferences about participation in arts in-real or digitally; art receivers to compare their judgement about the participation ways in arts with the preferences of Polish art receivers. The first attempt in the literature assessing the quality of the participation in the aesthetic situation regarding the form of participation between Polish and non-Polish societies.

**Keywords:** digitalisation; cultural differences; creativity; artistry loss; participation in arts; arts management; aesthetics; aesthetic situation; receiving process; art perception

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**Additional disciplines:** sociology, psychology, aesthetics, creativity

### 1. Introduction

For centuries, the content of human activities has been relatively fixed, although their forms change endlessly – currently, in-real activities are quickly transferred to digital forms or changed by them. Because the form of participation affects participation content and accordingly switches contributions and results (Karayılanoğlu & Arabacıoğlu, 2020), culture diversifies them even more (Hofstede, 2011; Vollero et al., 2020). Furthermore,

digitalisation progressively transforms the culture in its wholeness: along with technological progress comes a conversion of social contacts, aesthetic experiences and forms of expression (Kröner et al., 2021). In constantly-evolved settings, also management needs new methodologies and tools.

The COVID-19 pandemic marked many processes and sped up digital participation in various areas, including the arts (Lei & Tan, 2021). Considering the participation in arts from the aesthetic situation perspective, the examination should be undertaken from two edges: the creators' and the receivers' (Gołaszewska, 1984; Szostak, 2020, 2021a; Szostak & Sułkowski, 2020a). Therefore, the spine of this examination is a function of the "aesthetic situation" and "digital technologies" to get evidence about the change of creativity and artistry potential. The leading research issue is analysing the impact of "digital technologies" on particular "aesthetic situation" components, adding the lens of cultural factors. Therefore, the central exploration on this issue was separated into two levels: 1) creator-artwork (creative process) and 2) artwork-receiver (receiving process). This article highlights the artwork-receiver perspective, and its goals are: 1) assessment of the influence of digital technologies on the perception of each type of arts by non-Poles and Poles; 2) assessment of the scale of the influence of digital technologies on the perception of each type of arts by non-Poles and Poles; 3) assessment of the scale of creativity and artistry loss or gain because of the use of digital technologies in each type of art seen by non-Poles and Poles. Therefore, based on cultural differences, the following research hypothesis was created to achieve these goals: The form of participation (in-real or digital) in arts shapes participation quality in the aesthetic situation by the non-Polish and Polish arts receivers differently. Therefore, the following research questions were set to verify this hypothesis: RQ1) How do the non-Polish and Polish arts receivers perceive the quality of participation in particular types of arts regarding the form of participation (in-real or digitally)? RQ2) What are the differences among the non-Polish and Polish arts receivers between particular forms of participation in particular types of arts? RQ3) What are the differences among the non-Polish and Polish arts receivers between participation in particular types of arts regarding the form of participation?

## 2. Literature review

Communism and ethnocentric individualism are two main metatheories explaining the faintness of post-communist social capital. Weak but collectively accepted social capital habits link bribery, corruption, favouritism and achieve institutional fairness. Decades of conjunction with established democracies support citizens having ambitions well suited to the context of post-communist transformation to make up for the delay of decades gripping the jaws of communism (Soaita & Wind, 2020). Conversion between publicly- and private-owned assets shapes people's minds, behaviours, and objectives (Huber & Montag, 2020). Researchers explored the quality of social capital among post-communist societies – including Poland (Dolšák, 2019; Markowska-Przybyła, 2020; Nicoara, 2018; Soaita & Wind, 2020). Poland, placed between two powerful nations of Germany and Russia, has been a space of political conflicts and a safety buffer reducing the aggressors' impulses; this factor determines many social, behavioural, mental and cultural consequences of individuals and the whole nation. The far-reaching conclusion may be drawn here: the Polish nation has a severe problem with planned and constant improvement of social capital, which is seen in old-fashioned education, low participation, high emigration, constant internal fights (Aksiuto, 2019; Markowska-Przybyła, 2020; Markowska-Przybyła & Ramsey, 2016; Vučković & Škuflić, 2021).

It is worth asking about the reasons for dissimilarities between societies in assessing the receiving process of arts. The system transformation theory focused on time perspective for changes in culture and identity (individual and group) may be the first answer; longer and tighter embrace of communism, more significant changes and more extended period of leaving the past. These results were investigated by researchers of European post-communistic countries like the Czech Republic (Hornat, 2019), Estonia, Latvia, Lithuania (Kreuzer & Pettai, 2003), Slovakia (Mikloš, 2021), and still communist countries like China (Xue et al., 2021). There are three transformation approaches: gradualist approach, radical approach, and spontaneous approach (Mikloš, 2021). Each of them

influences the cultural dimensions differently due to education system quality and governments' priorities during the transformation process (Birch, 2003; Golob & Makarovič, 2017; Hornat, 2019). The second answer may be Hofstede's cultural dimensions theory indicating the impact of a society's culture on its members' values and behaviours (Hofstede, 2011). Following this theory, communist and post-communist societies equipped with diverse values structures evaluate participation in arts inversely compared to societies without communist background (Szostak, 2022a); this record is confirmed by the research about cultural differences of perception of creative identities of artists, managers, leaders and entrepreneurs (Szostak, 2021b, 2021d, 2022d; Szostak & Sułkowski, 2021c, 2021a). It cannot be forgotten that the communism burden had (or still has) been having diverse forms and influences: the Chinese society is differently influenced by its form of communism contrasted to Polish or Czech ones after dozens of years of freedom (Bartlová, 2019; Kozieł, 2019; Pavlica & Thorpe, 1998; Szostak, 2021d; Tan, 2012). Art history is filled with theories created by communist or fascist despots using culture as a crucial factor of their command (Gupta, 2010; Rasmussen, 2021). After the Cold War, profound political, economic, social, and cultural transformations in the former Eastern Bloc began, and forces started back to equilibrium (Kaljula, 2015). Post-communist countries started a new era of changes in the world of art. Gender factors, determining the structure of the society, may also have an essential influence on perception qualities by each nation (Szostak, 2021c, 2022b).

In the aesthetic situation theory, the most visible sign of creativity is the artwork; in the creator's personality, the essential processes making up the phenomenon of creativity happen. The work of art is a carrier of creativity and artistry (Szostak, 2020); simultaneously, the level of creativity and artistry (including universal values) located in the artwork varies on the art receiver's attitude and the form of participation in arts (Szostak, 2021a). The activity of artistic creation is shaped by specified factors like personality conditions, social conditions, a wealth of experience. However, a straightforward creative attitude is insufficient to start the creative process – creativity itself, with a crucial role of motifs and inspirations, is also necessary (Szostak, 2020, 2021a). Inevitably, cultural predispositions to improvisation and fixation play also an important role here (Szostak, 2019, 2021a). Art, as a way of transferring the artist's will into the artwork to affect the receivers, plays an essential role in cultural development. The artist's role is to communicate inner states by expressing them and allowing recipients to achieve them (Szostak & Sułkowski, 2020a). From the aesthetic situation point of view, the creator generates his artwork reflecting the natural world and the world of universal values, and the creator departs this ready-made result (artwork) for the receiver. The receiver selects the way of participation in the receiving process fitting to particular conditions. On the other side, the unadjusted-to-the-circumstances choice of the perception form determines the content of the receiving process. More-experienced receivers may be supplementary fluent in using a less efficient form of participation without the quality of the content. Opposing, even the most efficient participation form may not be sufficient to distribute the entire content to the less-experienced receiver (Gołaszewska, 1984; Szostak, 2020).

Participation in arts involves senses (Ekmekçi et al., 2014; Sosnowska, 2015) and – because of cultural differences – societies use their senses differently (Doğan et al., 2019). However, despite arts' digitalisation being regulated by the technical possibilities to transmit the analogue senses' experience into virtual dimensions (Mao & Jiang, 2021), digital participation in arts plays the role of 'digital mediation', which locates the role of digital technology in a proper place, i.e., in 'between' the artwork and the receiver (Jarrier & Bourgeon-Renault, 2019). Furthermore, senses allow for physical, emotional (Buravenkova et al., 2018), intellectual, and spiritual (Rivas-Carmona, 2020; J. C. Wu, 2020) participation in art. Therefore, examination of the receiving process on all levels in the context of cultural differences exposes the investigated problem's complexity level.

The last decades revealed new general trends in arts: globalisation of opinions, globalisation of trends, direct contact between creator and the audience, mass production, popularisation and intensification of kitsch (McBride, 2005; Szostak, 2021a; Szostak & Sułkowski, 2020b). The digitalisation, constantly developing IT tools and social media forced arts to take a sharp turn (Handa, 2020). Performative arts has especially undergone a fundamental

shift since ephemeral performance may currently be stopped, replayed and repeated (Dunne-Howrie, 2020). Even though the increase of digitalisation use in arts has been more intense year by year, the COVID-19 pandemic added new stimuli to this process. Parallely, aside from the digital transformation of the participation in arts, there are complementary trends among artists like their shift to entrepreneurship (Szostak & Sułkowski, 2021b) or new problems with artists' auto-identification (Szostak & Sułkowski, 2021c). That is why digitalisation may be seen as a revolution or evolution. Digital technologies allow redesigning the environment and historical attempts to numerous issues. Therefore, it can be said that today's culture is ordered by digitalisation (Roberge & Chantepie, 2017). Because the digital transformation affects and is shaped by specific cultures differently, it also amplifies spirituality from its real context in the socio-cultural interpretation of the natural world to current digitally-mediated settings (Sosnowska, 2015). Mediatisation of cultural practices has been changing the processes of cultural memory structure, and online interaction skills have become the basis of education to balance tradition and innovation (Arkhangelsky & Novikova, 2021). The goal of using the Internet as a participating platform engaging the public in creating artwork is to showcase the relationship between the shared imagination and the specific artistic sensibilities of its participants (Literat, 2012).

Digitalisation, broadening horizons for art receivers, unlocks further concerns simultaneously. First, the mass receivers' attitude forces decreasing the artwork's artistic quality. Second, the digitalisation of arts develops the serving role of arts to make them more understandable, customer-friendly and artistry-reduced (Pöppel et al., 2018; Szostak, 2021a). Third, digital exclusion limits participation in the receiving process (Hracs, 2015; Rikou & Chaviara, 2016). Still, a vital question is a relationship between value and quality, which is used to measure and compare various objects they encounter (Fortuna & Modliński, 2021). E.g., considering musical arts, during the reception of a recital in in-real form, the receiver meets the artwork in its determined appearance: no volume adjustments, no pauses. On the contrary, the digital form of participation in musical arts allows for these adjustments, and the artwork may affect the receiver differently from the creator's desire. Fourth, in performing arts participated in-real, a receiver is also a hostage of the artwork; he must keep the regimes of the artwork (its length, volume, visibility). Digitalisation probably shapes the performing arts (Dube & Ince, 2019). Finally, the concept of self-historicisation, merging with the contemporary artistic language of performance, supports the artists' recognition in the international art context; a long period of communism shaping the culture of participation in art plays a vital role here (Proksch-Weilguni, 2019). The use of visual image technology in art also permits the growth of digital media art (Mao & Jiang, 2021) and, accordingly, a never-ending cycle of mutual inspirations. The form of the receiving process of visual arts profoundly affects the shape of the receiving process: a painting is determined by its content and form (e.g. size), environment, emotions shaped by these issues and linked to the receiver's approach towards the artwork. Based on that, digital collaboration in art, digital marketing and digital performance can differentiate and include audiences as authentic arts co-producers (Fortuna & Modliński, 2021). It seems interesting to examine how art receivers of different cultures (Polish and non-Polish) perceive artworks created in this process because the effectiveness and sustainability of the aesthetic situation digitisation are not apparent (Nawa & Sirayi, 2014; Rusinko, 2020).

From the point of view of management, companies and organisations can gain from aesthetics on many levels: 1) utilising artistic interventions for individual and group creativity development or problems solving (Schnuugg, 2019; Skoldberg Johansson et al., 2015); 2) interpreting arts into executive action using the effectiveness of art forms (Pöppel et al., 2018); 3) utilising abstract concepts of aesthetics into management theory and practice (Szostak, 2021a, 2022c; Szostak & Sułkowski, 2020a, 2020b). Based on this, management selects and regulates the optimal type of participation in each type of art, considering the acceptable grade of creativity and artistry loss or gain. Furthermore, art creators work differently in the digital environment needing assistance from co-workers, contractors, and managers, playing a significant role in connecting, harmonising and curating projects and processes (Hracs, 2015). Also, marketers attempting to adjust to constant changes in the market may gain from this research. Cultural differences determine all these optics, and the communism factor plays an important role here.



Considering the above analysis, there is a vital research gap in the sensitivity of arts towards digital participation forms and defining the consequences of the differences between digital and in-real participation forms by Polish citizens compared to other countries, both post-communist and non-communist. For example, it may turn out that digital participation in an artistically valuable theatrical performance is much less valuable for a digital audience than a series of average quality designed for digital reception – this research tries to fill this gap.

### 3. Methods and materials

Research in reviewing literature focused on a qualitative choice of the content of Google Scholar, Mendeley, EBSCO, JSTOR, and Scopus databases, especially from the last five years (2018-2022) and data using NVivo Pro software was undertaken. The methodological approach to the literature review was based on an interdisciplinary approach blending aesthetic theory, cultural and reception studies, information visualisation, human-computer interaction, arts and management. For the purpose of this research, arts were divided into five separate categories: 1) musical arts (instrumental and vocal concert and performance, oratorio), 2) performing arts (ballet, dance, mime, opera, performance, theatre), 3) literary arts (drama, fiction, non-fiction, prose, poetry), 4) audio-visual arts (clip, movie, video game) and 4) visual arts (architecture, ceramics, comics, design, drawing, fashion, painting, photography, sculpture). After the literature review, ten aspects were set for the participation quality in each type of art assessment: 1) satisfaction from the participation (Guo et al., 2020; Quattrini et al., 2020; Zollo et al., 2021), 2) participation pleasure (Dunne-Howrie, 2020), 3) participation engagement (Dube & İnce, 2019; Quattrini et al., 2020; Y. Wu et al., 2017), 4) catharsis-experiencing possibility (Craig et al., 2020; Lee, 2011), 5) contact with the artwork itself (Habelsberger & Bhansing, 2021), 6) contact with the performer itself (Y. Wu et al., 2017), 7) participation comfort (Guidry, 2014), 8) shaping-the-aesthetical-experience possibilities (Jackson, 2017; Park & Lim, 2015), 9) own motivation to participate (Hobbs & Tuzel, 2017; Pianzola et al., 2021), 10) participation easiness (Dunne-Howrie, 2020; Fancourt et al., 2020).

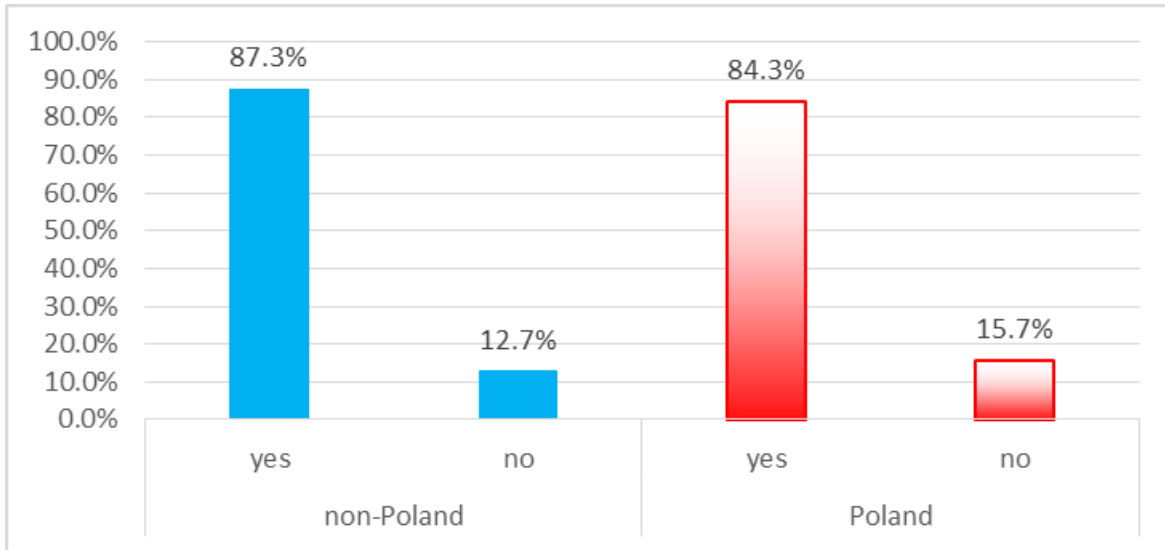
In the second step, a quantitative exploration was completed to estimate culturally-differentiated receivers' participation quality in each type of art analysed based on the ten criteria described above. Furthermore, this step aimed to conclude the results about possibly different artistic activities being comprehensible simultaneously. IBM SPSS and MS Excel software executed data analysis; however, complex statistics were not conducted due to the small sample size ( $n = 221$ ). The quantitative investigation was held between May and December 2021, applying digital tools by SURVIO company. The survey, in English, was dispersed by social media, direct requests and official announcements. It contained 71 questions and was divided into six parts. The first five parts regarded each type of art. All questions were closed-type; respondents could select prepared answers only. While assessing the level of quality of a factor, the respondents used a 5-step Lickert scale: *very low* (1), *rather low* (2), *neutral* (3), *rather high* (4), *very high* (5). The sixth part of the survey permitted categorising the respondents regarding age, gender, nationality and education level. 28.4% out of 777 visits concluded in 221 responses. The oldest participant was born in 1931 (90 y.o.) and the youngest in 2005 (16 y.o.). The majority of respondents (60.1%) graduated bachelor, master, or engineer studies; 28.2% had a doctorate, habilitation, or professorship; 9.4% graduated from a technical college or high school, and 2.3% from primary school or junior high school. Respondents (55.2% men and 44.8% women) came from 38 countries including 37.2% from Poland. The participant assessed belonging to the Polish circle based on which country he had lived in for the longest period and which culture was closest to him.

### 4. Findings

86.2% of respondents (i.e. 87.3% of non-Poles and 84.3% of Poles) participate in cultural life. On the contrary, 13.8% of respondents (12.7% of non-Poles and 15.7% of Poles) do not do it at all. See: Figure 1. Non-Poles participate in cultural life by choosing musical arts in 69.9%, performing arts in 62.1%, literary arts in 44.7%, audio-visual arts in 61.2% and visual arts in 51.5%. Poles participate in cultural life by choosing musical arts in

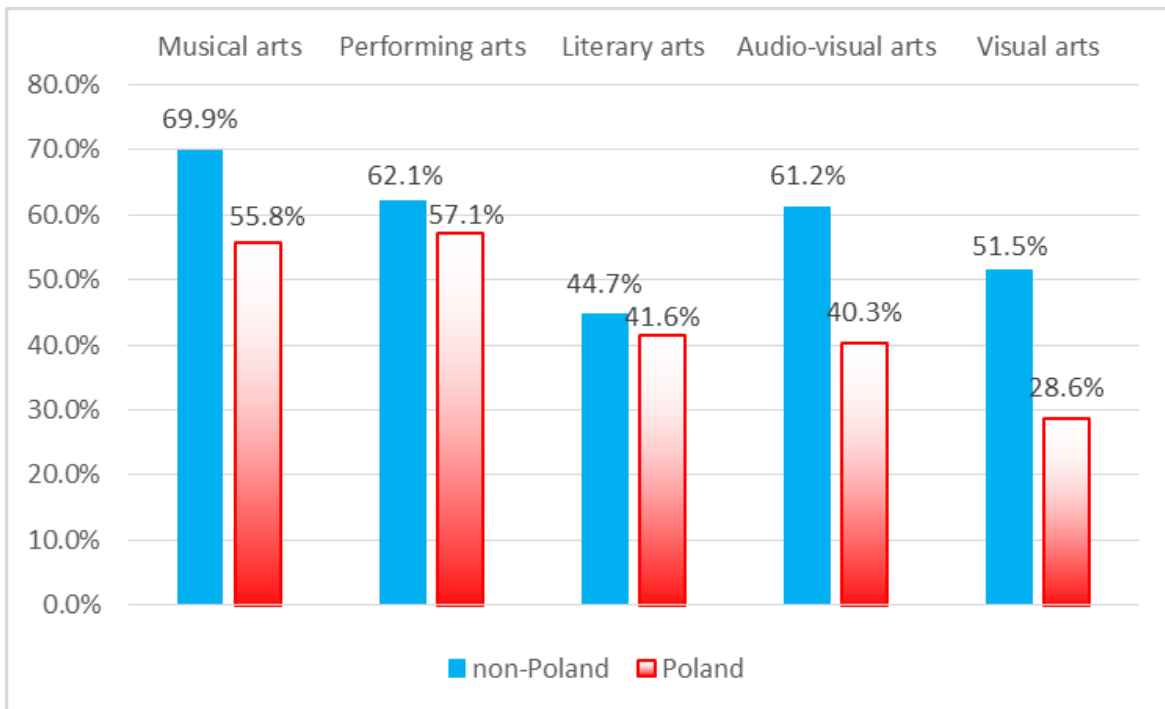


55.8%, performing arts in 57.1%, literary arts in 41.6%, audio-visual arts in 61.2% and visual arts in 28.6%. See: Figure 2. It can be said that Poles participate in arts much rare than non-Poles (in descending order): 44.5% less in visual arts, 34.4% less in audio-visual arts, 20.1% more in musical arts, 8.0% less in performing arts and 6.9% less in literary arts. See: Figure 3.



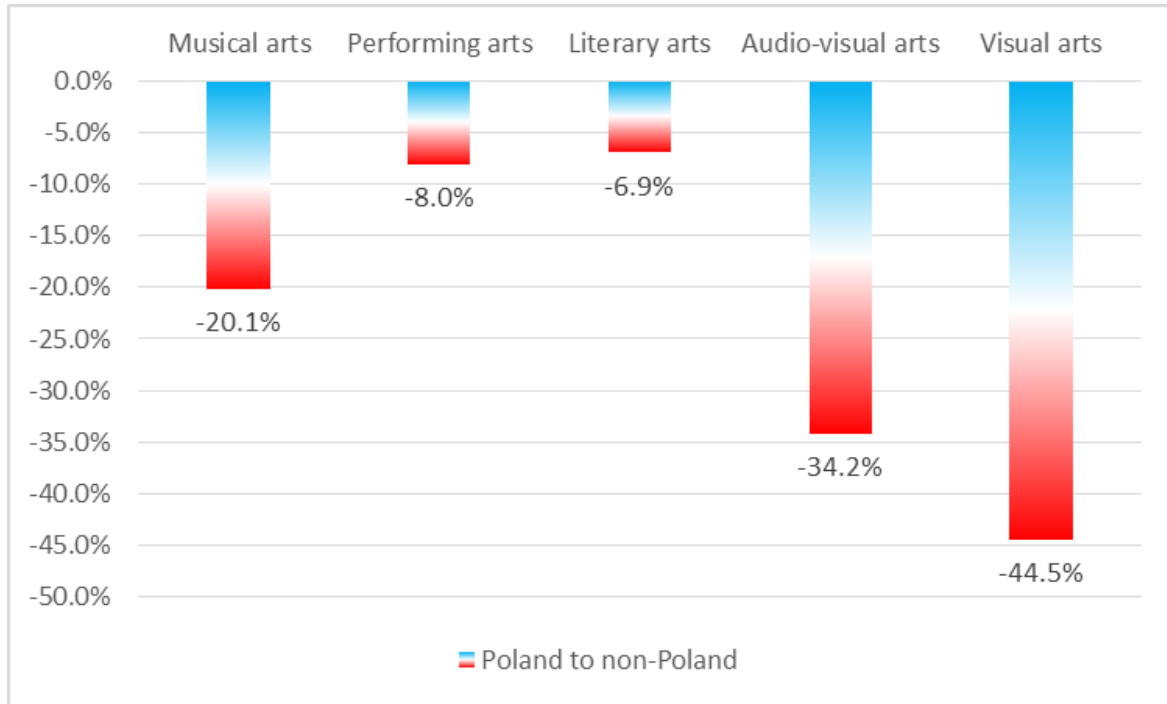
**Figure 1.** Participation in all types of arts by non-Poles and Poles.

*Source: own elaboration.*



**Figure 2.** Participation in each type of art by non-Poles and Poles.

*Source: own elaboration.*



**Figure 3.** Differences between Poles and non-Poles in participation in each type of art.

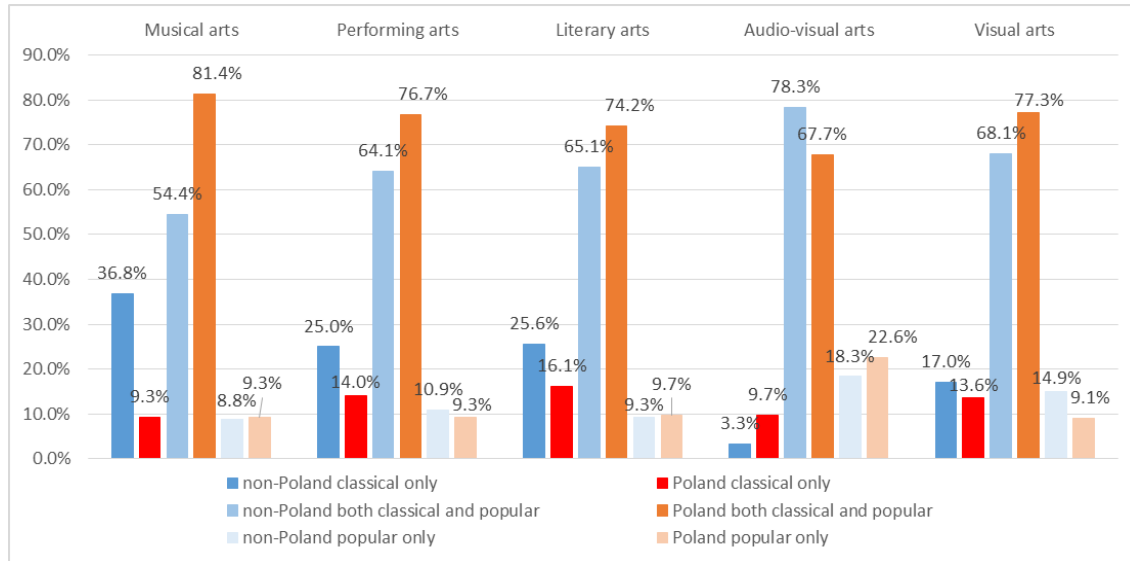
*Source: own elaboration.*

#### 4.1. Regarding the type of arts

The majority of all types of arts receivers is involved both in classical and popular forms of arts: 54.4% of non-Poles and 81.4% of Poles in musical arts (difference: 49.6%), 64.1% of non-Poles and 76.7% of Poles in performing arts (difference: 19.8%), 65.1% of non-Poles and 74.2% of Poles in literary arts (difference: 13.9%), 78.3% of non-Poles and 67.7% of Poles in audio-visual arts (difference: 13.5%), and 68.1% of non-Poles and 77.3% of Poles in visual arts (difference: 13.5%). However, only the classical form is attended by: 36.8% of non-Poles and 9.3% of Poles in the case of musical arts (difference: 74.7%), 25.0% of non-Poles and 14.0% of Poles in case of performing arts (difference: 44.2%), 25.6% of non-Poles and 16.1% of Poles in case of literary arts (difference: 37.0%), 3.3% of non-Poles and 9.7% of Poles in case audio-visual arts (difference: 190.3%), and 17.0% of non-Poles and 13.6% of Poles in case of visual arts (difference: 19.9%). On the other hand, only the popular form is attended by: 8.8% of non-Poles and 9.3% of Poles in case of musical arts (difference: 5.4%), 10.9% of non-Poles and 9.3% of Poles in case of performing arts (difference: 15.0%), 9.3% of non-Poles and 9.7% of Poles in case of literary arts (difference: 4.0%), 18.3% of non-Poles and 22.6% of Poles in case audio-visual arts (difference: 23.2%), and 14.9% of non-Poles and 9.1% of Poles in case of visual arts (difference: 39.0%). See: Figure 4 and Figure 5.

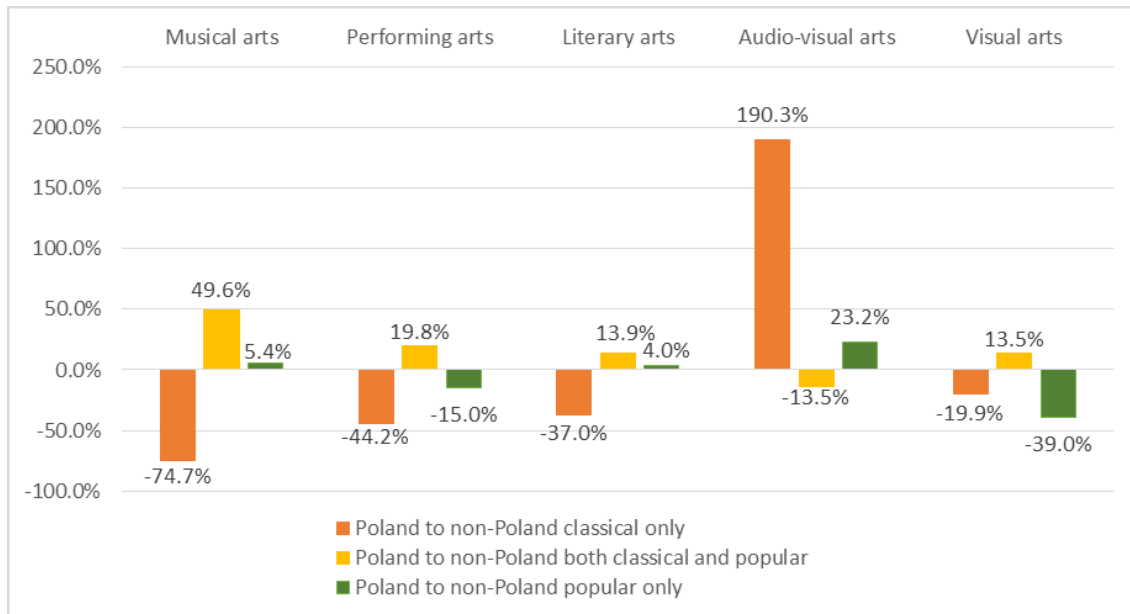
The research exposes the following variances between non-Poles and Poles in the form of participation in arts. Musical arts receivers assess the quality of the aesthetic situation concerning the form of participation in the following distribution: in-real – 4.15 by non-Poles and 4.02 by Poles (difference 3.0%), digitally – 3.24 by non-Poles and 3.35 by Poles (difference 3.3%). Performing arts receivers assess the quality of the whole aesthetic situation as follows: in-real – 4.01 by non-Poles and 3.96 by Poles (difference 1.4%), digitally – 3.07 by non-Poles and 3.05 by Poles (difference 0.7%). Literary arts receivers assess the quality of the whole aesthetic situation as follows: in-real – 4.04 by non-Poles and 3.90 by Poles (difference 3.6%), digitally – 3.67 by non-

Poles and 3.24 by Poles (difference 11.8%). Audio-visual arts receivers assess the quality of the whole aesthetic situation: in-real – 3.64 by non-Poles and 3.56 by Poles (difference 2.0%), digitally – 3.94 by non-Poles and 3.90 by Poles (difference 1.1%). Finally, visual arts receivers assess the quality of the whole aesthetic situation: in-real – 4.07 by non-Poles and 3.94 by Poles (difference 3.2%), digitally – 3.45 by non-Poles and 3.16 by Poles (difference 8.5%). See: Figure 6 and Figure 7.



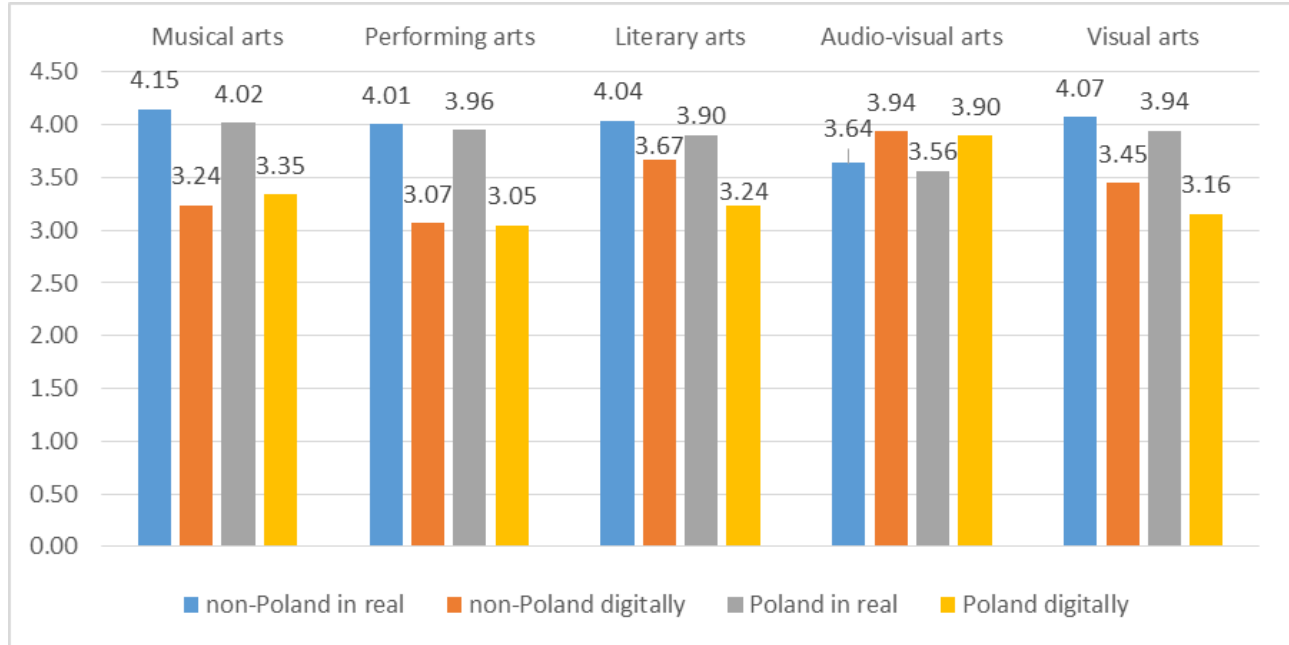
**Figure 4.** Participation in particular arts regarding arts types (classical only, both classical and popular, popular only) by non-Poles and Poles.

Source: own elaboration.



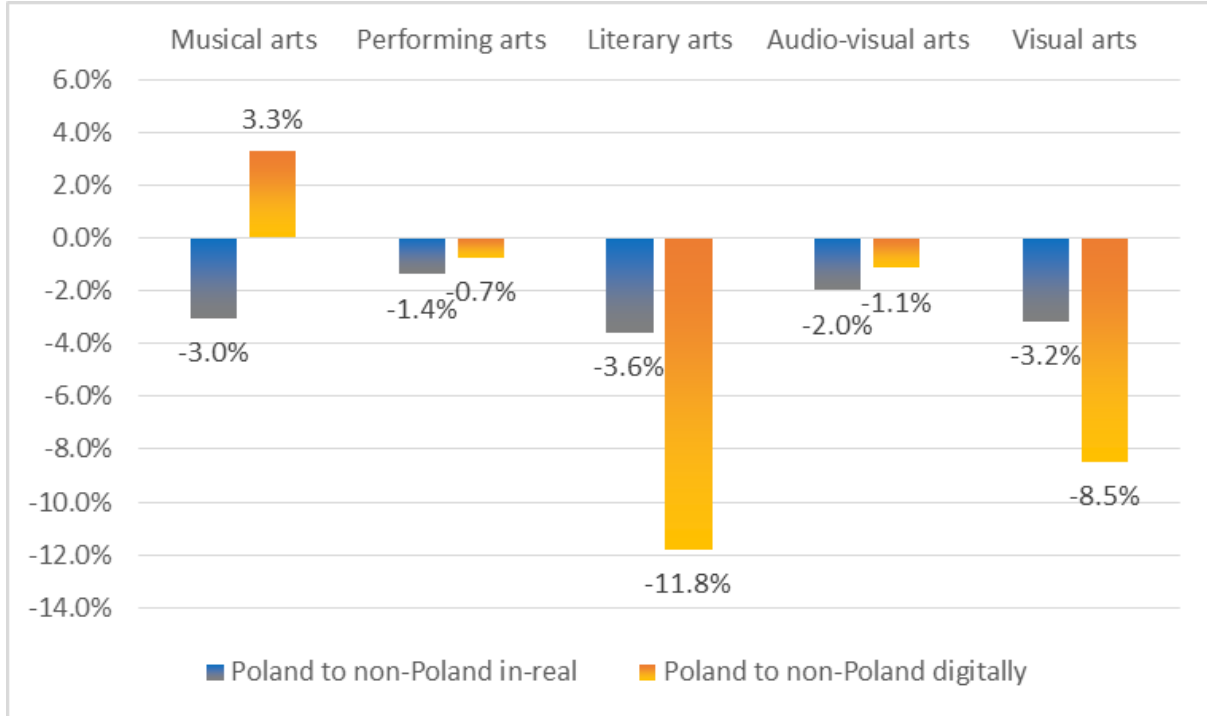
**Figure 5.** Differences between non-Poles and Poles in participation in different arts regarding arts types (classical only, both classical and popular, popular only).

Source: own elaboration.



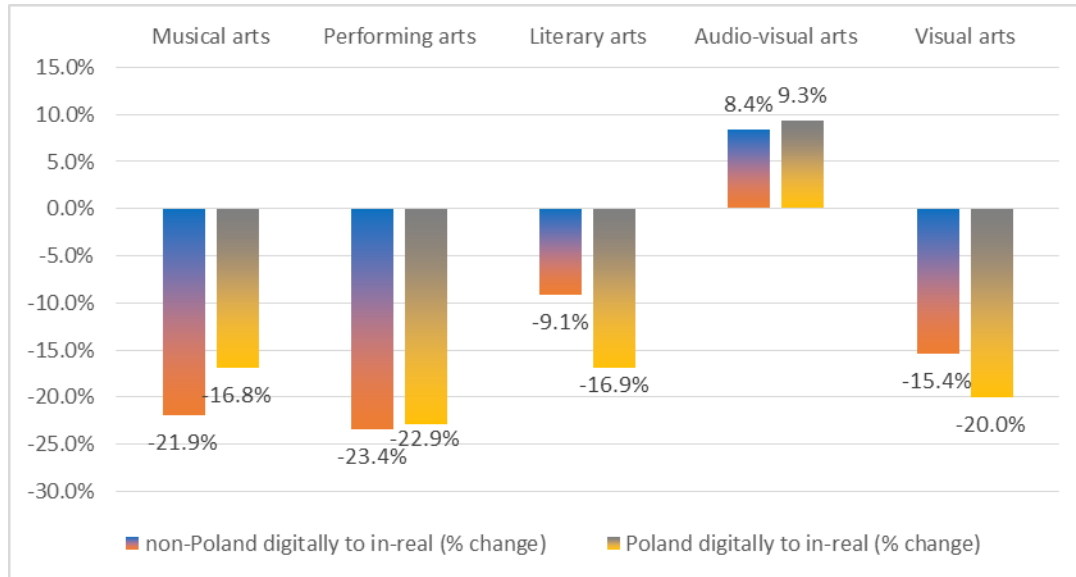
**Figure 6.** Assessment of the aesthetic situation quality regarding the form of participation in the receiving process of a particular type of arts between non-Polish and Polish citizens.

*Source: own elaboration.*



**Figure 7.** Differences between non-Poles and Poles in assessing the aesthetic situation quality regarding the in-real and digital form of participation in the receiving process of a particular type of art.

*Source: own elaboration.*



**Figure 8.** Differences between non-Poles' and Poles' assessment of the receiving process regarding the aesthetic situation quality of a particular type of art considering the form of participation (in-real or digital).

*Source: own elaboration.*

According to non-Poles, musical arts comparing digital to in-real participation lose 21.9% of the receiving process quality and 16.8%, according to Poles. Performing arts lose accordingly 23.4% to the non-Poles and 22.9% to Poles. Literary arts lose 9.1% to the non-Poles and 16.9% to Poles. On the other hand, audio-visual arts, comparing digital to in-real participation, gain 8.4% to non-Poles and 9.3% to Poles. On the other hand, visual arts lose 15.4% to the non-Poles and 20.0% to the Poles. See: Figure 8.

#### 4.2. Regarding qualities of the aesthetic situation

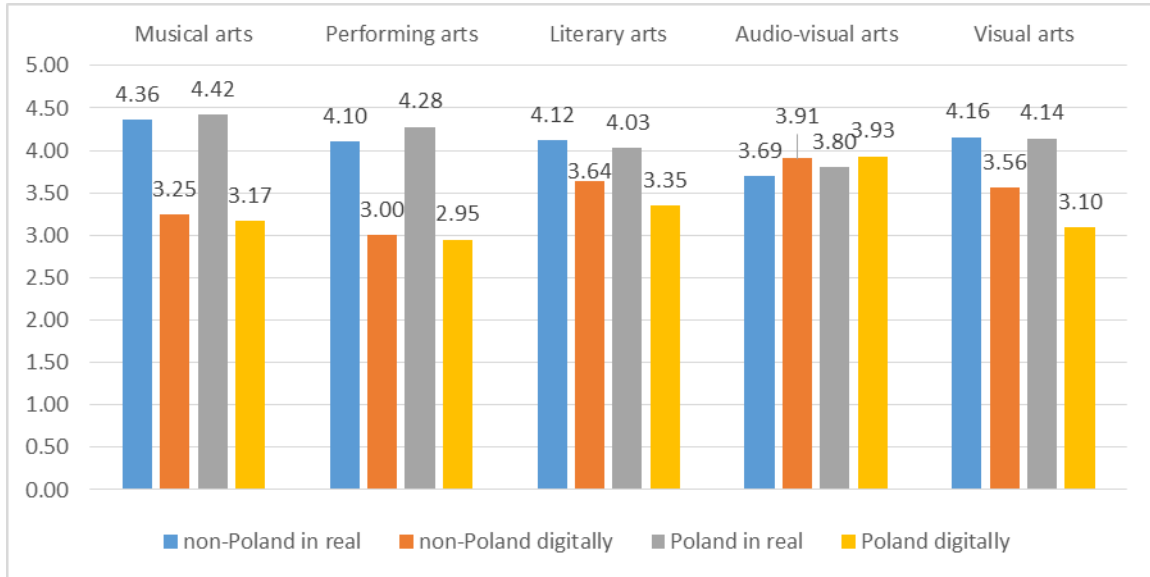
After analysing general variances between the forms of participation in each type of art by the non-Poles and Poles, it is worth verifying how particular components of the aesthetic situation behave regarding the type of participation in each type of art concerning the art receiver's cultural roots.

##### 4.2.1. Satisfaction

Musical arts receivers from non-Poland and Poland assess their satisfaction concerning the form of participation in the receiving process in the following distribution: in-real – 4.33 by non-Poles and 4.42 by Poles (difference of 1.3%), digitally – 3.25 by non-Poles and 3.17 by Poles (difference of 2.4%). Performing arts receivers assess their satisfaction as follows: in-real – 4.10 by non-Poles and 4.28 by Poles (difference of 4.3%), digitally – 3.00 by non-Poles and 2.95 by Poles (difference of 1.6%). Literary arts receivers assess their satisfaction as follows: in-real – 4.12 by non-Poles and 4.03 by Poles (difference of 2.1%), digitally – 3.64 by non-Poles and 3.35 by Poles (difference of 7.9%). Audio-visual arts receivers assess their satisfaction: in-real – 3.69 by non-Poles and 3.80 by Poles (difference of 2.8%), digitally – 3.91 by non-Poles and 3.93 by Poles (difference of 0.6%). Finally, visual arts receivers assess their satisfaction: in-real – 4.16 by non-Poles and 4.14 by Poles (difference of 0.3%), digitally – 3.56 by non-Poles and 3.10 by Poles (difference of 13.1%). See: Figure 9 and Figure 10.

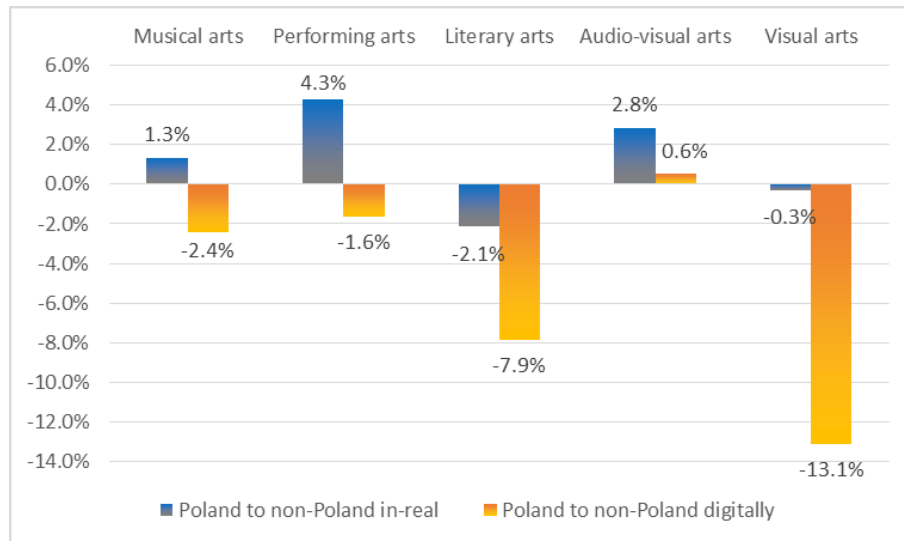
We can see the following variances between the form of participation in the receiving process by non-Poles and Poles regarding their satisfaction flowing from a particular type of art. First, non-Poles assess digital participation

in musical arts as 25.5% less satisfactory than in-real; for Poles, this difference is slightly higher, i.e. 28.2%. Second, the non-Poles assess digital participation in performing arts as 26.9% less satisfactory than in-real; this difference is 31.0% for Poles. Third, the non-Poles assess digital participation in literary arts as 11.6% less satisfactory than in-real; this difference is 16.8% for Poles. Fourth, the non-Poles assess digital participation in audio-visual arts as 5.8% more satisfactory than in-real; this difference is 3.4% for Poles. Finally, the non-Poles assess digital participation in visual arts as 14.3% less satisfactory than in-real; this difference is 25.3% for Poles. See: Figure 11.



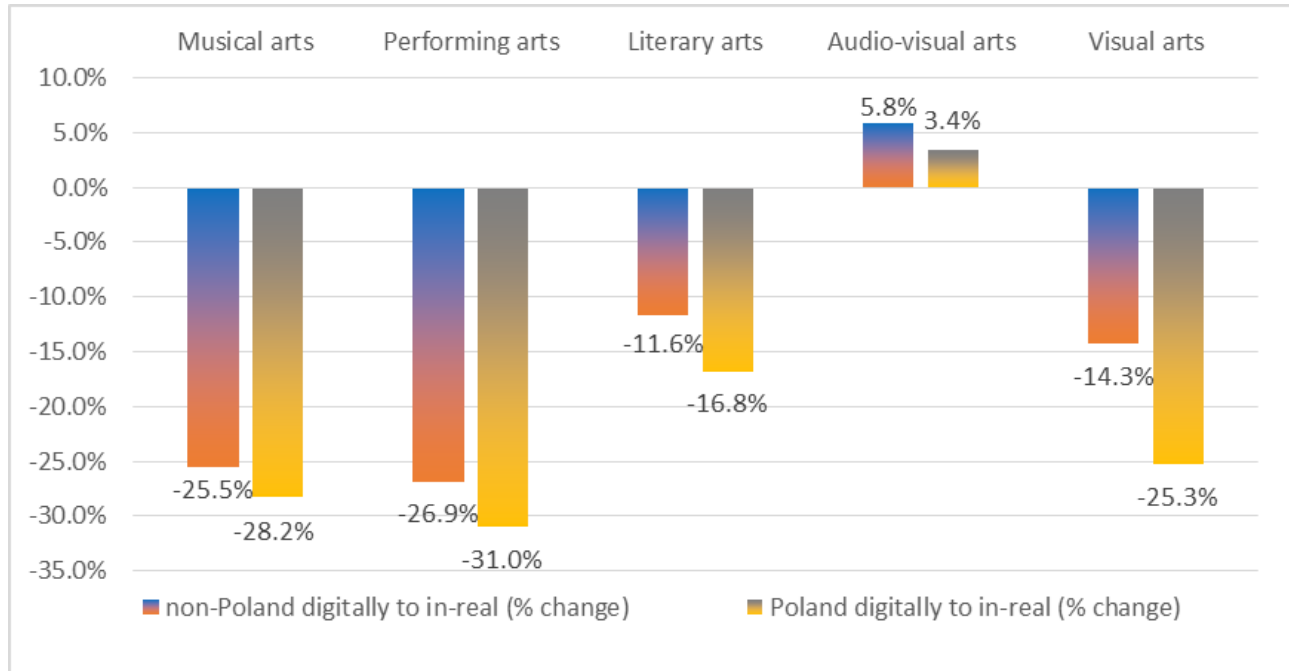
**Figure 9.** Assessment of non-Poles' and Poles' satisfaction flowing from a particular type of art concerning the form of participation in the receiving process.

Source: own elaboration.



**Figure 10.** Differences between non-Poles and Poles in assessing their satisfaction regarding the form of participation in the receiving process of a particular type of art.

Source: own elaboration.



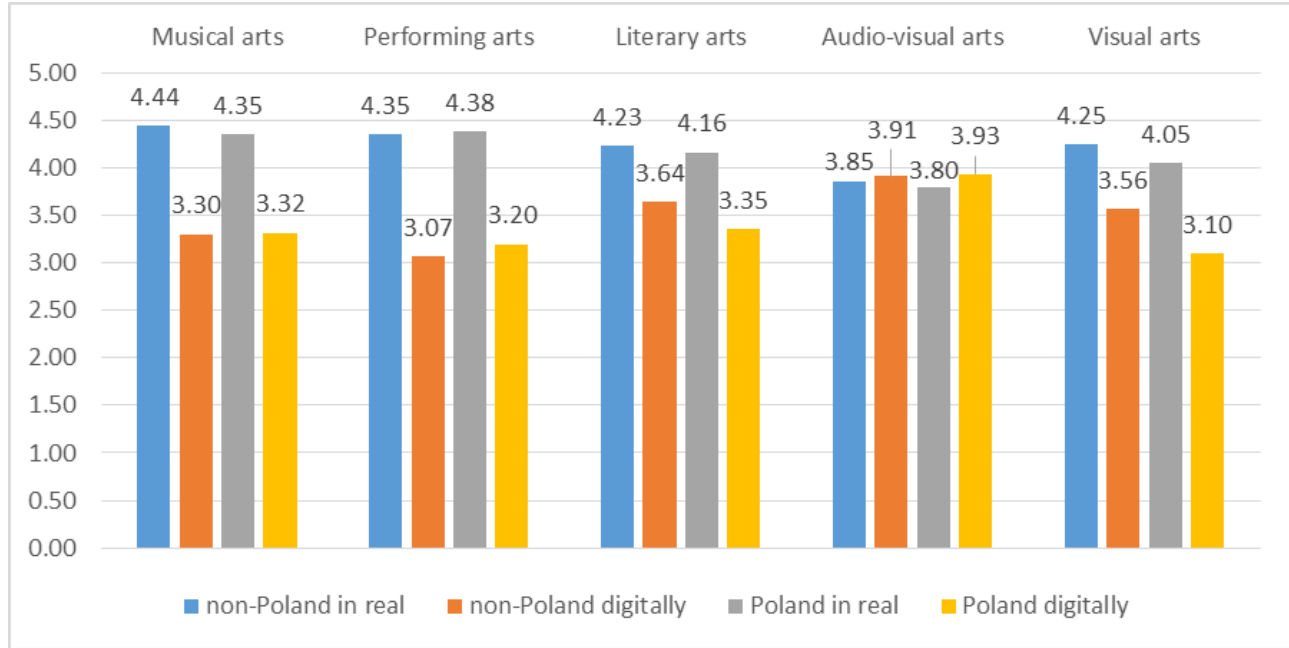
**Figure 11.** Differences between the form of participation in the receiving process by non-Poles and Poles regarding their satisfaction flowing from a particular type of art.

Source: own elaboration.

#### 4.2.2. Pleasure

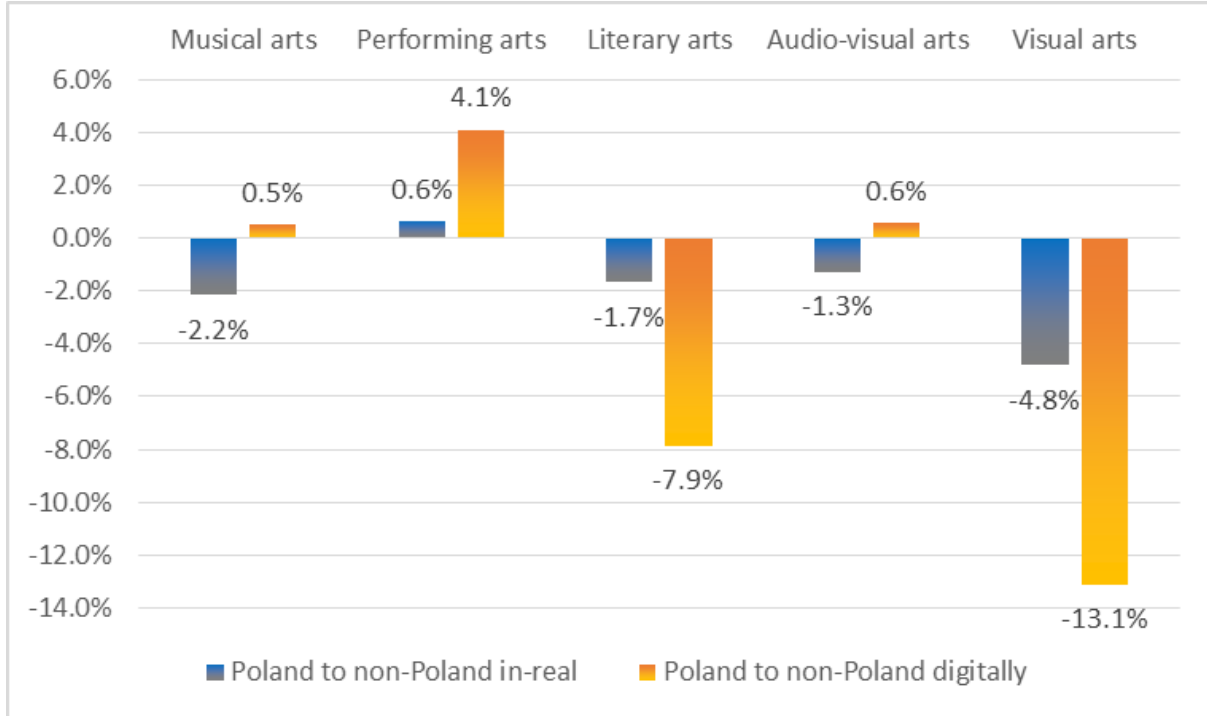
Musical arts receivers from non-Poland and Poland assess their pleasure concerning the form of participation in the receiving process in the following distribution: in-real – 4.44 by the non-Poles and 4.35 by the Poles (difference of 2.2%), digitally – 3.30 by non-Poles and 3.32 by Poles (difference of 0.5%). Performing arts receivers assess their pleasure as follows: in-real – 4.35 by non-Poles and 4.38 by Poles (difference of 0.6%), digitally – 3.07 by non-Poles and 3.20 by Poles (difference of 4.1%). Literary arts receivers assess their pleasure as follows: in-real – 4.23 by non-Poles and 4.16 by Poles (difference of 1.7%), digitally – 3.64 by non-Poles and 3.35 by Poles (difference of 7.9%). Audio-visual arts receivers assess their pleasure as follows: in-real – 3.85 by non-Poles and 3.80 by Poles (difference of 1.3%), digitally – 3.91 by non-Poles and 3.93 by Poles (difference of 0.6%). Finally, visual arts receivers assess their pleasure as follows: in-real – 4.25 by non-Poles and 4.05 by Poles (difference of 4.8%), digitally – 3.56 by non-Poles and 3.10 by Poles (difference of 13.1%). See: Figure 12 and Figure 13.

We can see the following variances between the form of participation in the receiving process by non-Poles and Poles regarding their pleasure flowing from a particular type of art. First, non-Poles assess digital participation in musical arts as 25.5% less pleasing than in-real; this difference is 28.2% for Poles. Second, non-Poles assess digital participation in performing arts as 26.9% less pleasing than in-real; this difference is 31.0% for Poles. Third, non-Poles assess digital participation in literary arts as 11.6% less pleasing than in-real; this difference is 16.8% for Poles. Fourth, non-Poles assess digital participation in audio-visual arts as 5.8% more pleasing than in-real; this difference is 3.4% for Poles. Finally, non-Poles assess digital participation in visual arts as 14.3% less pleasing than in-real; this difference is 25.3% for Poles. See: Figure 14.



**Figure 12.** Assessment of non-Poles' and Poles' pleasure flowing from a particular type of art concerning the form of participation in the receiving process.

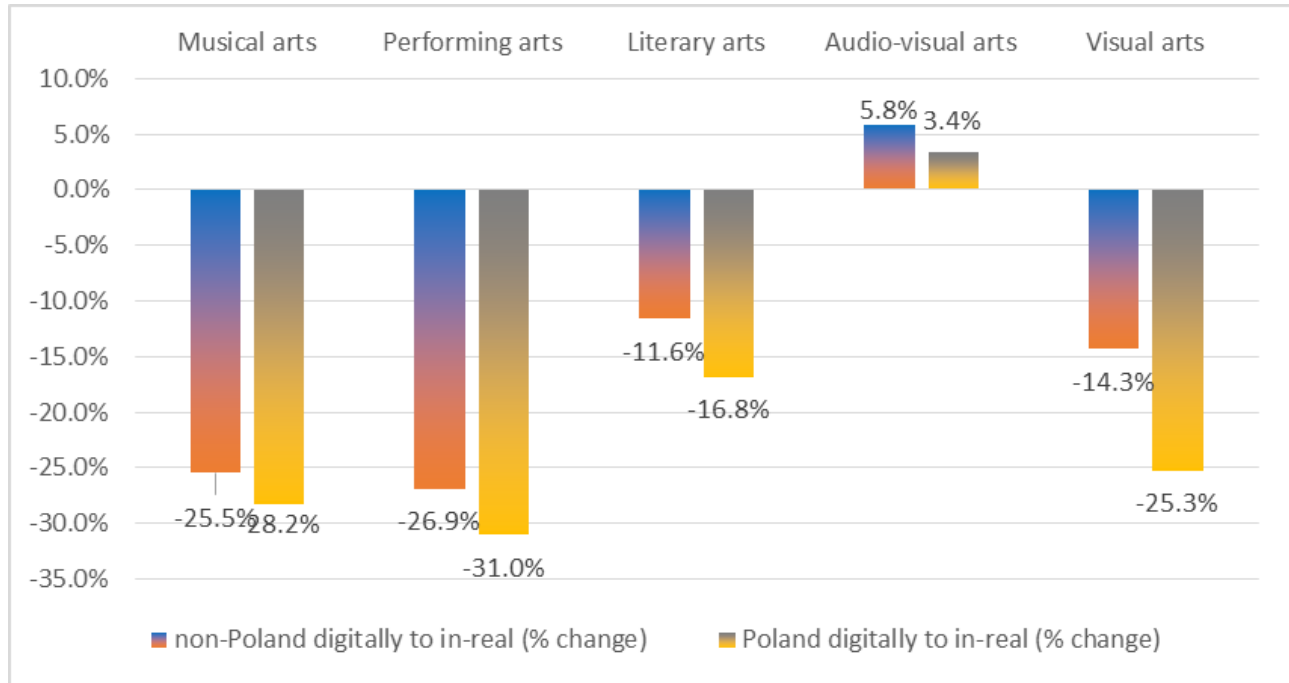
*Source: own elaboration.*



**Figure 13.** Differences between non-Poles and Poles in assessing their pleasure regarding the form of participation in the receiving process of a particular type of art.

*Source: own elaboration.*





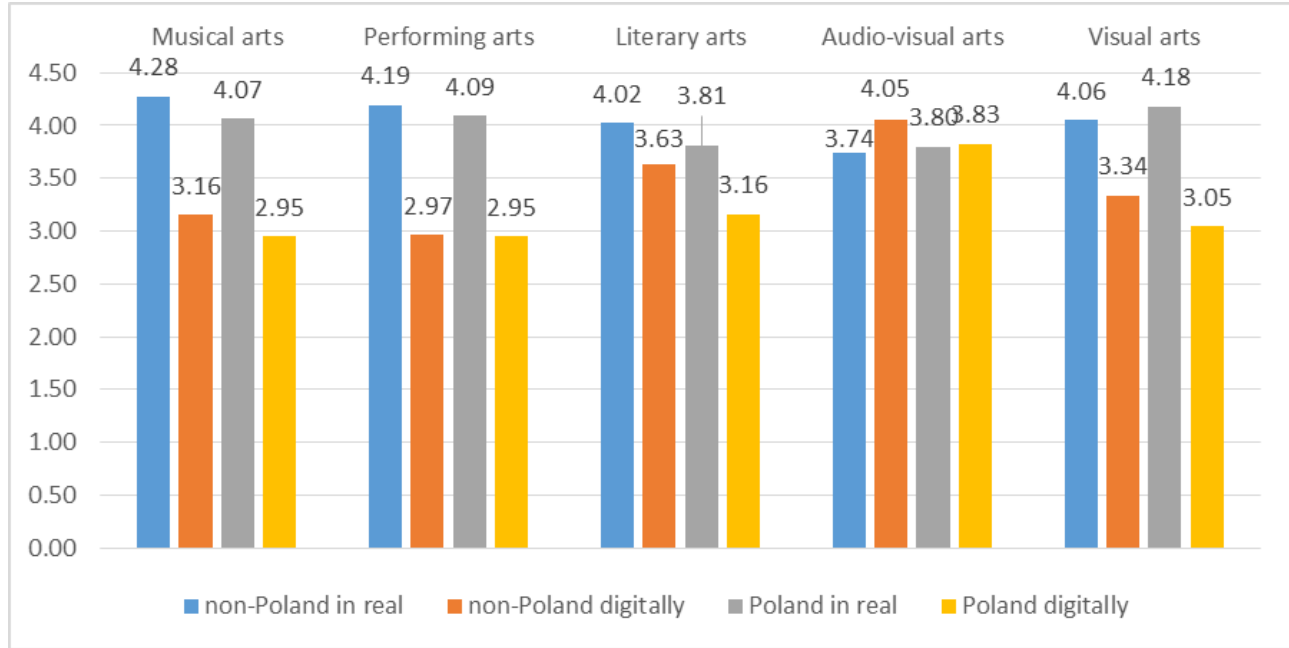
**Figure 14.** Differences between the form of participation in the receiving process by non-Poles and Poles regarding their pleasure flowing from a particular type of art.

*Source: own elaboration.*

#### 4.2.3. Engagement

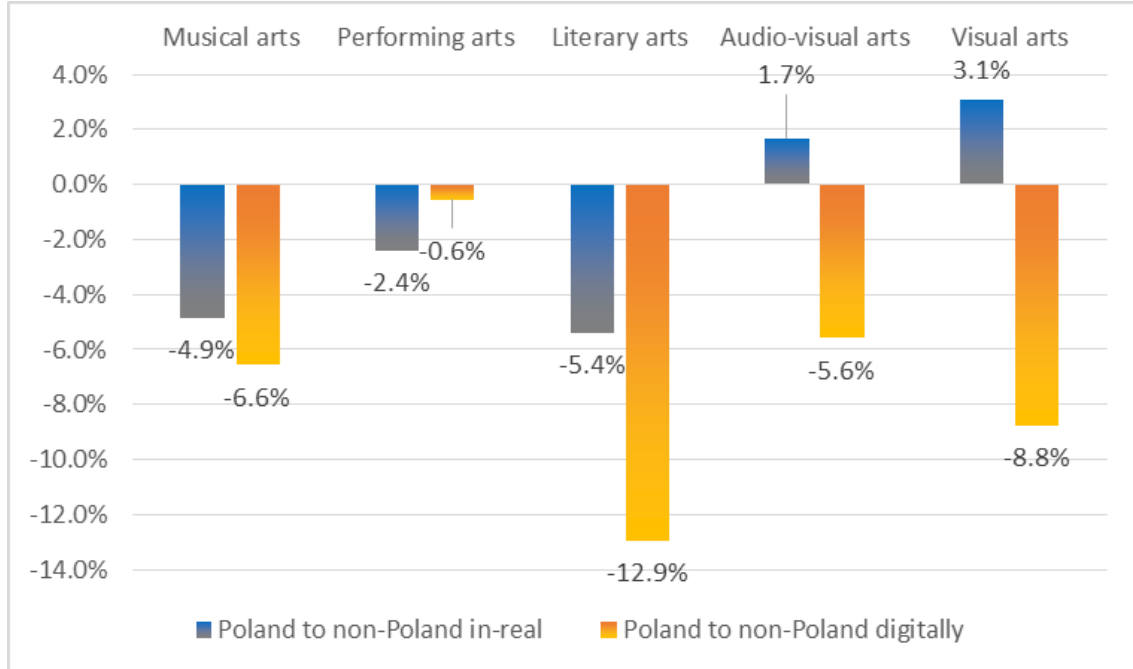
Musical arts receivers from non-Poland and Poland assess their engagement concerning participation form in the receiving process in the following distribution: in-real – 4.28 by non-Poles and 4.07 by Poles (difference of 4.9%), digitally – 3.16 by non-Poles and 2.95 by Poles (difference of 6.6%). Performing arts receivers assess their engagement: in-real – 4.19 by non-Poles and 4.09 by Poles (difference of 2.4%), digitally – 2.97 by non-Poles and 2.95 by Poles (difference of 0.6%). Literary arts receivers assess their engagement: in-real – 4.02 by non-Poles and 3.81 by Poles (difference of 5.4%), digitally – 3.63 by non-Poles and 3.16 by Poles (difference of 12.9%). Audio-visual arts receivers assess their engagement: in-real – 3.74 by non-Poles and 3.80 by Poles (difference of 1.7%), digitally – 4.05 by non-Poles and 3.83 by Poles (difference of 5.6%). Finally, visual arts receivers assess their engagement: in-real – 4.06 by non-Poles and 4.18 by Poles (difference of 3.1%), digitally – 3.34 by non-Poles and 3.05 by Poles (difference of 8.8%). See: Figure 15 and Figure 16.

We can see the following variances between the form of participation in the receiving process by the non-Poles and the Poles regarding their engagement flowing from a particular type of art. First, non-Poles assess digital participation in musical arts as 26.2% less engaging than in-real; this difference is 27.5% for Poles. Second, the non-Poles assess digital participation in performing arts as 29.3% less engaging than in-real; this difference is 27.9% for Poles. Third, the non-Poles assess digital participation in literary arts as 9.7% less engaging than in-real; this difference is 16.9% for Poles. Fourth, the non-Poles assess digital participation in audio-visual arts as 8.5% more engaging than in-real; Poles assess digital participation in audio-visual arts as 0.7% more engaging. Finally, the non-Poles assess digital participation in visual arts as 17.7% less engaging than in-real; this difference is 27.1% for the Poles. See: Figure 17.



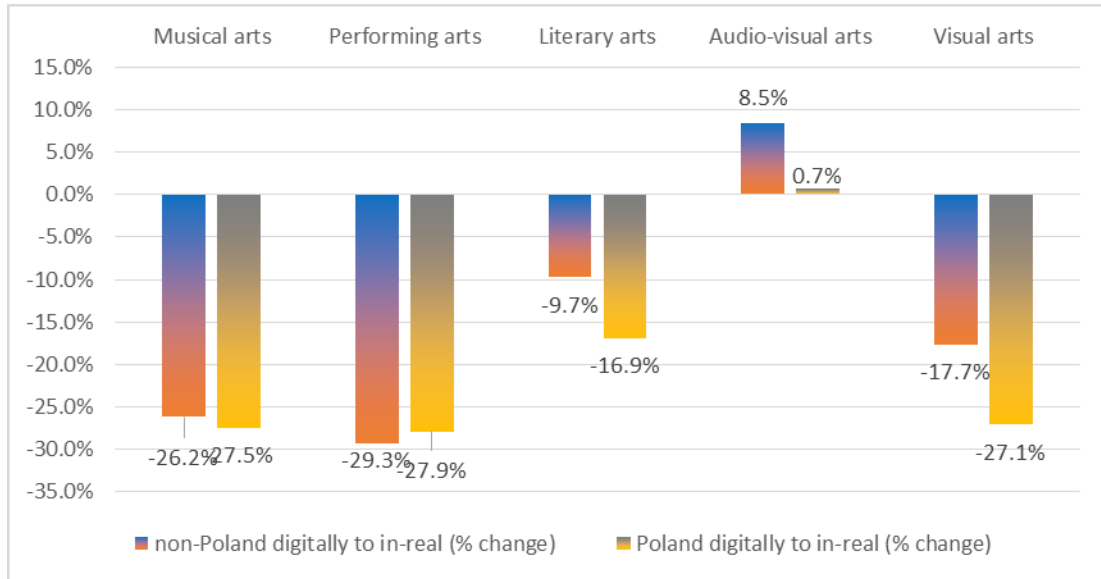
**Figure 15.** Assessment of non-Poles' and Poles' engagement flowing from a particular type of art concerning the form of participation in the receiving process.

Source: own elaboration.



**Figure 16.** Differences between non-Poles and Poles in assessing their engagement regarding the form of participation in the receiving process of a particular type of art.

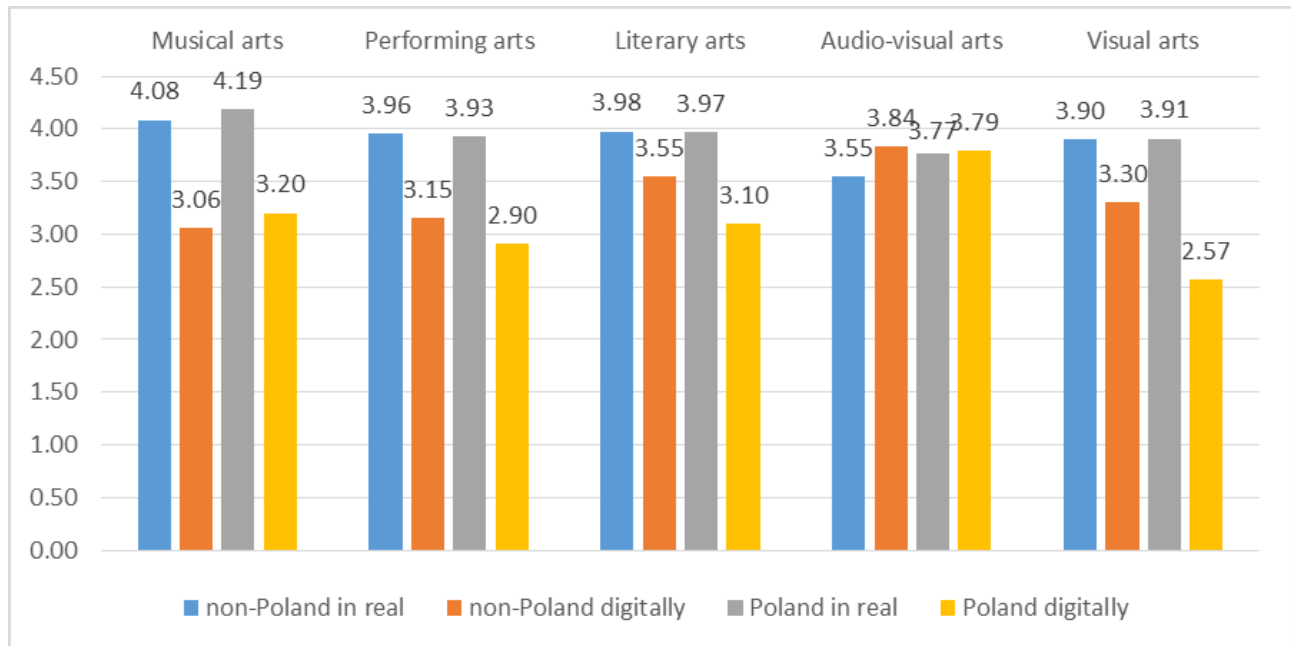
Source: own elaboration.



**Figure 17.** Differences between the form of participation in the receiving process by non-Poles and Poles regarding their engagement flowing from a particular type of art.

Source: own elaboration.

#### 4.2.4. The possibility of experiencing catharsis

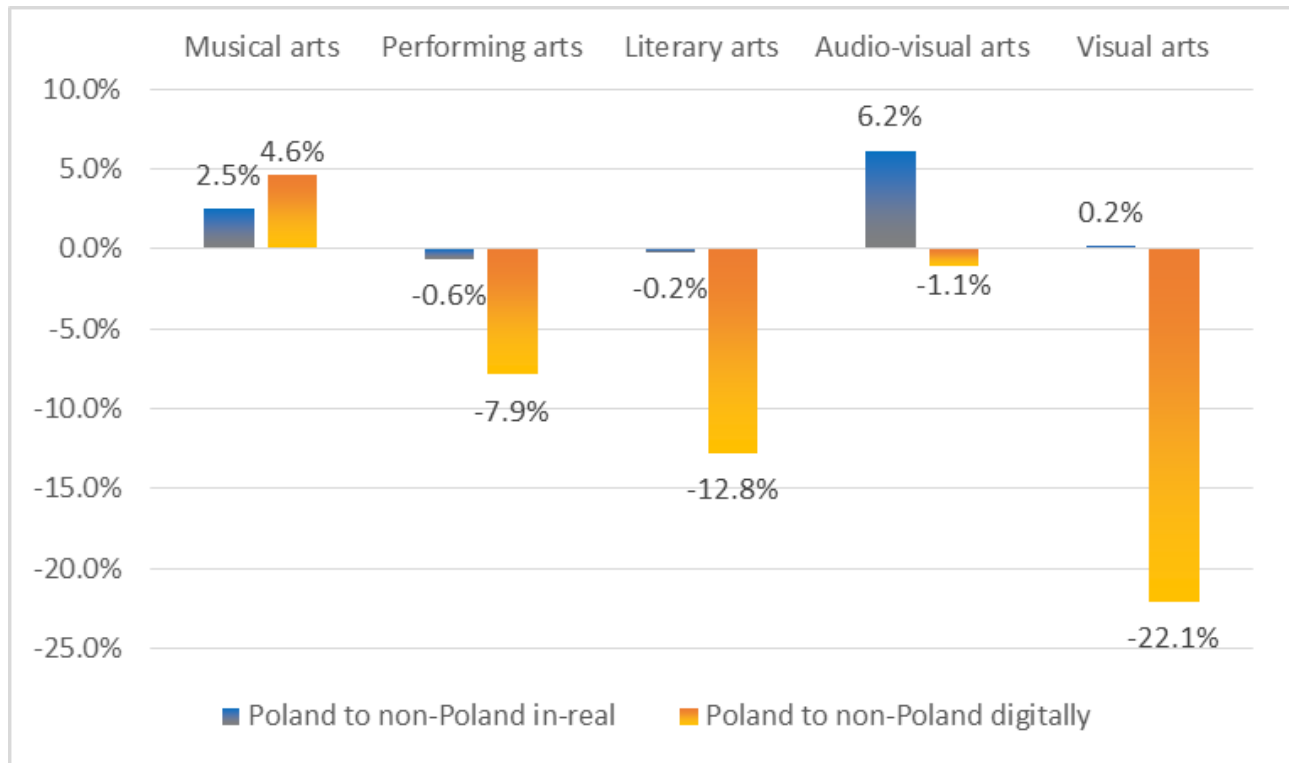


**Figure 18.** Assessment of non-Poles' and Poles' possibility of experiencing catharsis in a particular type of art concerning the form of participation in the receiving process.

Source: own elaboration.

Musical arts receivers from the non-Poland and Poland assess their possibility of experiencing catharsis concerning the form of participation in the receiving process in the following distribution: in-real – 4.08 by the

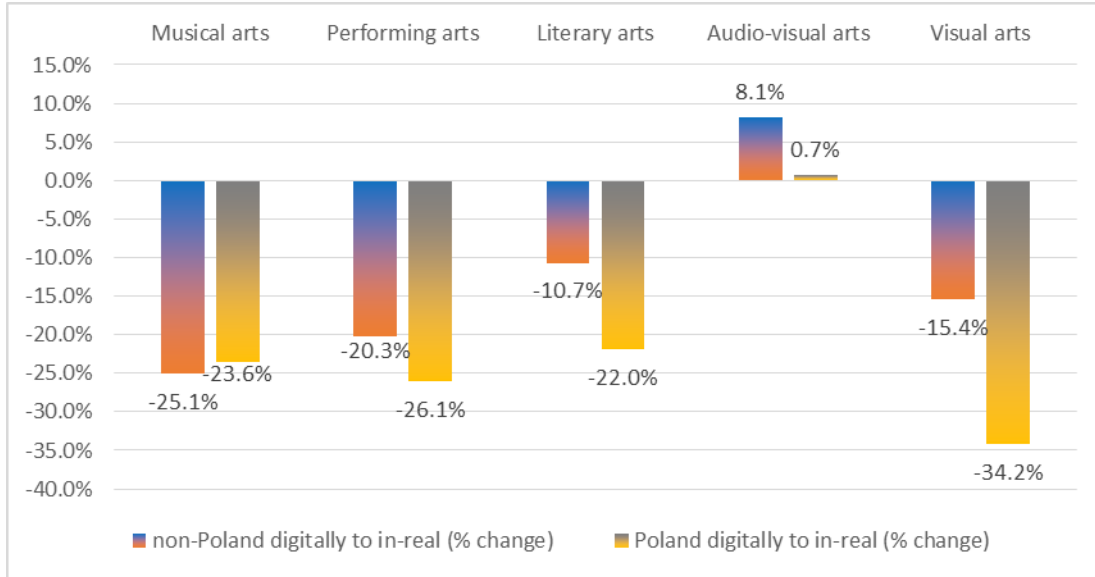
non-Poles and 4.19 by the Poles (difference of 2.5%), digitally – 3.06 by the non-Poles and 3.20 by the Poles (difference of 4.6%). Performing arts receivers assess their possibility of experiencing catharsis as follows: in-real – 3.96 by non-Poles and 3.93 by Poles (difference of 0.6%), digitally – 3.15 by the non-Poles and 2.90 by Poles (difference of 7.9%). Literary arts receivers assess their possibility of experiencing catharsis as follows: in-real – 3.98 by the non-Poles and 3.97 by Poles (difference of 0.2%), digitally – 3.55 by the non-Poles and 3.10 by the Poles (difference of 12.8%). Audio-visual arts receivers assess their possibility of experiencing catharsis: in-real – 3.55 by the non-Poles and 3.77 by Poles (difference of 6.2%), digitally – 3.84 by the non-Poles and 3.79 by Poles (difference of 1.1%). Finally, visual arts receivers assess their possibility of experiencing catharsis: in-real – 3.90 by non-Poles and 3.91 by Poles (difference of 0.2%), digitally – 3.30 by non-Poles and 3.57 by Poles (difference of 22.1%). See: Figure 18 and Figure 19.



**Figure 19.** Differences between non-Poles and Poles in assessing the possibility of experiencing catharsis regarding the form of participation in the receiving process of a particular type of art.

*Source: own elaboration.*

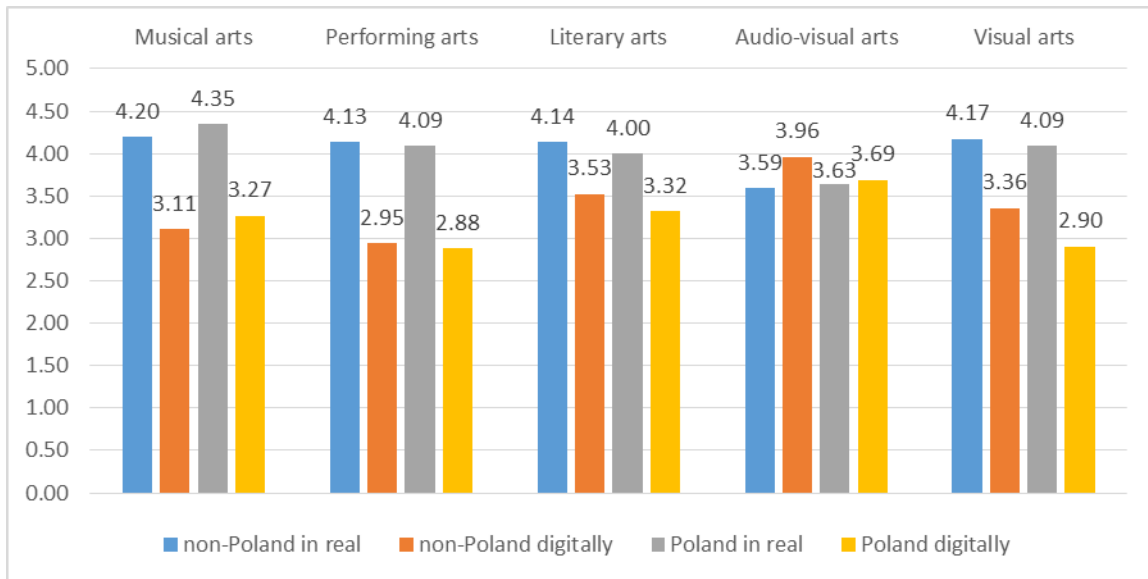
We can see the following variances between the form of participation in the receiving process by non-Poles and Poles regarding the possibility of experiencing catharsis from a particular type of art. First, non-Poles assess digital participation in musical arts as 25.1% less enabling experiencing catharsis than in-real; this difference is 23.6% for Poles. Second, non-Poles assess digital participation in performing arts as 20.3% less enabling experiencing catharsis than in-real; this difference is 26.1% for Poles. Third, non-Poles assess digital participation in literary arts as 10.7% less enabling experiencing catharsis than in-real; this difference is 22.0% for Poles. Fourth, non-Poles assess digital participation in audio-visual arts as 8.1% more enabling experiencing catharsis than in-real; Poles assess digital participation in audio-visual arts as 0.7% more enabling experiencing catharsis. Finally, non-Poles assess digital participation in visual arts as 15.4% less enabling experiencing catharsis than in-real; this difference is 34.2% for Poles. See: Figure 20.



**Figure 20.** Differences between the form of participation in the receiving process by non-Poles and Poles regarding the possibility of experiencing catharsis in a particular type of art.

Source: own elaboration.

#### 4.2.5. Contact with the artwork itself

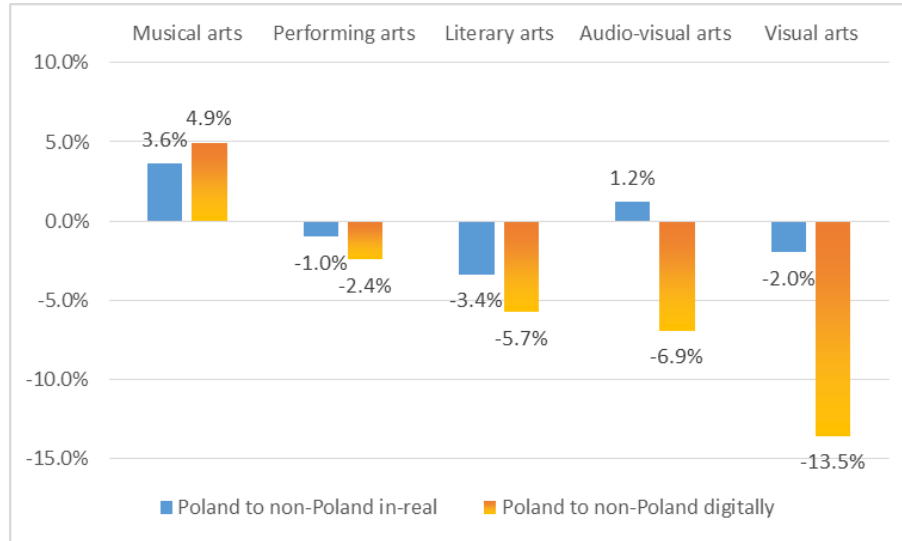


**Figure 21.** Assessment of non-Poles' and Poles' contact with the artwork itself in a particular type of art concerning the form of participation in the receiving process.

Source: own elaboration.

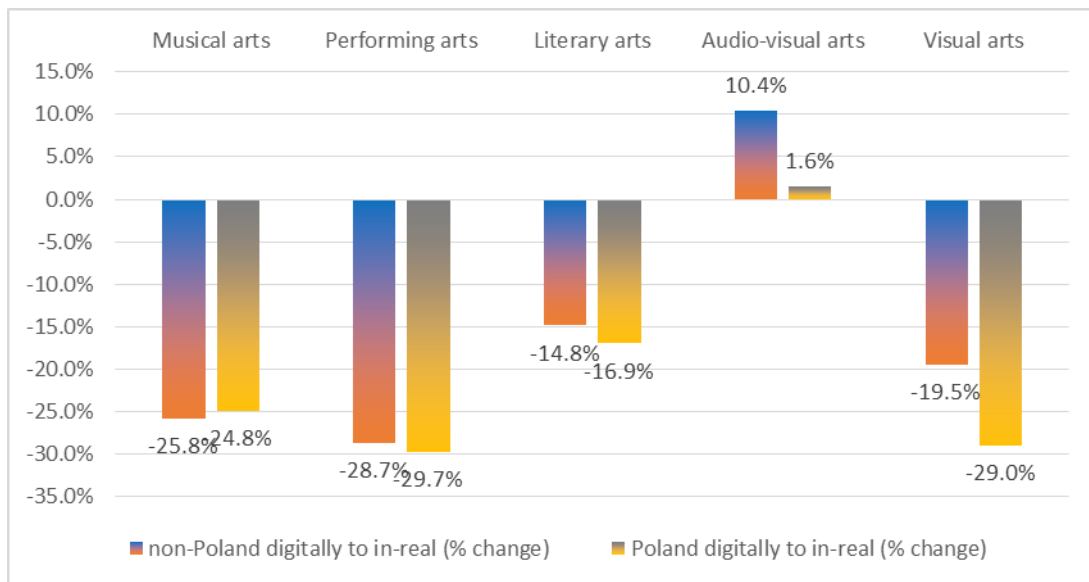
Musical arts receivers from non-Poland and Poland assess their contact with the artwork itself concerning the form of participation in the receiving process in the following distribution: in-real – 4.20 by non-Poles and 4.35 by Poles (difference of 3.6%), digitally – 3.11 by non-Poles and 3.27 by Poles (difference of 4.9%). Performing arts receivers assess their contact with the artwork itself as follows: in-real – 4.13 by non-Poles and 4.09 by Poles

(difference of 1.0%), digitally – 2.95 by non-Poles and 2.88 by Poles (difference of 2.4%). Literary arts receivers assess their contact with the artwork itself: in-real – 4.14 by non-Poles and 4.00 by Poles (difference of 3.4%), digitally – 3.53 by non-Poles and 3.32 by Poles (difference of 5.7%). Audio-visual arts receivers assess their contact with the artwork itself: in-real – 3.59 by non-Poles and 3.63 by Poles (difference of 1.2%), digitally – 3.96 by non-Poles and 3.69 by Poles (difference of 6.9%). Finally, visual arts receivers assess their contact with the artwork itself: in-real 4.17 by non-Poles and 4.09 by Poles (difference of 2.0%), digitally – 3.36 by non-Poles and 2.90 by Poles (difference of 13.5%). See: Figure 21 and Figure 22.



**Figure 22.** Differences between non-Poles and Poles in assessing contact with the artwork itself regarding the form of participation in the receiving process of a particular type of art.

Source: own elaboration.

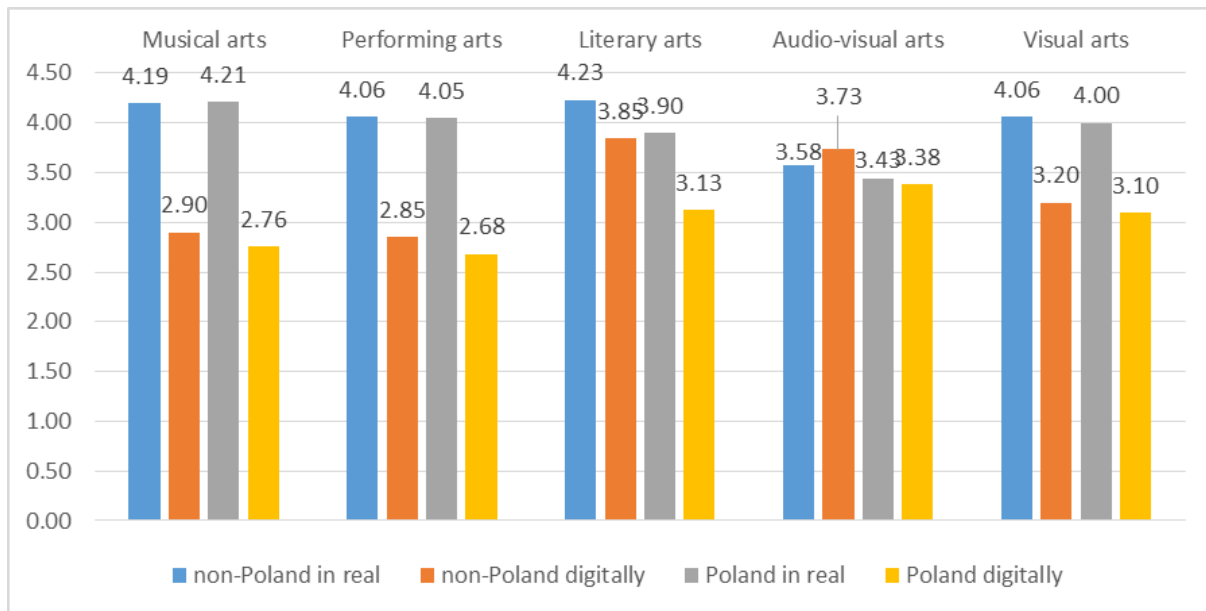


**Figure 23.** Differences between the form of participation in the receiving process by non-Poles and Poles regarding contact with the artwork itself flowing from a particular type of art.

Source: own elaboration.

We can see the following about the variances between the form of participation in the receiving process by the non-Poles and the Poles regarding contact with the artwork itself in a particular type of art. First, the non-Poles assess digital participation in musical arts as allowing 25.8% less contact with the artwork itself than in-real; this difference is 24.8% for Poles. Second, the non-Poles assess digital participation in performing arts as allowing 28.7% less contact with the artwork itself than in-real; this difference is 29.7% for the Poles. Third, the non-Poles assess digital participation in literary arts as allowing 14.8% less contact with the artwork itself than in-real; this difference is 16.9% for Poles. Fourth, the non-Poles assess digital participation in audio-visual arts as allowing 10.4% more contact with the artwork itself than in-real; the Poles assess digital participation in audio-visual arts as allowing 1.6% more contact with the artwork itself than in-real. Finally, the non-Poles assess digital participation in visual arts as allowing 19.5% less contact with the artwork itself than in-real; this difference is 29.0% for Poles. See: Figure 23.

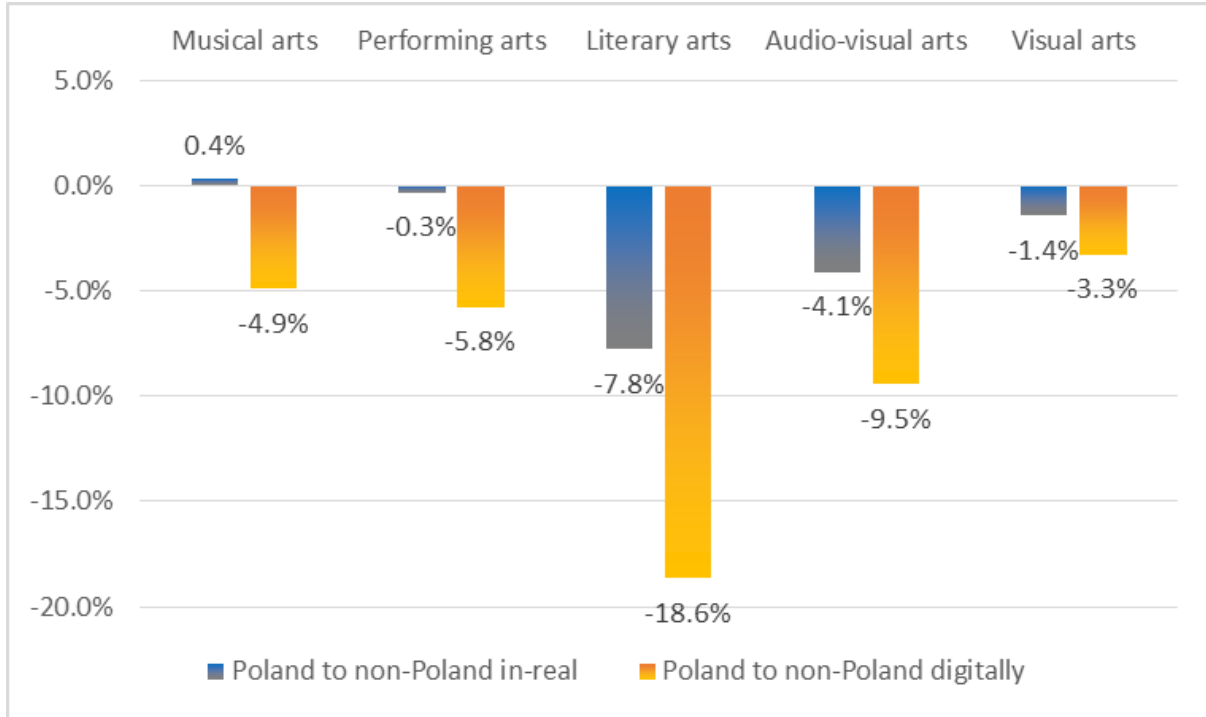
#### 4.2.6. Contact with the performer itself



**Figure 24.** Assessment of non-Poles' and Poles' contact with the performer itself in a particular type of art concerning the form of participation in the receiving process.

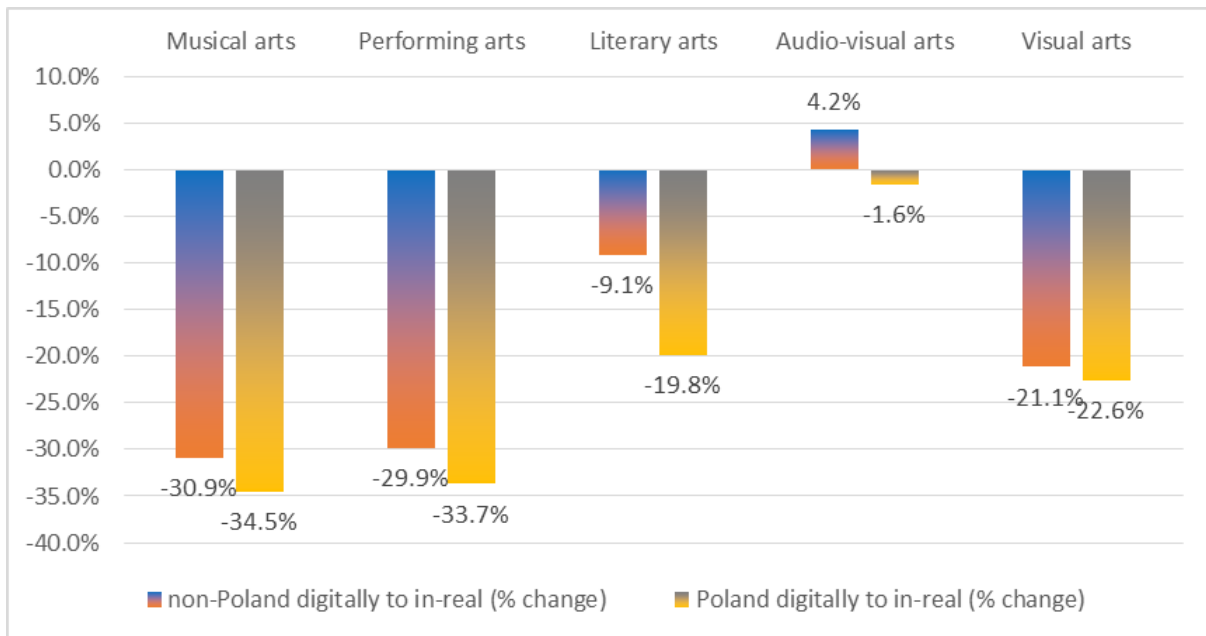
Source: own elaboration.

Musical arts receivers from non-Poland and Poland assess their contact with the performer itself concerning the form of participation in the receiving process in the following distribution: in-real – 4.19 by non-Poles and 4.21 by Poles (difference of 0.4%), digitally – 2.90 by non-Poles and 2.76 by Poles (difference of 4.9%). Performing arts receivers assess their contact with the performer itself as follows: in-real – 4.06 by non-Poles and 4.05 by Poles (difference of 0.3%), digitally – 2.85 by non-Poles and 2.68 by Poles (difference of 5.8%). Literary arts receivers assess their contact with the performer itself as follows: in-real – 4.23 by non-Poles and 3.90 by Poles (difference of 7.8%), digitally – 3.85 by non-Poles and 3.13 by Poles (difference of 18.6%). Audio-visual arts receivers assess their contact with the performer itself: in-real – 3.58 by non-Poles and 3.43 by Poles (difference of 4.1%), digitally – 3.73 by non-Poles and 3.38 by Poles (difference of 9.5%). Finally, visual arts receivers assess their contact with the performer itself: in-real – 4.06 by non-Poles and 4.00 by Poles (difference of 1.4%), digitally – 3.20 by non-Poles and 3.10 by Poles (difference of 3.3%). See: Figure 24 and Figure 25.



**Figure 25.** Differences between non-Poles and Poles in assessing contact with the performer itself regarding the form of participation in the receiving process of a particular type of art.

Source: own elaboration.



**Figure 26.** Differences between the form of participation in the receiving process by non-Poles and Poles regarding contact with the performer itself in a particular type of art.

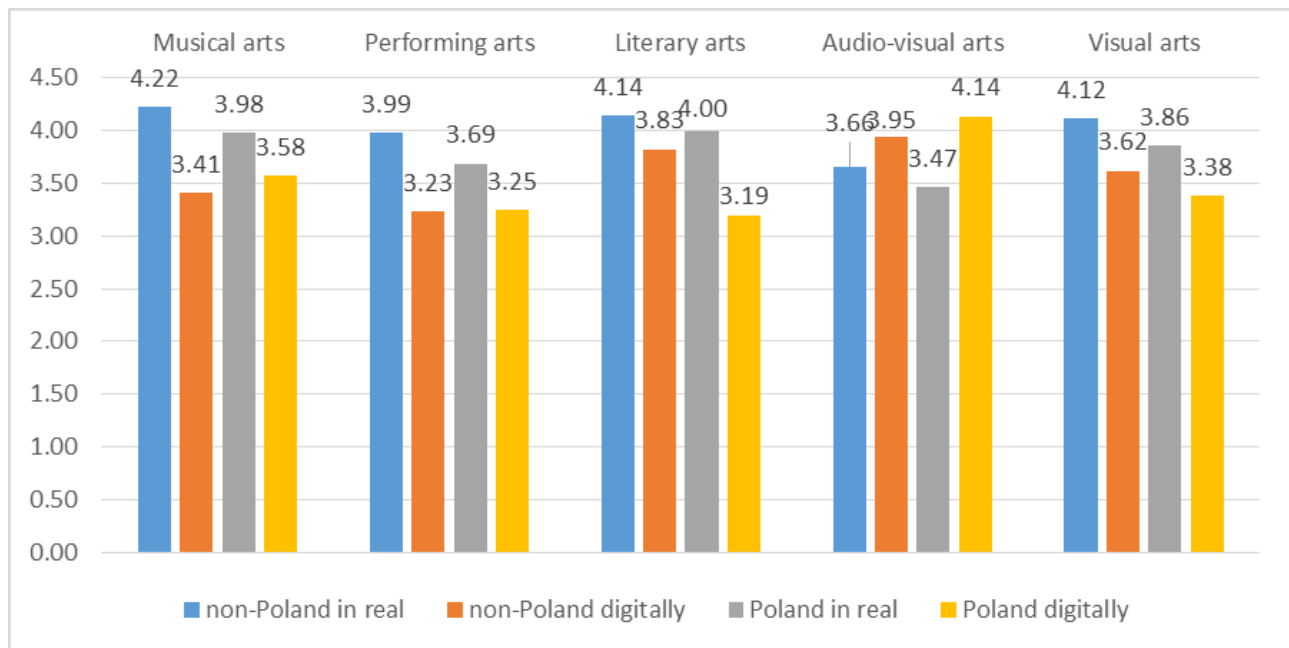
Source: own elaboration.



We can see the following variances between the form of participation in the receiving process by the non-Poles and the Poles regarding their contact with the performer itself flowing from a particular type of art. First, the non-Poles assess digital participation in musical arts as allowing 30.9% less contact with the performer itself than in-real; for Poles, this difference is 34.5%. Second, the non-Poles assess digital participation in performing arts as allowing 29.9% less contact with the performer itself than in-real; this difference is 33.7% for Poles. Third, the non-Poles assess digital participation in literary arts as allowing 9.1% less contact with the performer itself than in-real; this difference is 19.8% for the Poles. Fourth, the non-Poles assess digital participation in audio-visual arts as allowing 4.2% more contact with the performer itself than in-real; the Poles assess digital participation in audio-visual arts as allowing 1.6% less contact with the performer itself than in-real. Finally, the non-Poles assess digital participation in visual arts as allowing 21.1% less contact with the performer itself than in-real; this difference is 22.6% for the Poles. See: Figure 26.

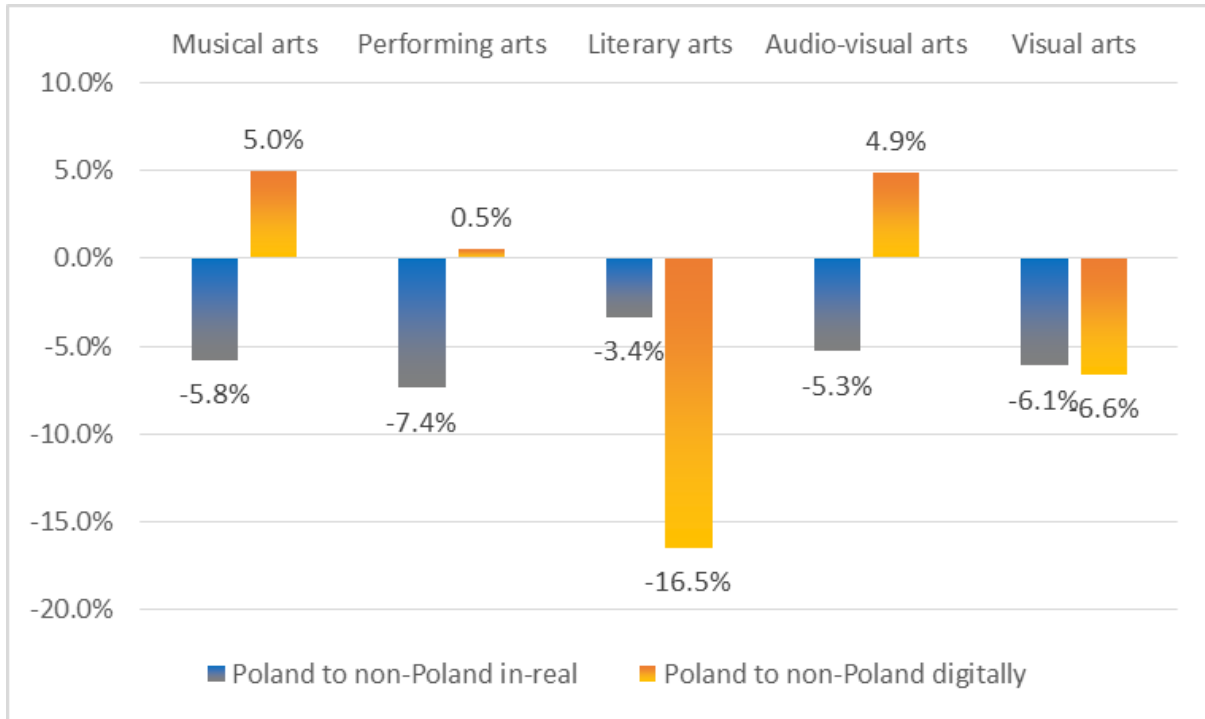
#### 4.2.7. Comfort of participation

Musical arts receivers from non-Poland and Poland assess their comfort of participation concerning the form of participation in the receiving process in the following distribution: in-real – 4.22 by non-Poles and 3.98 by Poles (difference of 5.8%), digitally – 3.41 by non-Poles and 3.58 by Poles (difference of 5.0%). Performing arts receivers assess their participation comfort as follows: in-real – 3.99 by non-Poles and 3.69 by Poles (difference of 7.4%), digitally – 3.23 by non-Poles and 3.25 by Poles (difference of 0.5%). Literary arts receivers assess participation comfort as follows: in-real – 4.14 by non-Poles and 4.00 by Poles (difference of 3.4%), digitally – 3.83 by non-Poles and 3.19 by Poles (difference of 16.5%). Audio-visual arts receivers assess their participation comfort: in-real – 3.66 by non-Poles and 3.47 by Poles (difference of 5.3%), digitally – 3.95 by non-Poles and 4.14 by Poles (difference of 4.9%). Finally, visual arts receivers assess their participation comfort: in-real – 4.12 by non-Poles and 3.86 by Poles (difference of 6.1%), digitally – 3.62 by non-Poles and 3.38 by Poles (difference of 6.6%). See: Figure 27 and Figure 28.



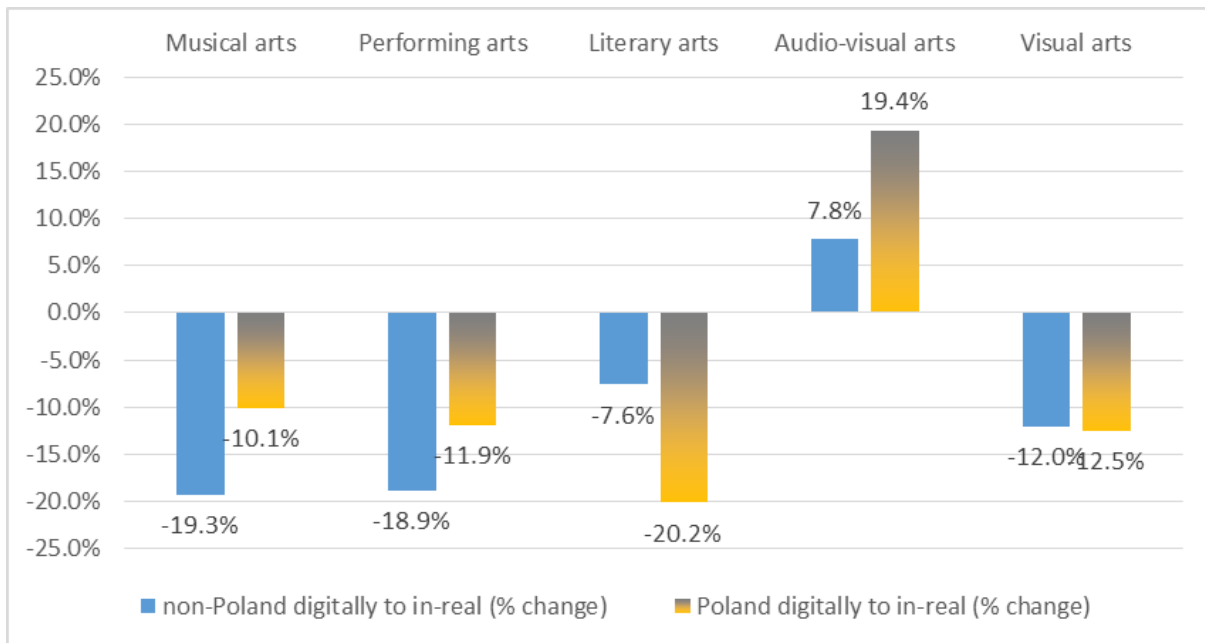
**Figure 27.** Assessment of non-Poles' and Poles' comfort of participation flowing from a particular type of art concerning the form of participation in the receiving process.

Source: own elaboration.



**Figure 28.** Differences between non-Poles and Poles in assessing their comfort of participation regarding the form of participation in the receiving process of a particular type of art.

Source: own elaboration.



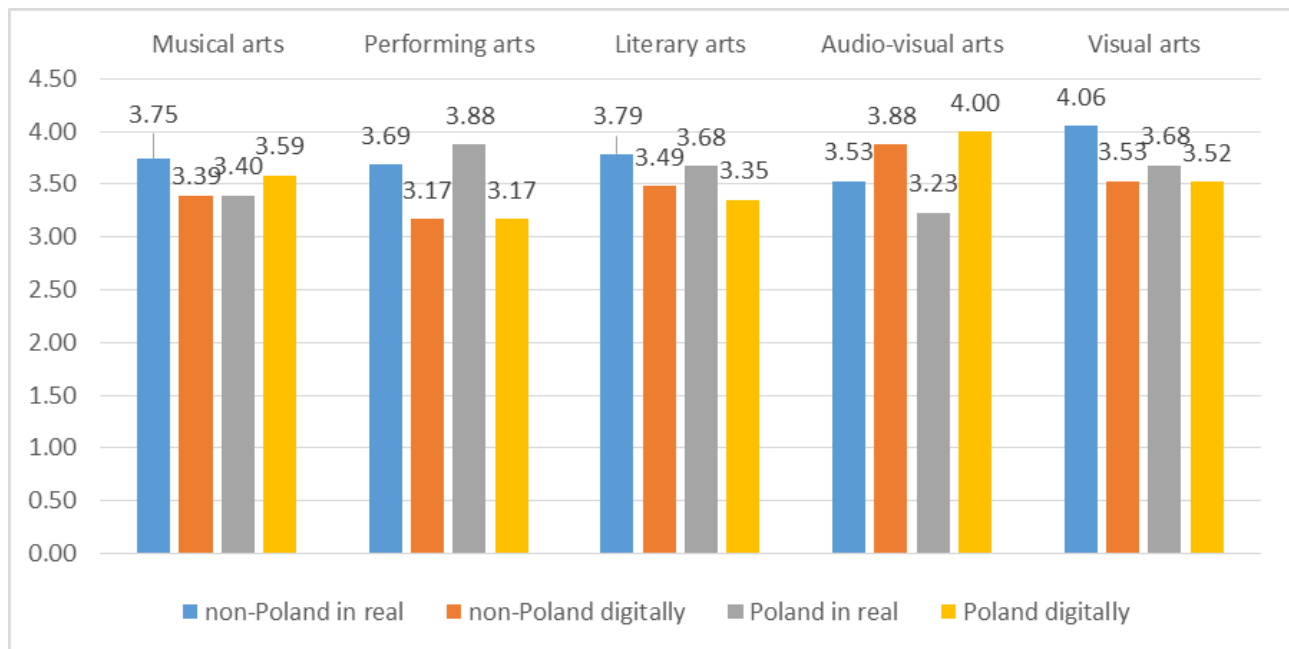
**Figure 29.** Differences between the form of participation in the receiving process by non-Poles and Poles regarding the comfort of participation flowing from a particular type of art.

Source: own elaboration.

We can see the following differences between the form of participation in the receiving process of a particular type of art by the non-Poles and the Poles regarding their comfort level. First, the non-Poles assess the comfort of digital participation in musical arts as 19.3% lower than in-real; this difference is 10.1% lower for Poles. Second, the non-Poles assess the comfort of digital participation in performing arts as 18.9% lower than in-real; this difference is 11.9% lower for Poles. Third, the non-Poles assess the comfort of digital participation in literary arts as 7.6% lower than in-real; this difference is 20.2% for Poles. Fourth, the non-Poles assess the comfort of digital participation in audio-visual arts as 7.8% higher than in-real; the Poles assess the comfort of digital participation in audio-visual arts as 19.4% higher than in-real. Finally, the non-Poles assess the comfort of digital participation in visual arts as 12.0% lower than in-real; this difference is 12.5% lower for Poles. See: Figure 29.

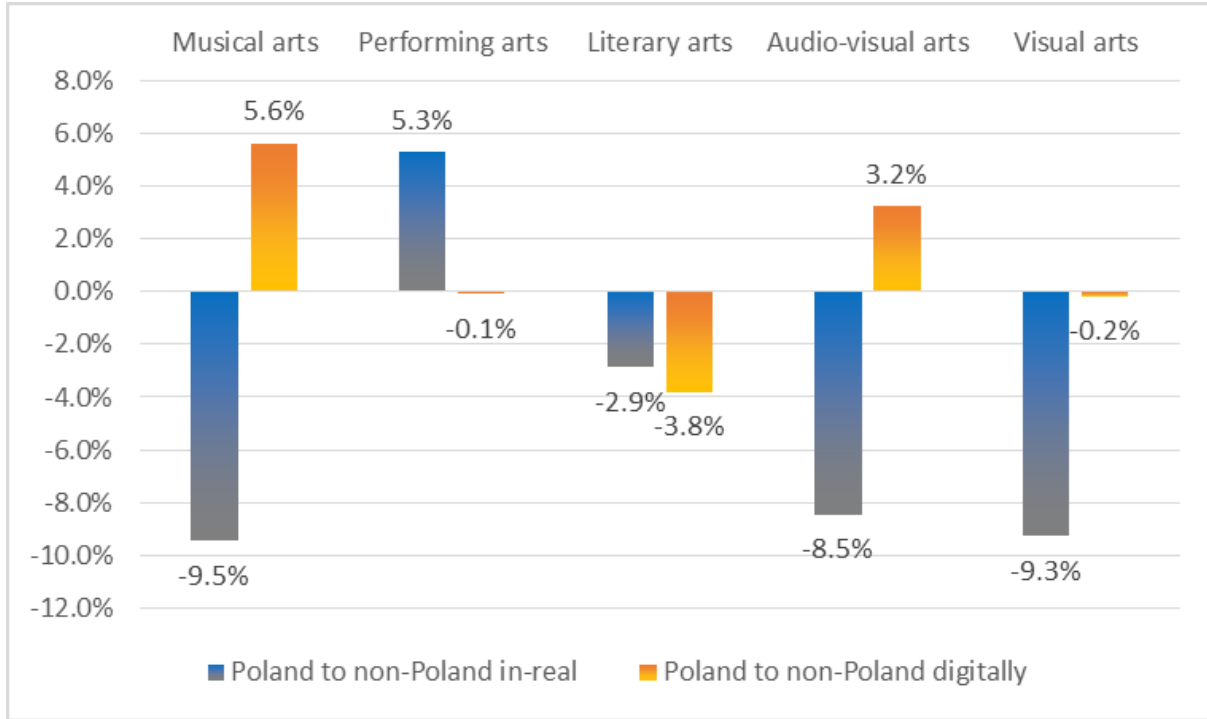
#### 4.2.8. Possibilities of shaping the aesthetical experience

Musical arts receivers from non-Poland and Poland assess their possibilities of shaping the aesthetical experience concerning the form of participation in the receiving process in the following distribution: in-real – 3.75 by non-Poles and 3.40 by Poles (difference of 9.5%), digitally – 3.39 by non-Poles and 3.59 by Poles (difference of 5.6%). Performing arts receivers assess their possibilities of shaping the aesthetical experience as follows: in-real – 3.69 by non-Poles and 3.88 by Poles (difference of 5.3%), digitally – equally 3.17 by non-Poles and Poles (difference of 0.1%). Literary arts receivers assess their possibilities of shaping the aesthetical experience as follows: in-real – 3.79 by non-Poles and 3.68 by Poles (difference of 2.9%), digitally – 3.49 by non-Poles and 3.35 by Poles (difference of 3.8%). Audio-visual arts receivers assess their possibilities of shaping the aesthetical experience: in-real – 3.53 by non-Poles and 3.23 by Poles (difference of 8.5%), digitally – 3.88 by non-Poles and 4.00 by Poles (difference of 3.2%). Finally, visual arts receivers assess their possibilities of shaping the aesthetical experience: in-real – 4.06 by non-Poles and 3.53 by Poles (difference of 9.3%), digitally – 3.53 by non-Poles and 3.52 by Poles (difference of 0.2%). See: Figure 30 and Figure 31.



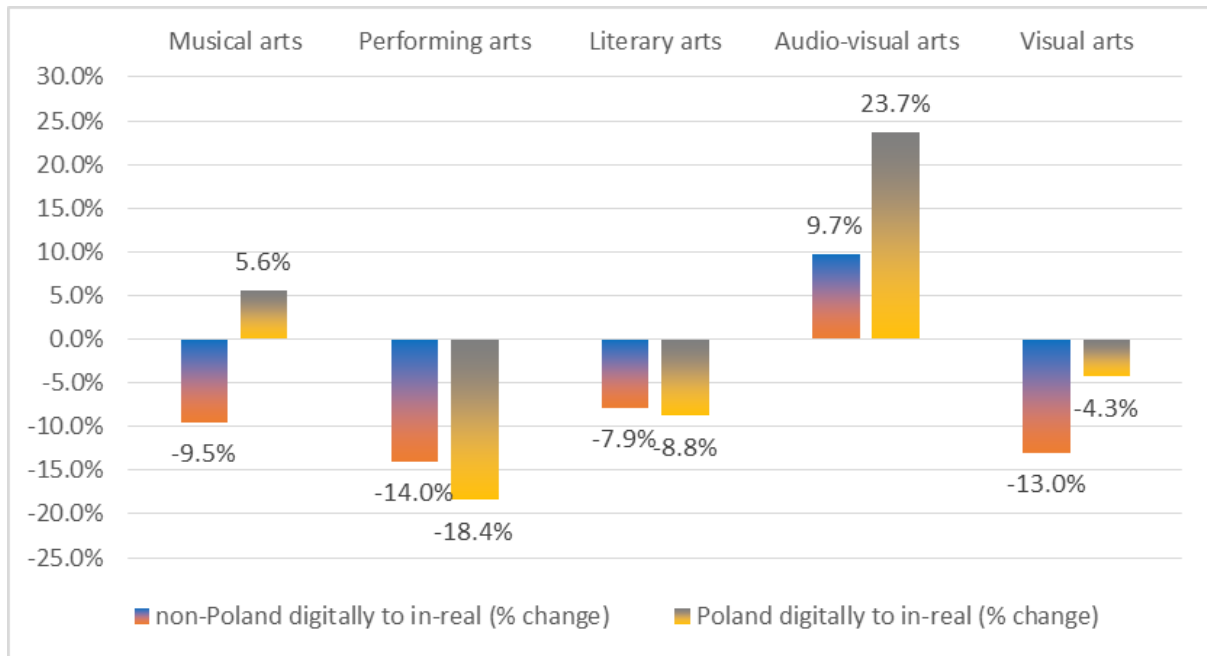
**Figure 30.** Assessment of non-Poles' and Poles' possibilities of shaping the aesthetical experience in a particular type of art concerning the form of participation in the receiving process.

Source: own elaboration.



**Figure 31.** Differences between non-Poles and Poles in assessing the possibilities of shaping the aesthetical experience regarding the form of participation in the receiving process of a particular type of art.

*Source: own elaboration.*



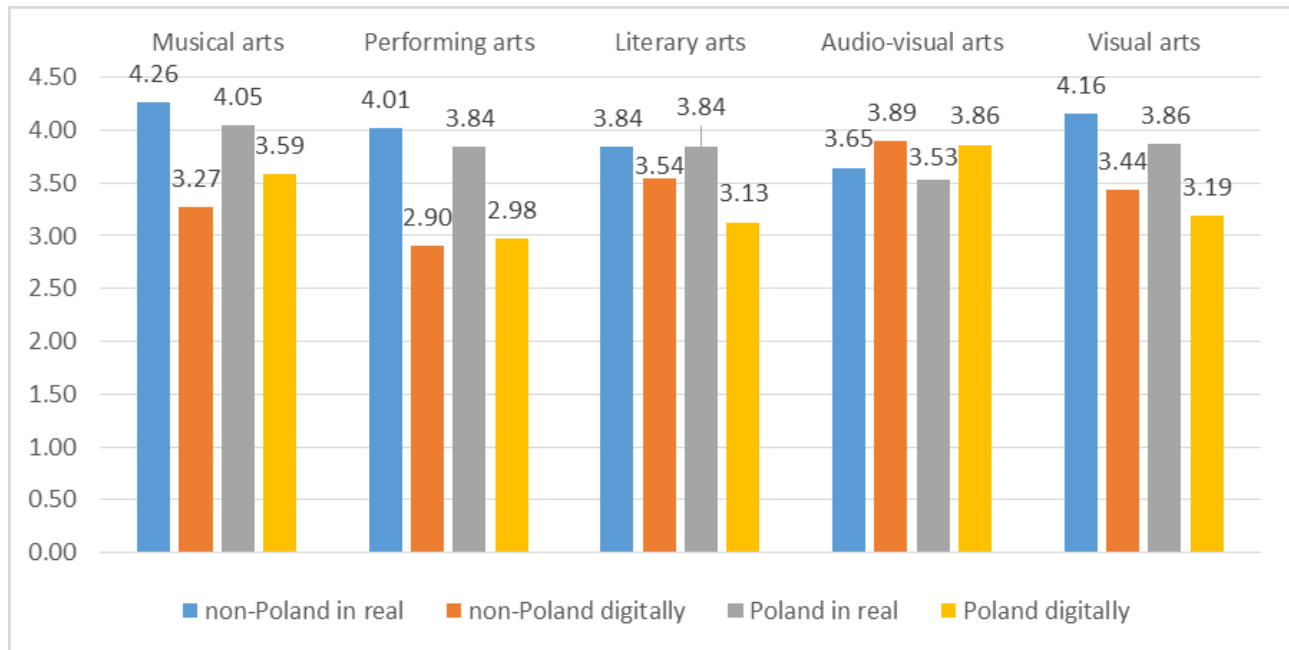
**Figure 32.** Differences between the form of participation in the receiving process by non-Poles and Poles regarding the possibilities of shaping the aesthetical experience in a particular type of art.

*Source: own elaboration.*

We can see the following differences between the form of participation in the receiving process by the non-Poles and the Poles regarding the possibility of shaping the aesthetical experience in particular types of art. First, the non-Poles assess the possibility of shaping the aesthetical experience in digital participation in musical arts as 9.5% lower than in-real; for Poles, this difference is 5.6% higher. Second, the non-Poles assess the possibility of shaping the aesthetical experience in digital participation in performing arts as 14.0% lower than in-real; this difference is 18.4% for Poles. Third, the non-Poles assess the possibility of shaping the aesthetical experience in digital participation in literary arts as 9.9% lower than in-real; this difference is 8.8% for Poles. Fourth, the non-Poles assess the possibility of shaping the aesthetical experience in digital participation in audio-visual arts as 9.7% better than in-real; this difference is 23.7% for Poles. Finally, the non-Poles assess the possibility of shaping the aesthetical experience in digital participation in visual arts as 13.0% lower than in-real; this difference is 4.3% for Poles. See: Figure 32.

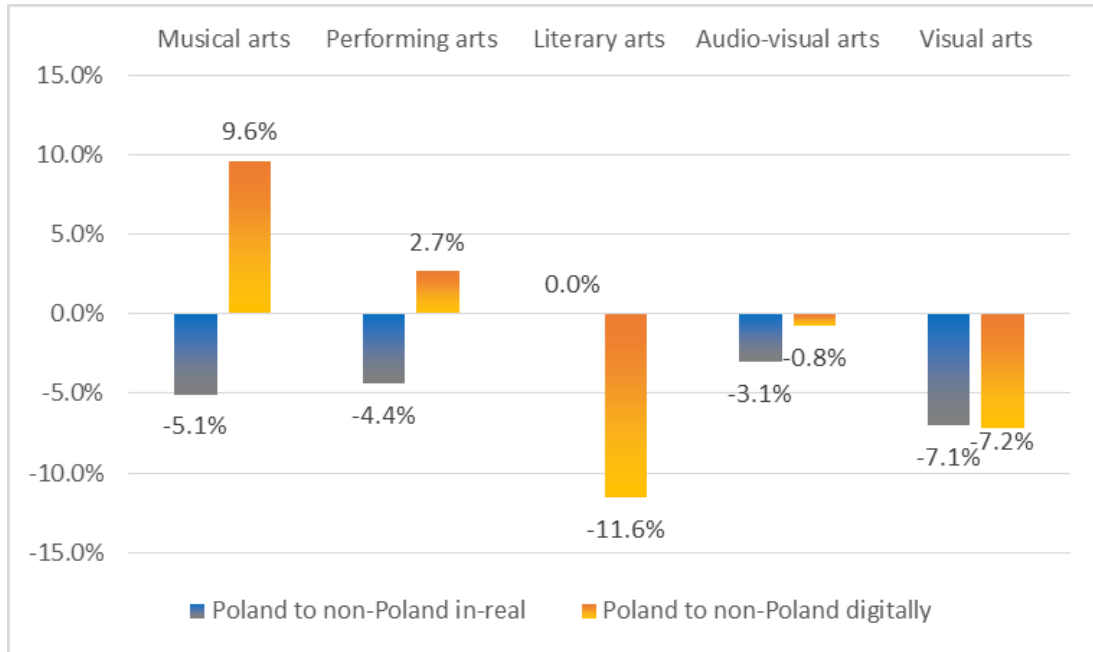
#### 4.2.9. Own motivation to participate

Musical arts receivers from non-Poland and Poland assess their motivation to participate concerning the form of participation in the receiving process in the following distribution: in-real – 4.26 by non-Poles and 4.05 by Poles (difference of 5.1%), digitally – 3.27 by non-Poles and 3.59 by Poles (difference of 9.6%). Performing arts male receivers assess their motivation to participate in-real as 4.01 and 3.84 by Poles (difference of 4.4%), digitally – 2.90 by non-Poles and 2.98 by Poles (difference of 2.7%). Literary arts receivers assess their motivation to participate as follows: in-real – equally 3.84 by non-Poles and Poles, digitally – 3.54 by non-Poles and 3.13 by Poles (difference of 11.6%). Audio-visual arts receivers assess their motivation to participate: in-real – 3.65 by non-Poles and 3.53 by Poles (difference of 3.1%), digitally – 3.89 by non-Poles and 3.86 by Poles (difference of 0.8%). Finally, visual arts receivers assess their motivation to participate: in-real – 4.16 by non-Poles and 3.86 by Poles (difference of 7.1%), digitally – 3.44 by non-Poles and 3.19 by Poles (difference of 7.2%). See: Figure 33 and Figure 34.



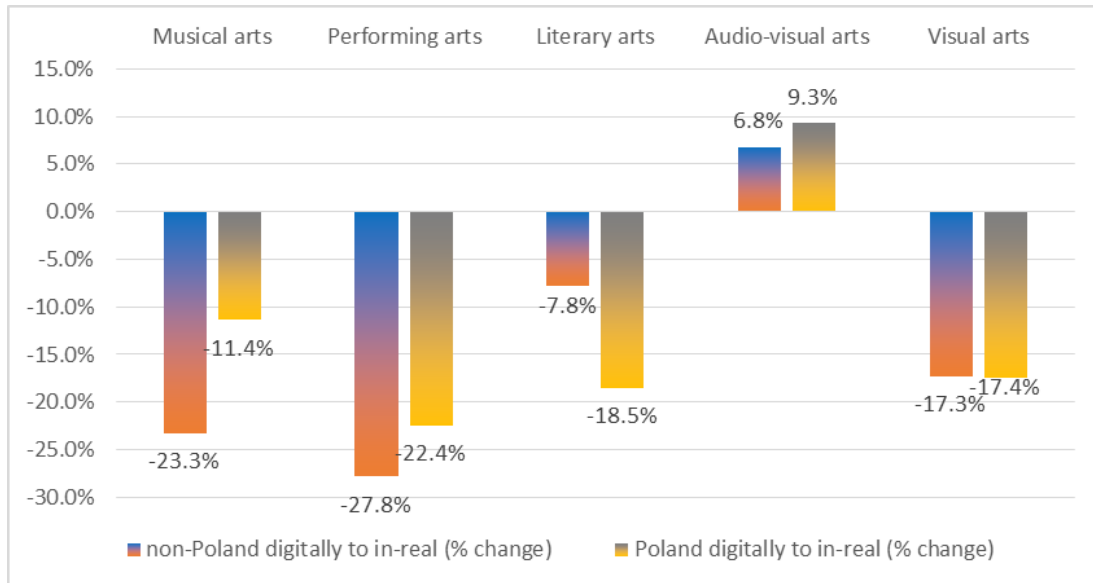
**Figure 33.** Assessment of non-Poles' and Poles' own motivation to participate in a particular type of art concerning the form of participation in the receiving process.

Source: own elaboration.



**Figure 34.** Differences between non-Poles and Poles in assessing their motivation to participate regarding the form of participation in the receiving process of a particular type of art.

Source: own elaboration.



**Figure 35.** Differences between the form of participation in the receiving process by non-Poles and Poles regarding their motivation to participate in a particular type of art.

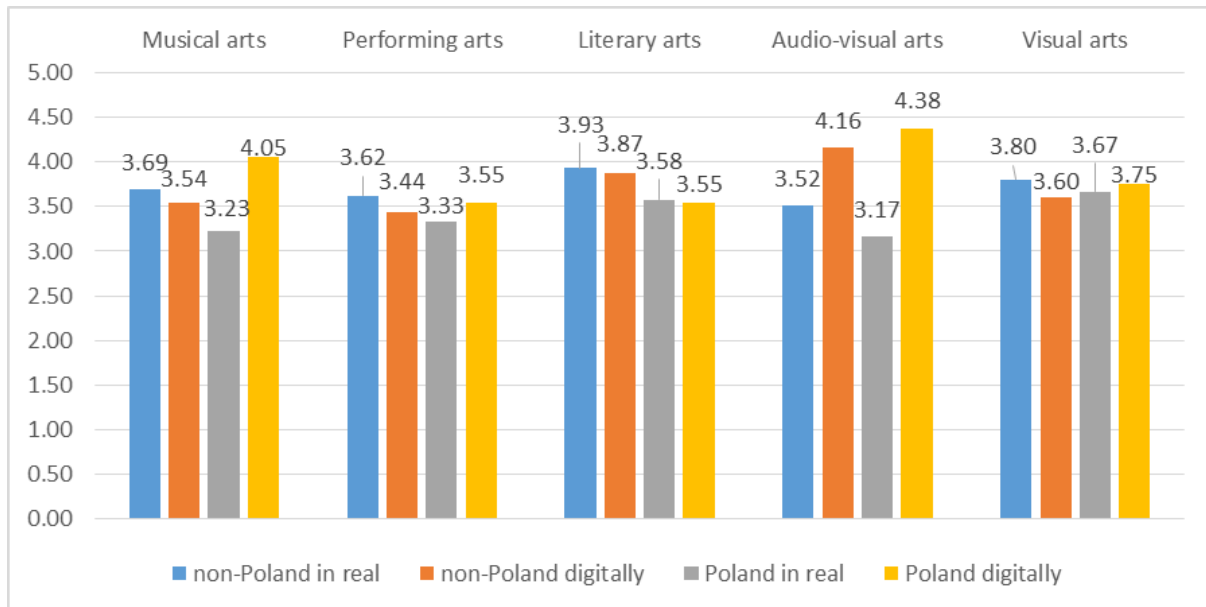
Source: own elaboration.

We can see the following about the differences between the form of participation in the receiving process by the non-Poles and the Poles regarding their motivation to participate in particular types of art. First, the non-Poles assess their motivation to participate digitally in musical arts as 23.3% lower than in-real; this difference is 11.4%

for Poles. Second, the non-Poles assess their motivation to participate digitally in performing arts as 27.8% lower than in-real; this difference is 22.4% for Poles. Third, the non-Poles assess their motivation to participate digitally in literary arts as 7.8% lower than in-real; this difference is 18.5% for Poles. Fourth, the non-Poles assess their motivation to participate digitally in audio-visual arts as 6.8% higher than in-real; this difference is 9.3% for Poles. Finally, the non-Poles assess their motivation to participate digitally in visual arts as 17.3% lower than in-real; this difference is 17.4% for Poles. See: Figure 35.

#### 4.2.10. Easiness of participation

Musical arts receivers from non-Poland and Poland assess their easiness of participation concerning the form of participation in the receiving process in the following distribution: in-real – 3.69 by non-Poles and 3.23 by Poles (difference of 12.5%), digitally – 3.54 by non-Poles and 4.05 by Poles (difference of 14.3%). Performing arts receivers assess the easiness of participation as follows: in-real – 3.62 by non-Poles and 3.33 by Poles (difference of 8.2%), digitally – 3.44 by non-Poles and 3.55 by Poles (difference of 3.0%). Literary arts receivers assess the easiness of participation as follows: in-real – 3.93 by non-Poles and 3.58 by Poles (difference of 8.9%), digitally – 3.87 by non-Poles and 3.55 by Poles (difference of 8.4%). Audio-visual arts receivers assess the easiness of participation: in-real – 3.52 by non-Poles and 3.17 by Poles (difference of 9.9%), digitally – 4.16 by non-Poles and 4.38 by Poles (difference of 5.2%). Finally, visual arts receivers assess the easiness of participation: in-real – 3.80 by non-Poles and 3.67 by Poles (difference of 3.6%), digitally – 3.60 by non-Poles and 3.75 by Poles (difference of 4.0%). See: Figure 36 and Figure 37.

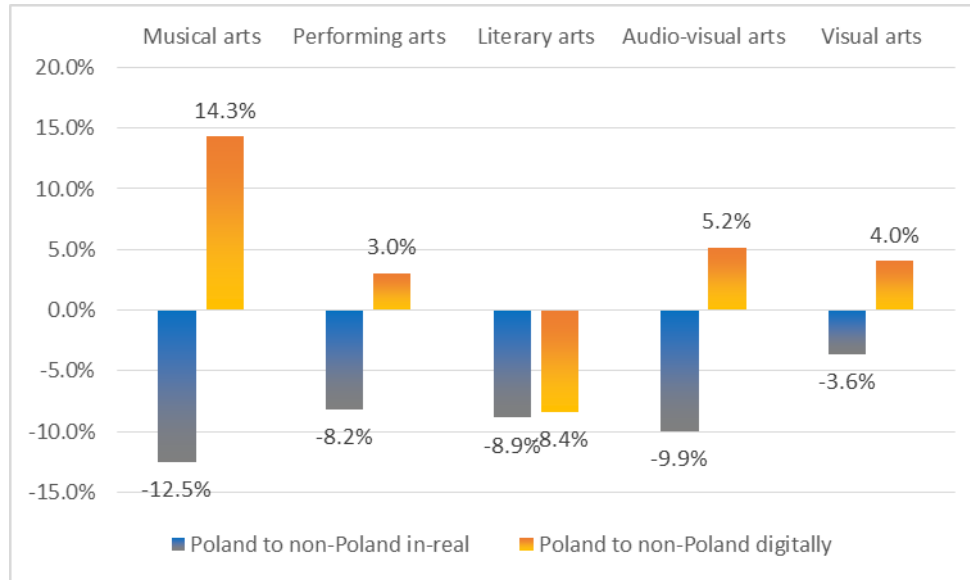


**Figure 36.** Assessment of non-Poles' and Poles' easiness of participation in a particular type of art concerning the form of participation in the receiving process.

Source: own elaboration.

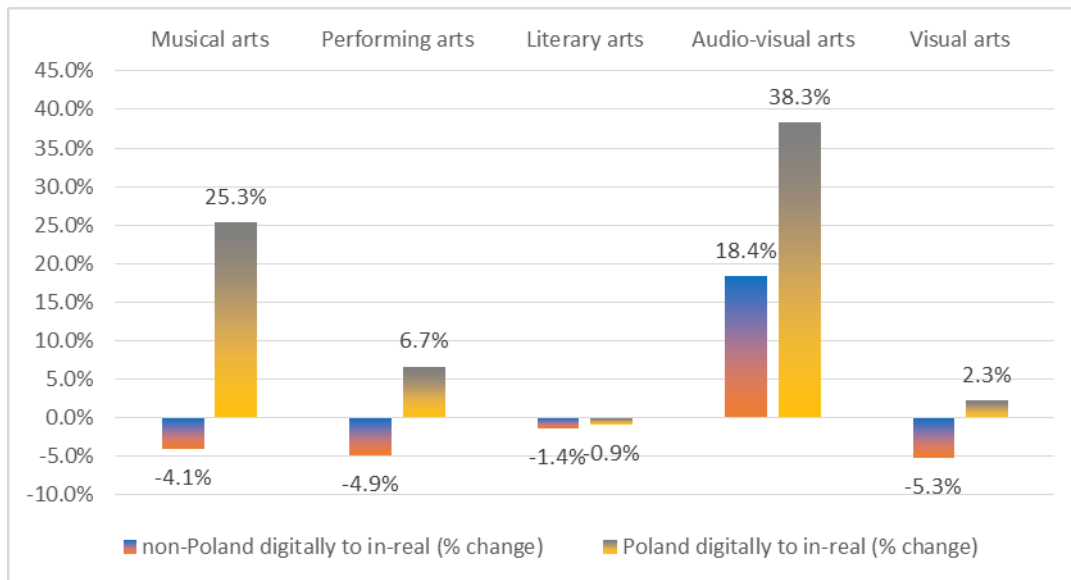
We can see the following about the differences between the form of participation in the receiving process by non-Poles and Poles regarding the easiness of participation in a particular type of art. First, non-Poles assess the easiness of digital participation in musical arts as 4.1% lower than in-real; Poles assess the easiness of digital participation in musical arts as 25.3% higher than in-real. Second, non-Poles assess the easiness of digital participation in performing arts as 4.9% lower than in-real; this difference is 6.7% higher for Poles. Third, non-

Poles assess the easiness of digital participation in literary arts as 1.4% lower than in-real; this difference is 0.9% lower for Poles. Fourth, non-Poles assess the easiness of digital participation in audio-visual arts as 18.4% higher than in-real; this difference is 38.3% for Poles. Finally, non-Poles assess the easiness of digital participation in visual arts as 5.3% lower than in-real; Poles assess the easiness of digital participation in visual arts as 2.3% higher than in-real. See: Figure 38.



**Figure 37.** Differences between non-Poles and Poles in assessing the easiness of participation regarding the form of participation in the receiving process of a particular type of art.

Source: own elaboration.



**Figure 38.** Differences between the form of participation in the receiving process by non-Poles and Poles regarding the easiness of participation in a particular type of art.

Source: own elaboration.



## Conclusions

The form of participation (in-real or digital) in arts influences the level of participation quality in the aesthetic situation in the assessment of the Polish receivers compared to receivers from other countries. Cultural variances between participation in particular types of arts and cultural variances between particular forms of participation in particular types of arts by Poles and non-Poles are also visible. Extrapolating the conclusions, it can be said that these differences are based on fundamental cultural dimensions, e.g. individualism-collectivism or uncertainty avoidance and arise strictly from history. Probably, proportionally to time flowing from the moment of starting the journey from communism to capitalism, these differences will diminish and will confirm particular national features without the influence of post-communist traumas. It must be underlined that this research and paper is the first attempt in the literature assessing the quality of the participation in the aesthetic situation regarding the digital and in-real forms of participation between Polish and non-Polish societies' citizens.

Limitations of the research: 1) The majority of the sample (88.3%) represents individuals with Bachelor's, Engineer's Master's, Doctoral and Professorship qualifications, who are more aware of their behaviour and better-equipped to portray their perception of intangible assets and features in comparison to the rest of society; 2) The sample set was relatively small ( $n = 221$ ).

The results of this analysis may be inspiring for: 1) Art creators exploring the optimal methods of distributing artworks among receivers from Poland and other countries; 2) Art managers and marketers for a more profound understanding of Polish art receivers' perspectives and their predilections about participation in arts in-real or digitally; 3) Art receivers to balance their opinion about the ways of participation in arts with the preferences of art receivers from Poland.

Potential research questions for future research may be the following: 1) How do Polish and non-Polish art creators perceive the artistry and creativity loss or gain regarding diverse forms of artwork distribution? 2) What are the variances between Polish and other post-communist countries' citizens in artistry and creativity loss or gain regarding diverse forms of receiving process? 3) What are the variances in artistry and creativity loss or gain regarding diverse forms of receiving process by the Polish and other post-communist countries' citizens?

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**Michał SZOSTAK** is Associate Professor of University of Social Sciences - a graduate of master's studies (management and marketing) and doctoral studies at the Koźmiński University in Warsaw. Since 2004, he has been practising business (on managerial and director positions) in capital groups in an international environment (in the commercial and industrial sector), cooperating with corporations from the USA, Canada, EU and South Korea. He has experience in the field of financial and organisational optimisation of business processes and entire enterprises, preparation and service of mergers, divisions, separation of organised parts of enterprises and acquisition activities of capital companies, personal and private economic activities, as well as the implementation and maintenance of quality management systems. As an Associate Professor at the University of Social Sciences in Warsaw and an Assistant Professor at Collegium Civitas in Warsaw, he conducts interdisciplinary research at the interface between management and art (international publications), as well as teaching activities for English and Polish-language MBA, Master's and Bachelor's programs in the field of international finance, corporate finance, financial analysis, financial accounting, management accounting, project management, strategic financial decisions, visual arts marketing, self-presentation, business presentations, business ethics and CSR. He also conducts teaching activities in the field of management at universities in the Czech Republic, Lithuania and Slovakia. In addition, he obtained a doctorate in musical arts, specialising in organ performance at the Fryderyk Chopin University of Music in Warsaw, recorded several CDs, and has been publishing in renowned British, Canadian, and American periodicals. As a musician-instrumentalist, he conducts lively international concert activity, performing several dozen recitals annually in Europe, the Americas, Africa and Asia. More at: [www.michalszostak.org](http://www.michalszostak.org)

**ORCID ID:** [orcid.org/0000-0002-7774-2964](https://orcid.org/0000-0002-7774-2964)

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## CONDITIONS FOR APPLICATION OF CRIMINAL LIABILITY TO THE BOARD OF A COMPANY IN THE LEGAL SYSTEM OF THE REPUBLIC OF LATVIA

Jānis Teivāns-Treinovskis <sup>1\*</sup>, Nikolajs Jefimovs <sup>2</sup>, Ruta Velika <sup>3</sup>, Anatolijs Kriviņš <sup>4</sup>

<sup>1 2 3 4</sup> *Department of Law, Faculty of Social Sciences, Daugavpils University,  
Daugavpils, Vienības street 13, Republic of Latvia*

*E-mails:* <sup>1</sup> [janis.teivans@du.lv](mailto:janis.teivans@du.lv) (Corresponding author); <sup>2</sup> [nikolajs.jefimovs@du.lv](mailto:nikolajs.jefimovs@du.lv);  
<sup>3</sup> [ruta.velika@daugavpils.lv](mailto:ruta.velika@daugavpils.lv); <sup>4</sup> [anatolijs.krivins@du.lv](mailto:anatolijs.krivins@du.lv)

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**Abstract.** Criminal offenses in the area of commercial relationships, especially in recent years, pose a number of problems for public security and the efficient development of the economy. There is currently no common practice for identifying and qualifying them. Thus, there is a need to perform a detailed analysis of criminal offenses, committed during the management of capital companies, paying special attention to such aspects as the level of liability of a legal person, as well as the criminal liability of persons - management board members, for violations of law committed during the management of a legal person. In order to comply with the principles of international law regarding the criminal liability of legal persons and in order to harmonize legal norms, amendments to the Criminal Law of the Republic of Latvia were adopted. It gave a possibility to imply legal sanctions on legal entities. The adoption of these amendments strengthened the principles of equality, fairness and inevitability of punishment regarding to the criminal liability of legal persons.

**Keywords:** company, legal person, natural person, criminal liability.

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## 1. Doctrinal meaning of the concept of the board of a company

The process of defining the concept of the board of a company is closely related to the theoretical research of legal scientists, working in the field of social sciences. In the book “Handbook on the Formation, Management and Winding Up of Joint Stock Companies”, published in 1908, the authors F. Gors-Brown and V. Jordan viewed the board of the company as an executive body of the company, which is entitled to decide any issue, arising from the organization of the company, acting completely independently from the company’s shareholders (Gore-Browne, Jordan, 1908). The issue of defining the concept of a board of a company was also studied by L. C. B. Gower in his 1954 book “The Principles of Modern Company Law” (Gower, 1954), as well as F. B. Palmer in his 1949 book “Company Law: A Practical Handbook For Lawyers and Business Men” (Palmer, 1949), in which the board of the company was designated as the “board of directors”. In the seventies of the twentieth century, with the emergence and development of theories of effective management of the company, the United States began a gradual study of the effectiveness of the executive body of the company. In his 1973 book “European Commercial Law” (Goldman, 1973), B. Goldman focused on the concept of a company’s board of directors, focusing on the efficient management of the company’s performance while maximizing its profits. P. J. Sutton, T. W. Cousins in the book “Commercial Law” (Sutton, Cousins, 1971) define the concept of the board of a company as a guarantor of the company’s efficiency. At the end of the twentieth century, when the political and legal approach to defining the concept of a company’s board was mainly economic and psychological, the board was defined as a managing body, appointed by the company’s shareholders, whose performance is based on a certain ideology, but the main motive of the activity is to increase the profit of the company. Specific popularity achieved J. W. Smith’s book “A Compendium of Mercantile Law” (Smith, 1987), which declared the need for constant evaluation of the efficiency of the company’s board. At the same time, S. W. Gellerman defined the concept of the board of a company as a preacher of the company’s ethical values, which focused on the unwritten ethical and moral values of the company (Gellerman, 1986).

In the modern legal doctrine the understanding of the board of a company as an independent executive body, that organizes and manages processes within the company (Tumalavičius, Veikša, Načšcionis, Zahars, Draskovic, 2017; Wang et al., 2021; Jiang et al, 2021), has strengthened its position. The understanding has expanded of possible mechanisms for improving the efficiency of the work of the board of the company, its techniques and methods of decision-making. P. A. Read, T. Portwood and A. Odeke defines the board of a company as a corporate governance body, that identifies business problems and solves them, trying to achieve the main aim of an efficient management (Read, Portwood, Odeke, 1992). A. Gibson and D. Fraser links the definition of a board of a company with a member of the board, posing on him special authorities, that are connected with organizing and directing performance of the company (Gibson, Fraser, 1997). D. Mills attributes the board of the company to the company's main management bodies, offering to perceive the members of the board of the company as substitutes for the company's shareholders and their representatives (Mills, 1995).

Representatives of the Latvian social sciences started to focus on the study of the concept of the board of a company at the end of the 1990s after the restoration of the country's independence and after the unification of the Latvian legal system in accordance with democratic guidelines and EU law. Researcher V. Vilcāne defines the company’s board as an institution, that manages, represents, administers property of the private company, including money (Vilcāne, 2015). Lawyer U. Medne points out that the main task of a board member is to manage the company, make decisions, related to the company’s operations and its future development (Medne, 2016). Sworn advocate D. Rone points out that a member of the board of a company takes care of the welfare, prosperity, growth and order within the company (Rone, 2007). Sworn advocate I. Tillere-Tilnere believes, that the board of a company is the main executor of the company’s operational management, which is responsible for the company’s operations (Tillere-Tilnere, 2020). Sworn advocate T. Šulmanis points out, that the members of the board have rights to represent the company separately, each of the members of the board signs documents and concludes



transactions, that fall within his / her field of responsibility (Šulmanis, 2015). G. Šantare points out, that the company authorizes a member of the board to manage the company and to represent the company in relations with third parties within the limits of competence of the board, that is specified in the company's basic articles, as well as in the board members' decisions and company councils' decisions (*if such corporate body is functioning*) (Šantare, Šulmanis, 2019). On the other hand, H. Jauja, a specialist in commercial law, points out, that members of the board of a company must act as good and diligent representatives, otherwise inflicted losses to the company could be covered from the board (Jauja, 2017). E. Novicane, a doctoral student at the Faculty of Law of the University of Latvia, in the publication "Duty of a board member to act in the interests of a company" defines the board of a company as an institution, that has a duty to act in a good faith and in the best interests of a company (Novicane, 2019).

It should be noted, that there is no significant contradictions between all these ideas, regarding the notion of the board of a company, and in most cases authors grant specific rights to the company's board, that are connected mainly with rights to organize and manage the performance of a company. The existing definitions in the Latvian legal doctrine are similar and indicate the special legal status of the board of a company, its obligation to act in the best interests of the company and not to harm the company and its shareholders.

## **2. Basis for the application of criminal liability on the board of a company**

The Convention of 26 July 1995 on the protection of the European Communities' financial interests clearly defines principles of the inevitability of liability of the board of directors of a company. In accordance with Article 3 of the Convention, each member state shall take the necessary measures to allow heads of businesses or any persons having power to take decisions or exercise control within a business to be declared criminally liable in accordance with the principles defined by its national law in cases of fraud affecting the European Community's financial interests, as referred to in Article 1, by a person under their authority acting on behalf of the business. According with Second Protocol of May 19th, 2009, of the Convention on protection of the European Communities' financial interests, that was drawn up on the basis of Article 3 of the Treaty on European Union, the conditions for determining the responsible persons were clarified.

In order to comply with the principles of international law regarding the criminal liability of legal persons and in order to harmonize legal norms, amendments to the Criminal Law of the Republic of Latvia were adopted on 5th May 2005, supplementing the law with Chapter VIII "Coercive Measures Applicable to Legal Entities". The adoption of these amendments strengthened the principles of equality, fairness and inevitability of punishment regarding to the criminal liability of legal persons (Zahars, Stivrenieks, 2018). In addition, it is important to note, that the adoption of these amendments does not violate the principle of *non bis in idem* of Criminal Law, because the purpose of Criminal Law has achieved by applying punishment for the criminal acts of behaviour to the natural or legal person. Initially the idea of criminal liability of a legal person was not popular in Latvia. This idea was opposed by a number of legal professionals, resulting in a compromise and defining the criminal liability of a legal person as coercive measures applicable to legal persons. In this case it is possible to see an analogy with the application of coercive measures of upbringing to children and the application of coercive measures of a medical nature to limitedly dependent persons.

For example, on 5 April 2017, the European Court of Justice ruled in the decision ECLI: EU: C: 2017: 264, that Article 50 of the Charter of Fundamental Rights of the European Union must be interpreted as permitting an application of national legislation in the main proceedings, connected with failures to pay value added tax, after a final tax charge has been imposed on a legal entity and at the same time criminal proceedings were initiated against a natural person.

The main essence of the case: the applicants (Orsi and Baldetti), were prosecuted for VAT fraud, because they had not paid VAT within the time limits formulated by law. Criminal proceedings were initiated after the tax service authorities reported the offenses to the prosecutor. However, before the criminal proceedings were applied, the tax service authorities had calculated the amount of unpaid VAT and imposed an additional penalty on the company. The court sought a preliminary ruling on whether the prosecution of Orsi and Baldetti should have been terminated as a result of the *ne bis in idem* principle (Joined cases C-217/15 and C-350/15).

This decision of the court confirmed the principle of the parallel responsibility of a natural person and a legal person, that means, what the prosecution of one person does not preclude the possibility of prosecuting another person. Applying a criminal liability, the identification of the facts, the legal classification of the offense under national law and its nature must be carefully assessed. Those facts shall be assessed, taking into account the purpose of the provision, the applicants and the legal advantage of the application, as well as the nature and severity of the penalty (Decision of the Court of Justice of the European Union of March 20, 2018 *Menci*, ECLI:EU:C:2017:667).

The legal principle *ne bis in idem* is a fundamental principle of the human rights. Consequently, when applying the legal measures, it is the duty of the person, conducting the proceedings, to carefully assess whether there is no violation of the principle in his / her actions. According with the opinion of the authors, a formalized approach is not allowed in this case, as otherwise human rights and fundamental freedoms may be endangered.

Paragraphs one and three of the section 169 of the Commercial Law stipulate, that a member of the board must perform his or her duties as a prudent and diligent owner. A member of the board shall not be responsible for damages, if he proves, that he acted as a prudent and diligent owner. In practice this means, that the board member is responsible for everything, that occurs in the company, because he has to know everything (Jarkina, 2020).

In this occasion, the attention should be paid to the notion of „prudent and diligent owner”, which by its very nature implies a duty on the board member to control and supervise the employees and their actions. When assessing the criteria, specified in the article 18 of the Criminal Law Convention against Corruption of January 27, 1999, a member of the board is obliged to establish a logical and transparent crime prevention system in the company.

The liability of a member of the board for the inflicted consequences of his or her actions may take the form of civil and criminal case. In addition, the authors note the importance of administrative responsibility in determining the responsibility of board members. In addition to the civil and criminal liability, various alternative legal instruments are often applied to combat the offences of legal person and its board members. For example, in addition to criminal liability, European national legal systems have created an instrument of administrative liability (Ligeti, 2015).

For the form of criminal liability, it must be established the subjective and objective features of the offense, as well as the gravity of the offense, which should correspond to a specific composition of the criminal offense, provided in the Criminal Law of the Republic of Latvia. The purpose of applying the criminal liability of a member of the board of a company also differs (Lavrinovich, Lavrinenko, Jefimovs, 2012). The obligation to reimburse overdue tax payments, imposed on a member of the board of a company, has both a deterrent and a punitive feature of Criminal Law. At the same time the basis for the application of Civil liability for the illegal actions of the board is the acquisition of material satisfaction for the damage, inflicted to the company or its cooperation partner. The criminal liability of a board member may not only affect himself personally, but also have negative legal and financial consequences for the legal entity the board member represents (Matvejevs, 2018). Thus the shareholders of the company are negatively affected too (Jarkina, 2020).

The basis for the application of the criminal liability of a member of the board is closely related to the so-called the institute of application of coercive measures to the legal person. Thus, in accordance with Section 70<sup>1</sup> of the Criminal Law, a court or a prosecutor may apply a coercive measure to a legal person, including a state or local government company, as well as a partnership, for a criminal offense provided in the special part of the law. It is necessary to establish, what the offense was committed in the interests of a legal person, for the benefit of that person or as a result of its improper supervision or control, by a natural person, acting individually or as a member of a collegial institution of the legal person:

- 1) based on the right to represent or act on behalf of the legal person;
- 2) based on the right to take decisions on behalf of the legal person;
- 3) exercising a control functions within a legal person.

In order to impose any punitive measure on a legal person, it is necessary to establish a legal link between the legal person and the natural person, who has committed the criminal offense. If such a link is not established, there will be no basis for imposing any coercive measure on the legal person (Rozenbergs, Strada-Rozenberga, 2018).

At the same time, the Criminal Law does not distinguish such a special subject of criminal liability as a member of the board of a company (Kriviņš, 2015). Taking into account the features of application of punitive measures to a legal person, referred in the Section 70<sup>1</sup> of the Criminal Law, the application of criminal liability on a member of the board of a company shall be based on the following features:

- committing an offense in the interests of the company and for its benefit or committing an offense in its own (board) interests;
- inadequate supervision and control of the processes in the company by the board and the company's shareholders has been established;
- the board abuses the trust of the shareholders of the company by handling their property (here the company is meant) within the assigned competence or by violating the limits of its competence;
- the activities of the board of a company are performed covertly from the shareholders and without their consent.

The establishment of such features allows the application of a punitive measure to a legal person, while the board of a company - natural persons - is subject to the criminal penalty provided in the Criminal Law.

### **3. Forms of criminal liability of the board of a company**

Legal practitioners are reducing their focus increasingly on the responsibilities of senior management, including members of the company's board of directors. Legal mechanisms are being developed to combat economic and financial crime in a uniform, rational and effective manner.

The sustainable development of the country could be achieved by introducing the principle of inevitability of responsibility into the legal system and introducing clear and transparent legal instruments.

Each country incorporates individual and strategically important measures to combat financial crime, taking into account the genesis of the law and the common legal awareness of the society. Undoubtedly, when evaluating the experience of other countries, it is possible to see the common position of the countries and the similarity in the application of legal norms and creation of legal institutes.

In the Latvian legal system, the basis for the application of criminal liability to the members of the board of a company as natural persons is presumed in the Section 12 of the Criminal Law. The liability of a natural person as a representative of a legal person is established by presuming, that a criminal offense is committed in the interests of a legal entity under private law, for the benefit of that person or as a result of its improper supervision or control. In other words the liability of a natural person as a representative of a legal entity arises both as a result of an act or an omission, if it is proved in the case, that the person's duties were connected with supervising or controlling a legal entity.

Thus, for example, in the decision of the Senate of the Republic of Latvia on September 21, 2021 (Case no.11816006415), the Senate stated, that the appellate court had stipulated what the accused had not deliberately committed the violation of copyrights, as well as the accused didn't understand the harmfulness of his conduct and didn't intend to cause any harmful consequences. Consequently the Senate hasn't assessed the circumstances, established in the case and hasn't applied Section 12 of the Criminal Law, which regulates the liability of a natural person in the case of a violation of the interests of legal entity. The main task of a member of the board of the company is to manage and represent the company. This means that a member of the board has a certain set of rights and obligations, that he has to assume in order to ensure the activities of the company. An individual natural person (CEO, chairman or other responsible employee) or a group of natural persons (board, council, etc.) have to act on behalf of a legal entity. In order to bring an action against a member of the management board, who manages a legal entity, it is sufficient that an improper control of the company by the member of the management board is established. In this case, it is necessary to speak of the legal scope of the concept of „prudent and diligent owner”.

The Supreme Court in the case No.11816015611 (SKK-311/2016) on 23 November 2016 has strengthened the legal link between the act or omission of the responsible natural person and the actual activities of the legal entity. The court has established, that contrary to the provisions of Section 12 of the Criminal Law, the appellate court has made a conclusion, that a natural person may be held criminally liable only, if he or she has acted individually. The appellate court has not assessed, what is indicated in the indictment against /I.S./, that he acted as a responsible official of the legal entity. That means, what in accordance with Article 12 of the Criminal Law he could perform his illegal acts in a form of actual acts or omission. Thus, the appellate court has incorrectly applied Section 12 and Section 148, paragraph three of the Criminal Law. As a result the indictment did not indicate the features of the composition of the criminal offense, provided in the Section 148, paragraph three of the Criminal Law. Such a ruling shall not be recognized as lawful and justified within the meaning of Section 511, paragraph two of the Criminal Procedure Law.

Article 70<sup>6</sup> of the Criminal Law stipulates that a court or, in the cases provided by law, a prosecutor may apply a coercive measure to a legal entity, including a state or local government company, as well as a partnership, for a criminal offense provided in a special part of this Law. It is necessary to establish, that the offense was committed in the interests of a legal entity, as well as for the benefit of that person or as a result of its improper supervision or control, by a natural person acting individually or as a member of a collegial institution of that legal entity. That means, what in each individual case, both the legal entity and the natural person, who committed the offense in the interests of the legal entity, for the benefit of that person or as a result of its improper supervision or control, will be identified. And only in the presence of such conditions is it possible to apply a coercive measure to a legal person. Exceptional cases are stipulated in the Section 439, paragraph three of the Criminal Procedure Law. It stipulates, that the person, conducting the proceedings, may separate the proceedings regarding the application of a coercive measure to a legal person in a separate case by a decision, if:

- 1) criminal proceedings against a natural person are terminated on the basis of non-rehabilitative circumstances;

- 2) circumstances have been established which prevent the identification or prosecution of a specific natural person, or, for objective reasons, it is not possible to bring the criminal case to court in the near future (within a reasonable time);
- 3) to resolve in a timely manner the criminal proceeding with the natural person, who has the right on defense;
- 4) this is requested by the representative of the legal entity.

Coercive measures such as liquidation, restriction of rights, confiscation of property, recovery of money may be imposed on a legal person. Court decisions impose either one or more coercive measures. No other coercive measures are imposed in the case of liquidation.

Members of the board of a company as natural persons are punished in accordance with the provisions of the special part of the Criminal Law. The members of the board of a capital company may be subject to criminal penalties such as deprivation of liberty or temporary incarceration, forced labor or fine, with or without confiscation of property, probation supervision, deprivation of the right to conduct specific or all type of commercial activities or deprivation of the right to conduct a certain occupation or the right to hold a certain position.

Undoubtedly, when evaluating the legal mechanisms of Latvia in the term of the criminal liability of the board of a company, it is important to compare and analyze the connections between the experience of other countries regarding this issue.

For example, the Finland Criminal Code sets out the liability of a natural person acting on behalf of a legal person in the Chapter 5, Section 8. Contrary to the provisions of the Criminal Code, the Finnish legal regulation separately distinguishes the group of persons, who may be held liable acting on behalf of a legal person. These persons include members of the management of a company, as well as persons, who is entitled with decision-making power in the company or who otherwise acting on its behalf. In the Finnish criminal law, similar to the provisions of Latvian criminal law, the liability of a legal person does not replace the individual criminal liability of a natural person. That means, what one form of liability does not preclude the application of another form of liability.

In the decision of the Supreme Court of Finland KKO 2016: 58 the court assessed the liability of the head of a company for inflicted environmental damage. The court in the judgment assessed whether the members of the board could be held liable for the degradation of the environment. The court concluded, that the ignorance of two members of the board, who didn't read the content of the environmental permit, is considered as a negligence, therefore the members of the board should be held liable. This means, that the members of the board are liable not only for intentional and deliberate action, but also for failure to act, because these responsibilities are included in the supervisory function of the company board.

Article 121-2 of the French Penal Code establishes the form of criminal liability of a legal person. Code stipulates, that the criminal liability of a legal person does not exclude the criminal liability of a natural person, who performs the same activity and therefore is considered to be the subject of the Article 121-3 of the French Penal Code.

In order to fight corruption and promote fair business in France, Law no. 2016-1691, known as „Sapin II”, passed on 9 December 2016. The law came into force on June 1, 2017. For example, Article 17 of the law requires companies and groups of companies with a parent company in France, as well as public industrial and commercial establishments with at least 500 employees and a turnover of more than EUR 100 million, to take measures to prevent any cases of corruption. Law no. 2016-1691 (in accordance with Article 41-1-2) established a procedure,



that allows any legal entity, accused of corruption, trading of influence, money laundering, tax fraud, to make a plea deal with the Prosecutor's Office in exchange for termination of the proceedings. The agreement is based on the conditions set by the Prosecutor's Office, which the legal entity have to comply with. However, it is important to note, that such an agreement does not relieve the company's board of directors of liability and that members of the company's board as natural persons could be the subject to sanctions.

The principle of the inevitability of liability of legal entity in the case of a merger with another company, was confirmed by a ruling of the French Chamber of Criminal Cases of the French Supreme Court (*Chambre criminelle de la Cour de cassation*) of 25 November 2020. The decision excluded the possibility of companies, violating the law and deliberately liquidating or merging, to avoid any liability.

In the Dutch legal system, the legal liability of members of a company's board is included in the Article 51 of the Dutch Criminal Code, which sets out the liability of both the legal person and the person, who committed or directed the offense. It is also important to note, that the article states that the criminal liability of the members of the company's board may also be considered as a criminal offense, committed in a group of individuals. The Dutch Criminal Code and the Dutch Economic Offences Act allow legal persons and natural persons, as representatives of a legal person, to be subject to criminal sanctions for criminal offenses.

The liability of a natural person as a representative of a legal person is enlisted in the case-law, which stipulates, that liability applies if a person fails to take measures to prevent a criminal offense (*The Dutch Supreme Court's decision of 26 April 2016, ECLI:NL:HR:2016:733*). Participation shall apply in cases, where two or more natural and / or legal persons jointly commit an offence, this cooperation between participants is intentional and deliberate, and it is possible to establish a significant contribution of the participants to the outcome of an offense (*The Dutch Supreme Court 2 December 2014, ECLI:NL:HR:2014:3474*).

#### **4. Conclusion**

As a result of the analysis, performed within the framework of the research, it can be concluded, that the management of the company is subject to a rather complicated regulation, violations of which are common in the legal entities of Latvia. The most serious violations in this area are criminal offenses, which require a high level of professionalism and qualification not only in their identification, but also in their qualification and application of liability. Very often the criminal liability of a natural person - a member of the Board - was applied simultaneously with the coercive measures, applied to legal persons within the framework of criminal proceedings and the penalties imposed by the State Revenue Service. In that situation it is important to avoid violating the legal principle of "ne bi in idem", which the authors are actively discussing in this article. Taking into account Latvia's limited experience in this field, the authors use the case law of foreign and European Union legal institutions, especially in matters, that are relevant to the activities of Latvian law enforcement institutions. Within the framework of the article the authors sought to identify the boundaries between different types of violations of law in order to prevent unjustified violations of human rights and the interests of shareholders of companies by imposing state coercive measures.

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**Jānis TEIVĀNS-TREINOVSKIS**

ORCID ID: <https://orcid.org/0000-0002-1440-2153>

**Nikolajs JEFIMOVS**

ORCID ID: <https://orcid.org/0000-0002-6291-6407>

**Ruta VELIKA**

ORCID ID: <https://orcid.org/0000-0000-0002-9661-9443>

**Anatolijs KRIVIŅŠ**

ORCID ID: <https://orcid.org/0000-0003-1764-4091>

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## INNOVATION MANAGEMENT AS BASIS OF DIGITALIZATION TRENDS AND SECURITY OF FINANCIAL SECTOR

Svitlana Khalatur <sup>1</sup>, Halyna Pavlova <sup>2</sup>, Lesja Vasilieva <sup>3</sup>, Daria Karamushka <sup>4</sup>, Alina Danileviča <sup>5</sup>

<sup>1,2,3,4</sup> Dnipro State Agrarian and Economic University, Sergey Efremov street, 25, Dnipro, Ukraine

<sup>5</sup> Daugavpils University, Institute of Humanities and Social Sciences, Parades Str. 1-421, Daugavpils, LV-5401, Latvia

E-mails: <sup>1</sup> [skhalatur@gmail.com](mailto:skhalatur@gmail.com) (Corresponding author); <sup>2</sup> [halynapovlova@ukr.net](mailto:halynapovlova@ukr.net); <sup>3</sup> [vasilieva.lm@dsau.dp.ua](mailto:vasilieva.lm@dsau.dp.ua); <sup>4</sup> [karamushka.dk@dsau.dp.ua](mailto:karamushka.dk@dsau.dp.ua); <sup>5</sup> [alina.danilevica@du.lv](mailto:alina.danilevica@du.lv)

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**Abstract.** Digital innovations significantly affect the security of the financial sector of Ukraine, Latvia, and the world, and transform financial services. Financial innovations such as mobile money, peer-to-peer or market-based lending, robot advisors, insurtech, and cryptocurrencies have emerged around the world. Over the past decade, financial technology has contributed to the access, convenience, and security of financial services for retail users. Meanwhile, artificial intelligence, cloud services, and other technologies are being transformed into wholesale markets in a variety of areas such as trading in financial markets, regulatory and supervisory technologies (regtech and supotech). Many new firms have emerged to deliver new technologies to meet consumer demand, and most officials point to the fact that digital transformation is a strategic priority for the financial sector. The purpose of the article was to substantiate the need for the development of digitalization of the financial sector, analysis of digitalization and security trends, identify areas for further management of consumer expectations of financial products and services. Constant innovation and new technologies in the financial sector, on the one hand, undermine the market and pose threats, and on the other hand, open up many financial opportunities to prosper. The pace of change in financial services is only increasing, as is the need for industries and businesses to respond to them. This paper assesses the steady growth of new business models and technologies emerging in the world and Ukraine in the financial sector.

**Keywords:** globalization; economy; development; threats; digitalization trends; challenges; financial sector

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**JEL Classification:** F29, G20, L86, O31, O33

### 1. Introduction

Innovative developments can not only make markets more diverse, competitive, efficient, and inclusive, but also increase concentration. Innovation has introduced competition and increased reach, especially in emerging markets. However, the economics of intermediation combined with new technologies can lead to concentration among both traditional and new financial service providers. The monopolistic or anti-competitive behavior of

large technology platforms is already being tested. As financial services move toward similar technology-driven configurations, regulators are struggling to better regulate and oversee a financial sector that is increasingly characterized by new players and business models; and potential challenges to financial stability, financial integrity, fair competition, and consumer protection (including data confidentiality). The COVID-19 pandemic has accelerated the digital transformation. In particular, the need for digital connectivity to replace physical interactions between consumers and service providers, and in the processes that produce financial services, will be even more important for the economy, financial service providers, businesses, and individuals after COVID-19. In particular, the pandemic has already accelerated the transition to digital payments, intensified e-commerce, which can bring great benefits to technology companies and their activities in the field of finance.

A fundamental feature of capital markets is the need to keep records of payment obligations. The various actors in the payment chain need to trust other links that will not expose them to fraud or liability, as required by customers, reliable counterparties to whom funds can be provided, and reliable processes for their delivery. Investments and insurance in the financial market are subject to uncertainty about future results, unfavorable selection, and moral hazard. Those who create investment products rely on reliable underwriting and execution services to be able to offer a quality product to their clients. Customers, in turn, must be able to trust the reliability of investments and transactions that underlie their ability to buy and sell. All this requires effective management of financial innovation.

In general, the complexity of the interaction between the financial sector and the specific circumstances of different customers due to asymmetric information or uncertainty of results means that the price, maturity or other conditions will inevitably not be entirely appropriate to the circumstances of some customers. They may reject the offer or the intermediary may consider certain segments commercially unviable. The forces driving these changes are forcing us to reconsider the role of digitalization for suppliers and consumers of financial products and services. Mobile money has proven to be an effective gateway for financial development. Bankers and financial support managers need to train their clients to make appropriate financial decisions during the day based on a combination of artificial intelligence, transactional and contextual data. The impact of the financial technology market on the financial sector is growing, and the long-term potential is even greater.

Financial services companies are structured to take into account specific information gaps and economic fluctuations related to intermediation. Banks are developing recommendations to address the issue of resolving the problem of transformation arising from incomplete information about the future liquidity needs of depositors. They also view transaction costs and risks as the need to manage intermediary investments between individuals who have no direct knowledge of other counterparties or information about doing business elsewhere.

Exchanges and brokers search for and transaction costs of individual issuers and investors, reducing information asymmetries by requiring listings and publishing prices, and providing infrastructure and services to reconcile and enable transactions between buyers and sellers who do not know each other. Because much of the mediation process is not easy for customers, the risks can be realized only after a long period and the need of consumers for reliable suppliers is greater than in other industries.

Providing these services requires not only information and financial resources but also real resources. These include manpower, equipment and facilities, financial contracting, account management, and customer transaction processing, which are included in the elements of financial innovation management.

## **2. Literature review**

Continuing the topic of Khalatur S., Stachowiak Z., Zhylenko K., Honcharenko O. & Khalatur O. (Khalatur et al., 2019) on financial instruments and innovations in the business environment of European countries and Ukraine, this article examines the trends of digitalization and security of the financial sector. The authors note that one of the most important tasks of the development of the national economies of both European countries and Ukraine is to stimulate and ensure sustainable economic growth. To this end, all countries are developing innovation and using various financial instruments.

Arefjevs I., Spilbergs A., Natrins, A., Verdenhofs, A, Mavlutova, I., Volkova, T. (Arefjevs et al., 2020) argue that data use, data analysis and understanding of the importance of data at the strategic level are both significant factors and catalysts for future financial sector development. The financial sector is becoming increasingly active and critical to the economy through rapid digitalization. Financial technology companies in Latvia are successfully expanding their activities.

R.Rupeika-Apoga, S.Wendt (2021) studied current events and challenges facing the Latvian financial technology sector. The size and financial results of fintech companies in Latvia over the last ten years indicate certain difficulties, both in growth and in the formation and maintenance of business models that are financially stable. FinTech companies require special regulations on financial technology. Khalatur S., Trokhymets O., Karamushka O. (Khalatur et al., 2020) substantiate the conceptual basis of tax policy formation in globalization conditions.

Danileviciene I., Lace N. (2017) write that growth and development based on innovation is important in all economies of the world. The openness of knowledge, openness of business, and openness of innovations are key characteristics and success factors of the modern global world. Khalatur S. (2017) examines important provisions (including financial) for the development of agriculture in Ukraine.

Frénod E., Ménard P., Safa M. (Frénod et al., 2018) in their research consider two new optimization problems. The first is to find a lending scheme that minimizes the cost of credit for the project, along with the time to achieve the goals. The second problem is that they provide credit, savings schemes to find their best options. Khalatur S., Kriuchko L., Sirko A. (Khalatur et al., 2020) note the need to study the world experience of adaptation of anti-crisis management of enterprises in the conditions of the national economy's transformation.

Makdissi R., Nehme A., Chahine R. (Makdissi et al., 2020) note, that entrepreneurs face complex financial decisions to change their business. Small and medium business owners must have a certain level of knowledge that requires financial knowledge, behavior, and attitudes that will increase the financial productivity of the business. Khalatur S., Vinichenko I., Volovyk D. (Khalatur et al., 2021) in studying the development of modern business processes and outsourcing activities paid great attention to various types of outsourcing (including financial and IT outsourcing).

Stolper O., Walter A. (2017) analyze the role of financial literacy of individuals in the use of professional financial advice and assess whether expert intervention can replace financial literacy.

The United Nations development program Human Development Reports seeks to shift the focus of the development economy from national income accounting to people-centered policies. Vasyliева N. (2019) in her study used a functional comparative approach to develop ways to improve agricultural management.

Velychko O., Velychko L. Ramanauskas J. (Velychko et al., 2016) based on SWOT-analysis applied the author's methodological approach to the retrospective systematic assessment of alternatives for the transformation of

production and logistics enterprises. Zsolt K.S. (2020) in his study focused on limiting the placement of basic financial services in the online space.

Chien-Chiang Leea, Chih-Wei Wangb, Shan-Ju Hoa (Chien-Chiang Leea et al., 2022) explore whether aid flows to the financial sector can improve the recipient country's financial attractiveness from AidData and WBES databases. The results of research by these researchers show that financial assistance is an important determinant of the financial inclusion of firms and countries. Mirzet Šehoa, Mansor H. Ibrahimb, Abbas Mirakhorc (Šehoa et al., 2021) studied the impact of sectoral diversification of credit and financing on bank risk and profitability. The results of the research show that industry diversification of loans and financing reduces profitability and increases the risk of banks. Kitsios F., Giatsidis I., Kamariotou M. (Kitsios et al., 2021) argue that the modern technological environment is constantly changing and forcing all economic units to digital transformation. The digital transformation has two functions, as it allows the financial sector to offer new channels of service through new electronic platforms.

Krylov D., Papaika O., Panchenko O., Pylevych D., Kozlianchenko O., Konoplia N. (Krylov et al., 2022) in their works highlight current trends in the digitalization of financial services. Researchers have found that fintech companies are important for the formation and development of companies working to achieve effective interaction between the financial sector and innovative technologies in the use of mobile applications to most fully and quickly meet customer needs in financial services. Mykhailiuk G., Rustamzade A., Bakhishov A. (Mykhailiuk et al., 2021) note that digitalization is already an important part of modern trends. Researchers also discuss the controversial effects of using new technological solutions and note the possibility of developing modern technologies, creating a favorable basis for hiding many criminal acts, such as money laundering, terrorism, fraud, and tax evasion.

Niemand T., Rigtering J.P. Coen, Kallmunzer A., Kraus S., Maalaoui A. (Niemand et al., 2021) note that technology is rapidly changing the financial industry. Digital technologies are becoming more and more a modern standard in the banking sector; they challenge traditional business models and allow banks to make money. The results of the research show that the level of digitalization of the bank does not affect profitability. Instead, in this time of technological change, banks need to develop a clear vision of digitalization, characterized by innovation, outperforming competitors, and willingness to take risks. Buss K.P., Oberbeck H., Tullius K. (Buss et al., 2021) argue that the changes that are taking place now should not be interpreted as technological shocks, but rather as sectoral developments in systems rationalization. Based on their empirical conclusions, the authors argue that the actual driver of digitalization and the purpose of using digital technologies is an attempt to optimize and control market relations and competitive processes, which are primarily due to the specifics of relevant industries.

Tsindeliani I.A., Proshunin M.M., Sadovskaya T.D., Popkova Z.G., Davydova M.A., Babayan O.A. (Tsindeliani et al., 2022) write that digitalization and globalization of the economy stimulate the processes of international regulatory cooperation and harmonization of legislation, the use of new approaches in the development and adoption of regulations in the financial market. Chen, Z.W., Zhu, K.L., Yue C. (2020) as well emphasize the role of regulation in the sustainable performance of contemporary digitalized banks. The growth of digitalization of relations in the banking sector will contribute to the effective implementation of rules, including those related to the need to protect state interests. Burlacu S., Ciobanu G., Troaca V.A., Gombos C.C. (Burlacu et al., 2021) note that information and telecommunications technologies have changed society, the economy, and financial banking around the world over the past few decades. The current stage of mass digitization is to design an increasing number of managerial, technical, and technological tasks in all sectors of society and economic activity. In the financial sector, digitalization is already rapidly affecting the financial services sector, with a wide range of products, applications, and various processes, as well as the development of business models.

Tanda A., Schena C.M. (2020) write that the financial technology revolution has changed the financial markets, which are now facing a point of no return. New products, services, and processes are offered by new entrants, be it FinTech, BigTech, or digital financial intermediaries. Competitiveness, which stems mainly from new business models adopted for financial services, is forcing existing banks to reconsider their approach to the market and customers. Brandl B., Hornuf L. (2020) note, that the digitalization of financial services has opened a window for new players in the financial industry. The researcher explains the reluctance of traditional banks to fully approve the new opportunities of digital financial services by the peculiarities of the technology itself and the deferred fundamental decisions of banks to modernize their IT infrastructure. Kotliarov I.D. (2020) argues that the digital transformation of the financial industry is causing a profound change in the patterns of interaction between financial market players. The author shows how types of innovations determine the nature of the digital transformation of the financial industry and how they manifest themselves in various digital financial products. The digital transformation of finance includes two aspects: the fintech revolution and the introduction of innovative digital technologies by traditional financial companies.

Mavlutova I., Volkova T., Natrins A., Spilbergs A., Arefjevs I., Miahkykh I. (Mavlutova et al., 2021) write that the development of financial technologies is characterized by the emergence of alternative services and new industries and is highly innovative. The functional equivalent of commonly used terms such as digital disruption and digital transformation is digital innovation, emphasizing strategic orientation, developing new products and business models in one case, and transforming traditional models to work with existing loyal customers in another.

Researchers of Institute of Humanities and Social Sciences (IHSC) of Daugavpils University (DU) have been studying different aspects of digitalization (Menshikov, Sinica 2016; Sinica 2017). In 2021 economists and sociologists of DU realised the scientific research project “Mobile technologies as a factor of business efficiency during the COVID 19 pandemic (the case of Latvia and Poland)” (Daugavpils University, 2021). Research project contributes to the digital economy theory by evaluating the methodology and assessing the level of use of Internet technology in the EU disparities in the use of Internet technology in the EU countries in the period 2012-2020.

Therefore, further research is needed in the management of financial innovations in the context of digitalization trends and the security of the financial sector.

### **3. Setting objectives**

The purpose of the work is to substantiate the need for the development of digitalization of the financial sector, analysis of digitalization and security trends; identify areas for further management of consumer expectations of financial products and services.

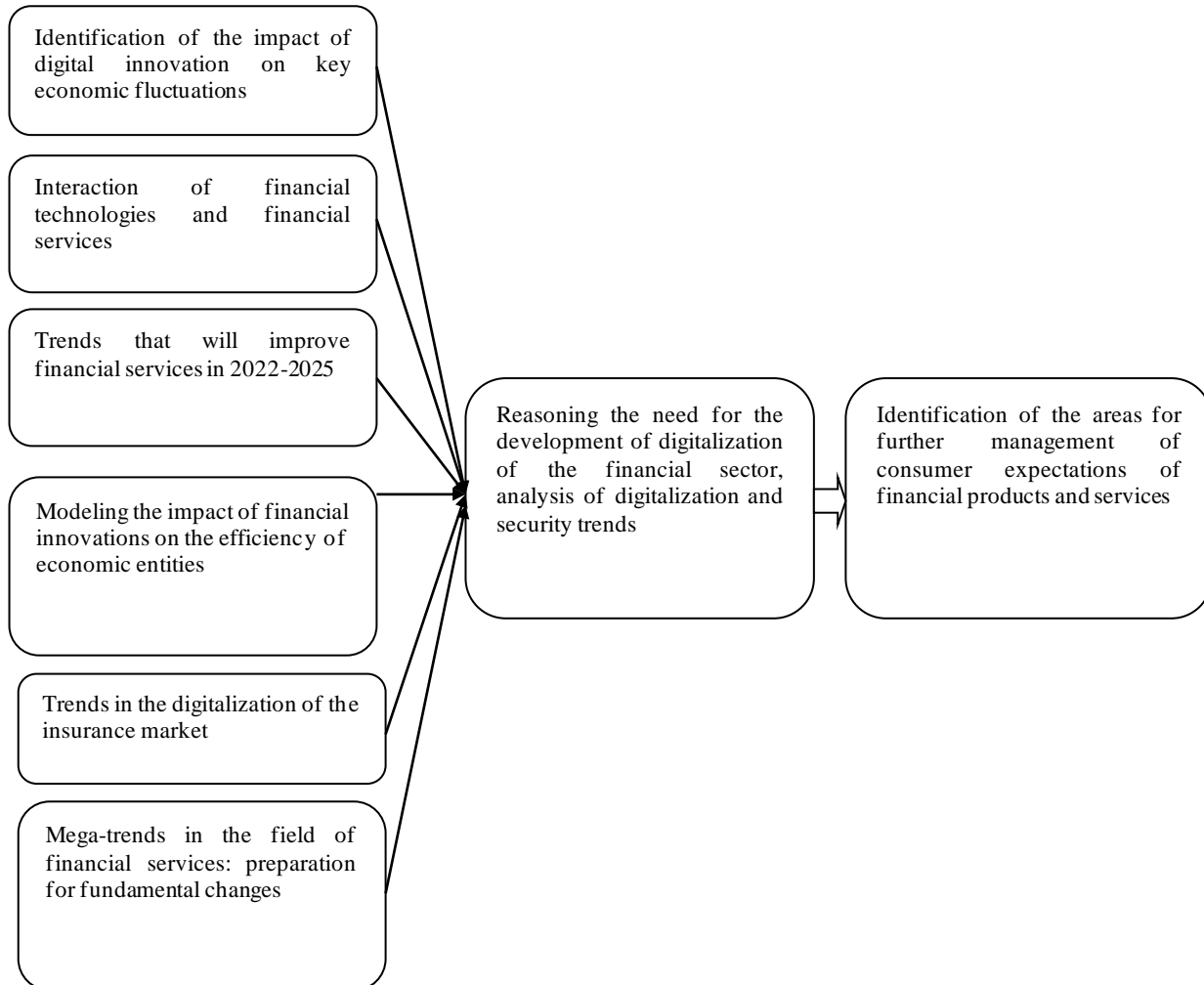
Achieving the goal will help solve the following tasks:

1. To identify the impact of digital innovation on key economic fluctuations.
2. Interaction of financial technologies and financial services.
3. Trends that will improve financial services in 2022-2025.
4. Modeling the impact of financial innovations on the efficiency of economic entities.
5. Trends in the digitalization of the insurance market.
6. Mega-trends in the field of financial services: preparation for fundamental changes.



#### 4. Research methodology

When writing the article, general scientific and specific research methods were used, namely: methods of financial analysis, synthesis, comparison, economic and statistical methods, and systematic approach. The theoretical framework of the study is presented below (see Figure 1).



**Figure 1.** The theoretical framework of the study  
Source: the authors

#### 5. Research results

##### 5.1. The impact of digital innovation on key economic fluctuations

The introduction of technology is not new in the financial sector, but many limitations have defined the work environment until recently. By the end of the 20th century, the industry was already characterized by a relatively

high degree of computerization, as most financial services were dematerialized. Payments alone often require physical money or a check, and adapting to new products and services often requires personal or paperwork. Physical infrastructure, such as branches and ATMs, is usually required to interact with customers. Clients wishing to conduct transactions with counterparties using other banks had to use expensive and sometimes slow or risky processes, such as bank transfers. Even after the advent of digital payment systems and the dematerialization of securities, communication remained a barrier to entry - the institution usually had to be licensed and part of a consortium of banks or brokerages to participate in the transaction network. In addition, data processing and storage were expensive, requiring custom work and data centers. This limited the amount of information that could be collected, stored, analyzed, and exchanged to increase efficiency, better price risk, and adapt products to customer needs.

Technological advances in data connectivity, processing and storage, and significant technological advances have taken place in two key areas that have contributed to the current wave of technology-based financing:

- increase the connection. The Internet and mobile technologies are rapidly developing the ability to transmit information and interact remotely between businesses and consumers. Through mobile phones and smartphones, which are almost ubiquitous, technology has greater access to and efficiency of direct delivery channels and promotes low-cost, personalized financial services.

- low costs for calculation and storage of data. The efficiency of the calculations increased exponentially, as the cost of data storage decreased rapidly. The ability to quickly process such data has also increased through the achievement of artificial intelligence and machine learning. Digital technologies, activities, e-commerce generate a lot of new data. Much of the new data relates to individuals (personal data) or companies and can be processed automatically. These advances have created a large amount of new data, tools for analyzing this data, as well as new business models that use knowledge of analysis. Table 1 shows the ownership of an account in a financial institution or a mobile money service provider in the world.

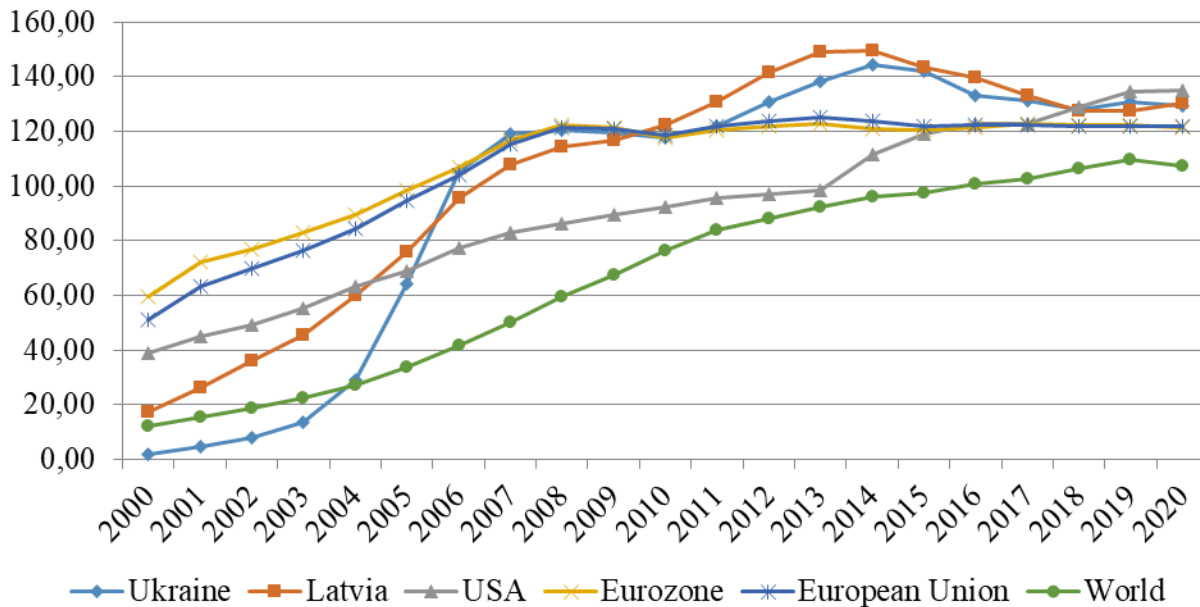
**Table 1.** Possession of an account in a financial institution or a mobile money service provider in the world on average for 2000-2020

Indicator	Ukraine	Latvia	USA	Eurozone	World
% of the population aged 15 and over	52,30	78,26	91,55	93,47	60,38
women (% of population aged 15 and over)	50,74	76,40	90,52	92,20	56,64
men (% of population aged 15 and over)	54,31	80,34	92,64	94,87	64,20
elderly people (% of the population aged 25+)	52,26	82,13	93,25	95,97	64,21
40% of the poorest (% of the population aged 15+)	42,41	72,58	83,83	92,10	52,16
primary education or less (% of the population aged 15 and over)	21,32	50,30	57,21	82,84	47,15
60% of the richest (% of the population aged 15+)	58,86	82,05	96,64	94,38	65,95
secondary education or more (% of the population aged 15 and over)	58,07	85,03	92,89	96,40	72,67
youth (% of the population aged 15-24)	51,66	58,05	83,55	78,63	46,75
Mobile subscriptions	18382590,33	17210821,14	131112800,38	160806378,86	2065674003,20
Mobile subscriptions (per 100 people)	41,50	45,09	42,51	48,39	29,24

Source: compiled by authors based on World Bank data

As of the end of 2020, the World Bank estimates that there were more than 5 billion mobile subscriptions worldwide. Figure 2 shows the dynamics of the number of subscriptions to mobile communications in Ukraine and around the world. As a result, most financial services can now be provided directly in digital form, which greatly expands access to finance.





**Figure 2.** Dynamics of the number of mobile subscriptions (per 100 people) for 2000-2020

*Source:* compiled by authors based on World Bank data

A new class of services and assets can in principle even be provided without the need for an intermediary. At the same time, the rapid growth of connections has led to major networking effects and strengthened the position created by intermediaries offering mobile networks and subscriptions, including telecommunications companies, especially in some emerging markets. In addition, the development of widely used applications and services such as social media, search and social networking have enabled more casual peer-to-peer interactions. They are increasingly attracted by economic interactions, and this has strengthened the position of companies providing these services.

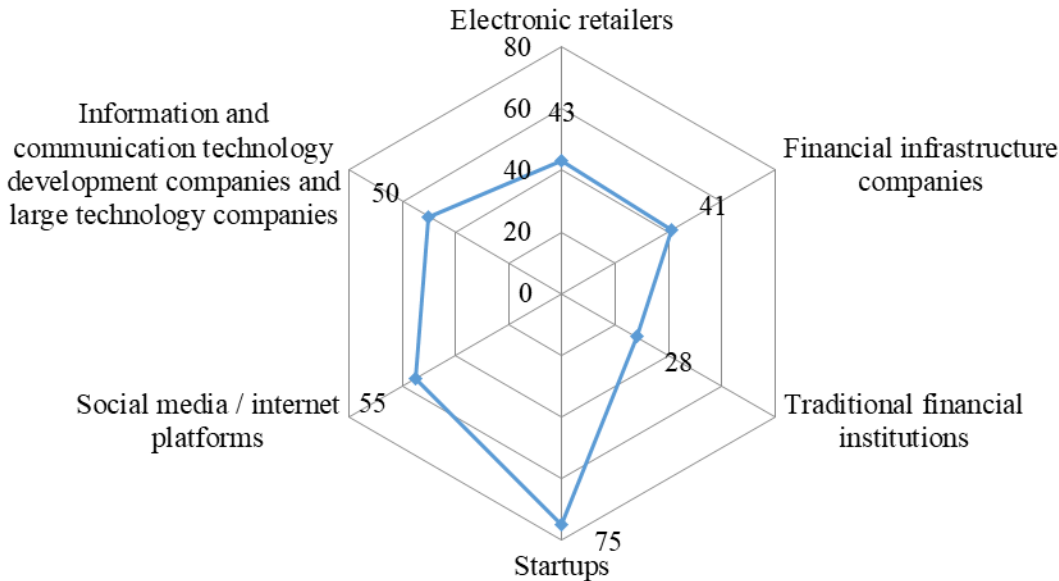
## 5.2. Interaction of financial technologies and financial services

Financial technology (FinTech) has evolved from startups that want to overtake existing companies to a wider ecosystem of different enterprises, and in many cases are looking for partnerships. Fintech startups need capital, they need customers. At the same time, existing enterprises need new approaches to stimulate change and achieve their innovative development. The new approach to digitalization-based partnerships offers alternative strategies for both new entrants and startups, but it also carries a new set of risks.

Big Data is used in a wide range of traditional financial services and new businesses to improve credit analysis, process efficiency, risk management, product design, customer service, and more. Data can be an important resource and driving force for economic development.

These advances also allow the creation of many new business models for the provision of technology services, one of which is cloud computing. They combine the ability of an enterprise or individual to connect to data-driven and externally managed centers with low-cost computing power and storage. The result is the ability to obtain on-demand infrastructures and reduce the fixed cost barrier to accessing financial services.

Innovations in cloud services are rapid as venture capital grows and private equity financing shifts to new cloud technology and development operations (DevOps) programs over the past three years. Figure 3 shows the structure of financial sector entities that influence digitalization trends in Ukraine and the world.



**Figure 3.** Structure of financial sector entities that influence digitalization trends

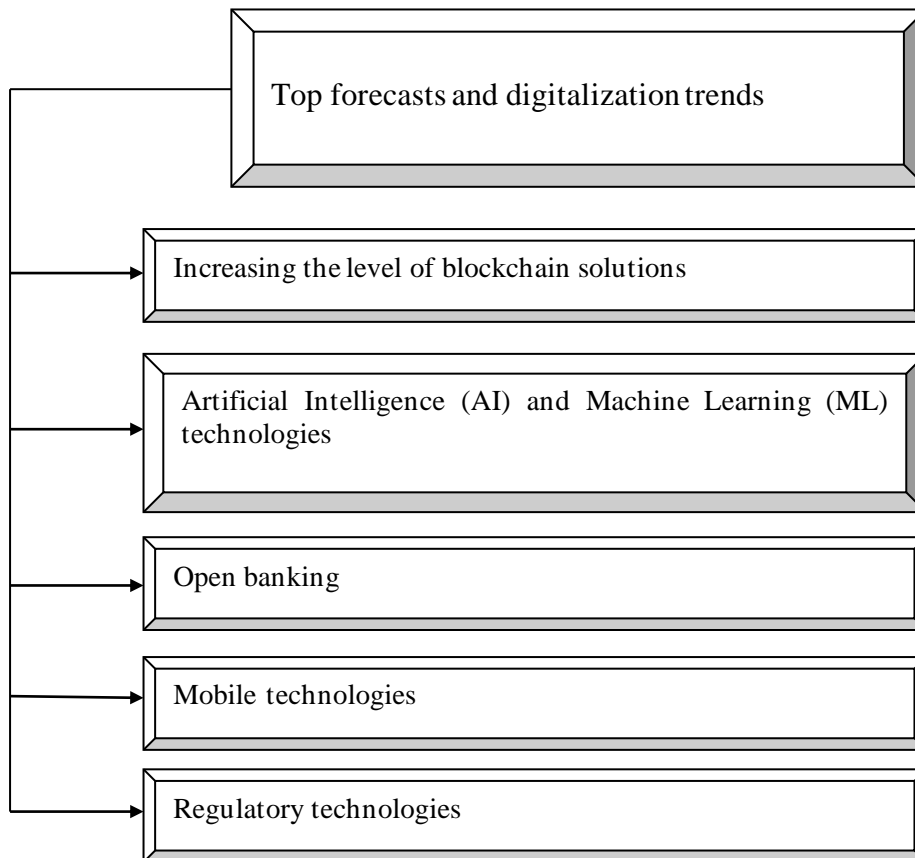
*Source:* compiled by authors based on The IMD World Digital Competitiveness Ranking 2021

Financial intermediaries can reduce marginal costs through automation and processing, which are accelerated with the expanded use of data and processes based on artificial intelligence. Digital innovation can also help overcome spatial (geographical) barriers and even bridge differences between jurisdictions. Increased use of digital tools and platforms for many economic activities makes it possible to radically introduce special financial products in non-financial activities, reducing costs and risks of attracting customers.

Another result of the technological advances described above has been the widespread emergence of platform business models. Businesses use the connections of individuals and companies, as well as the ability to quickly and easily cooperate, find contractors, package, and supply a variety of digital and physical goods and services. Platforms are bilateral or multilateral markets that use networking effects to create more value for each participant, increasing the number of other participants. The platform provider also benefits from network effects that attract more users, revenue-generating transactions, and data that in turn allow providers to target more products or services to users.

### 5.3. Trends that will improve financial services in 2022-2025

The financial technology industry can be described as the best place for change when customers liked the idea of on-demand financing, which is applied through mobile and cloud computing. It is more convenient for customers to manage their assets online. Thus, we can identify the main trends of 2022-2025 in the financial sector: the expansion of blockchain solutions; artificial intelligence (AI) and machine learning (ML) technologies; open banking; mobile technologies; regulatory technology (RegTech) (Figure 4).

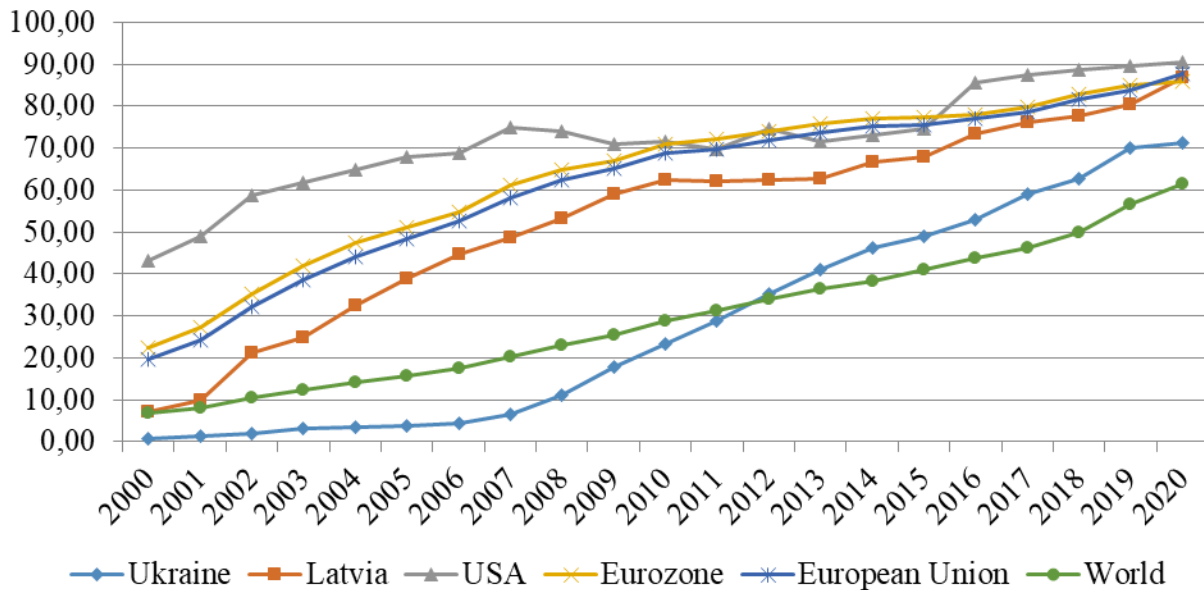


**Figure 4.** Top forecasts and trends of digitalization of the financial sector in 2022-2025

*Source:* compiled by authors based on The IMD World Digital Competitiveness Ranking 2021 and Business Data Platform

Thus, we will consider more significantly these trends in the digitalization of the financial sector. The Blockchain for Secure Financial Transactions was created primarily to make cryptocurrency transactions secure and secure against hacking attempts. In financial technology, this trend works as follows: there is a chain of financial transactions consisting of blocks, each cryptocurrency transaction is part of a block in this chain and is combined with the next and previous transaction. Therefore, any changes made to the previous transaction require the approval of all stakeholders involved in the chain. In addition, the entire system is completely encrypted, which makes it impossible to penetrate it.

When it comes to regular currency transactions, only code snippets are transferred from one account to another. Although security remains a top priority, more and more financial institutions are beginning to implement blockchain in banking systems due to unsurpassed security. Figure 5 shows the dynamics of the number of people who use the Internet in Ukraine and around the world.



**Figure 5.** Dynamics of the number of people who use the Internet in 2000-2020, % of the population  
*Source:* compiled by authors based on World Bank data and The Global Competitiveness Report 2020

However, the blockchain is not fully used in the financial sector. In 60% of cases, this fintech trend is implemented to protect transactions. Thanks to the blockchain it became possible to: make a transaction faster without the need for an intermediary; reducing the need for things in the financial back office, which saves a lot of money.

The benefits of customers from Open Banking:

- if the client has accounts in four different banks, he does not need to use four separate banking programs;
- risks of refund are excluded (customers make direct payments from account to account);
- lower transaction costs.

Demand for mobile technology is part of the financial technology trend, which combines physical and digital banking with other financial services. Thus, fintech companies will become allies rather than competitors for outdated financial institutions, which will lead to a significant increase in fintech outsourcing services sold worldwide.

Regulatory technology (RegTech) means regulatory management in the financial sector through technology. The rise in digital solutions has led to cyberattacks, money laundering, hacking and other fraud. The goal of regulatory technology (RegTech) is to solve all this by using machine learning algorithms based on big data.

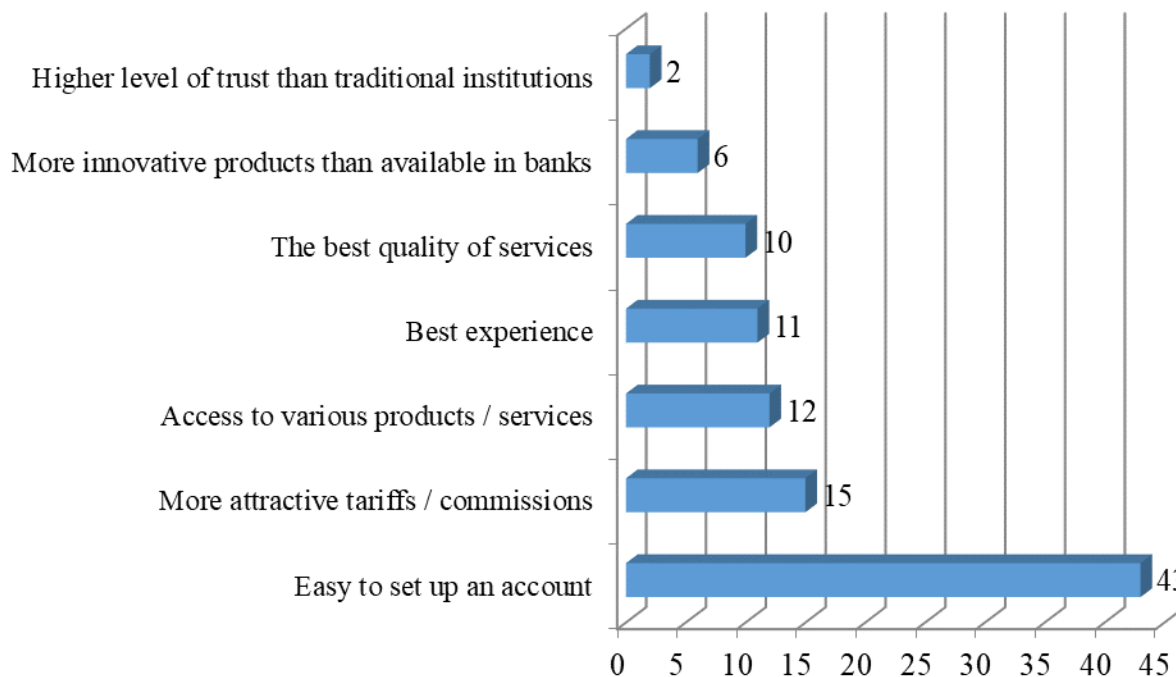
Advantages of regulatory technology (RegTech) for financial technology (FinTech), that, using RegTech in its financial services, the company will be able to:

- track financial transactions in real-time to create accurate financial statements;
- reduce the risk of money laundering in the organization;
- improve and maintain the compliance of financial technologies with existing needs;
- reduce costs associated with manual data management;
- increase data protection.

The RegTech Knowledge Center presents many cases where technology is used to carry out regulatory activities:

- improve product offering through the fully automated reporting service MiFIR (The Markets In Financial Instruments Regulation);
  - reduce the cost of regulatory reporting;
  - meet regulatory state goals;
- solve the complexities of the regulatory environment.

To summarize the main trends in financial technology in 2021, it should be noted that 70% of companies see customer satisfaction as a key driver of all digital technology improvements. Customers trust businesses more if they are out apply technological solutions to facilitate, secure and smooth any transaction. In Figure 6 it is shown the main reasons for the introduction of modern financial technology solutions by users.



**Figure 6.** The main reasons for the implementation of modern financial technology solutions by users, %

*Source:* compiled by authors based on The IMD World Digital Competitiveness Ranking 2021 and Intelligent software engineering

In recent years, the financial technology industry has undergone major transformations. Changes in this area can be explained both by the pandemic situation and new problems in the financial sector, which can be solved by:

- solutions based on blockchain technologies, which aim to make transactions fast and secure;
- machine learning and artificial intelligence in financial technologies that help to interact more effectively with customers;
- mobile financial technologies provide instant payments;
- Regulatory technologies (RegTech) are focused on improving efficiency and eliminating fraud.

The major transformations in the financial technology industry today are determined by the fact that people are accessing the Internet more intensively than ever because of the global pandemic. And market players are going to look for new opportunities to make the digitalization of the financial technology business smooth, secure and profitable.

#### **5.4. Modeling the impact of financial innovations on the efficiency of economic entities**

Analysis of financial innovations is important for business managers and entrepreneurs because it can help improve the ability of the business to develop and increase productivity. However, the external environment is much more important for entrepreneurs and managers, because it stimulates vigilance to unexpected factors. Given that productivity is an important goal of business entities, it is generally accepted that the structure and decision-making of the enterprise are influenced by the complexity and volatility of digitalization trends (Nassar, Strielkowski, 2022).

Many businesses compete in the global market, not just the domestic market. Changes in technique, technology, and improving the ability of the information retrieval process require more timely, efficient, and competitive responses. The rapid changes in the financial sector that are taking place in many countries are affecting the activities of enterprises, in addition to the desired product, the properties of consumers are increasingly diverse. Businesses need to be vigilant and aware of the impact of the reality of this environment, as it can be an effective player in the global economy. Companies that compete strategically, their owners and managers will look for patterns that can help them understand the external environment, and this may differ from their expectations. This is important for decision-makers who have an understanding of the company's competitive position.

The main components of the external business environment in the management of financial innovations:

a) The technological environment can be defined as a set of tools such as knowledge, methods, materials and tools used to achieve practical results. Technology has the potential to improve speed, quality, and efficiency. Some business owners or managers are reluctant to make technological changes because they are unsure of security and privacy. For such business owners, the idea of e-commerce in any form is too risky for their business. The idea of business related to the Internet or electronic data is not a necessary thing, but something that should be avoided at all costs. Other issues concern the lack of information technology professionals because the technology industry seems so complex, many companies do not use new technologies due to a lack of staff experience to solve potential problems.

b) The economic environment is vital for any organization. It is important for management to distinguish between short-term phenomena and more fundamental changes in the assessment of general economic activity. The political environment is considered through the legal framework where the organization operates and is carried out through laws and regulations governing the activities of the enterprise. The political stability of the external environment is also a necessity for the effective functioning of a business.

c) Political and legal environment influenced by political processes and legislation. These factors, being restrictive, tend to reduce the potential of the financial institution. The influence of regulators is pervasive, and understanding how they work is important to protect business interests and promote new programs to achieve greater productivity. It is important to understand the complexity of the legal environment, to avoid situations of inefficiency. In particular, the business industry needs to know about regulation, doing business, aspects of taxation, company control legislation, monopolies, mergers, and restrictive practices.

d) The competitive environment must also be taken into account when assessing the nature of competition, as well as profitability, as it often has a direct impact on the development of the industry. The competitive environment consists of many factors, especially the resource strategy, which includes potential or existing competitors, customers, and suppliers. There is an increasing tendency for firms to expand their activities. Globalization provides both opportunities for access to larger potential markets and a wide base of production factors.

e) Organizational efficiency is a source of influence on the actions of companies and the degree to which the organization achieves its goals and objectives through the strategies and policies of the organization. Organizational efficiency is also seen as a measure of how a manager uses the organization's resources to effectively achieve the organization's goals, as well as to satisfy all stakeholders.

The general model for determining the impact of the external environment on the efficiency of economic entities is shown below, the external environment (EXTE) has five dimensions. The above relationship can be expressed in the following characteristics of the model:

$$SMEP = f (EXTE) \quad (1)$$

$$SMEP = f (PE, TE, EE, CE, FE) \quad (2)$$

Where PE = Political environment

TE = Technological environment

EE = Economic environment

CE = Competitive environment

FE - financial environment

SMEP = Effects activity of the enterprise

Explicitly, the model can be expressed in the form:

$$SMEP = b_0 + b_1PE + b_2TE + b_3EE + b_4CE + b_5FE + U_t \quad (2)$$

Where,  $b_0$  = regression constant or free coefficient

$b_1, b_2, b_3, b_4, b_5$  Regression coefficient

$U_t$  = error value

A priori:  $b_1 > 0, b_2 > 0, b_3 > 0, b_4 > 0, b_5 > 0$

Thus, the assessment of the external environment provides an effective analysis to determine its impact on the activities of enterprises. There is a lack of understanding of the impact of the external environment on business, on the organizational productivity of the enterprise. It can be argued that organizational efficiency does not take place in a vacuum, but takes place in a certain environment that has challenges and opportunities. This study should provide an understanding of the relationship between the external environment and productivity. If companies effectively maintain their business goals following the existing environment, they will actively and favorably maintain efficiency. Importantly, in assessing a business, the environment not only contributes to the development of efficiency and effectiveness of the enterprise but also contributes to increased productivity, which will lead to improved or increased market share, operations, and competitive advantage. The external environment is a relatively remote environment and the elements that make it up to have an indirect impact on organizational performance.

The external business environment is strongly correlated with the small and medium scale of the entity, so it is an important aspect of achieving and effectively achieving production goals.

Based on the findings of the study, the following recommendations can be made:

- 1) The productivity of the entity should be a strategic priority, as it has been established that it is influenced by a wide range of factors.
- 2) The economic environment makes a negative contribution to the financial and economic activities of the enterprise, so management must make sure that all factors caused by the economic environment increase productivity.
- 3) The risk posed by various external factors is great; therefore, it is important to reduce these risks if the entity intends to operate efficiently.
- 4) Key stakeholders should ensure the effective implementation of strategic plans to help strengthen existing production orientations capable of reducing the impact of business environment factors. Businesses need to balance the focus on market opportunities in terms of achieving goals, assessing the impact of business environment factors, and managing financial innovation.



### 5.5. Trends in the digitalization of the insurance market

Over the decades, insurance has emerged as a fairly stable industry, characterized by low but stable growth rates and return on equity. This is changing at an accelerated pace. The 2008 financial crisis and the recent COVID-19 crisis have called into question the profitability of insurers and stock markets. In a traditionally low interaction, a tightly regulated industry that has long believed that it is protected from failure, digitalization is now beginning to dramatically change customer behavior and business models.

What is digital insurance? Where are the opportunities for transformation? Technological trends, trends of digitalization in the insurance industry will shape its future - and the future of enterprises. Insurers can place themselves at the center of a customer-driven, data-driven ecosystem that will drive the lives and economies of tomorrow's generations (see Table 3).

**Table 3.** The main trends in the insurance sector in Ukraine and Latvia on average for 2000-2020

Indicator	Ukraine	Latvia
Distribution of social insurance programs to the poorest quintiles (% of the total amount of social insurance payments)	13,83	8,20
Coverage by social insurance programs (% of population)	50,89	45,95
Coverage of social insurance programs in the 2nd quintile (% of population)	51,73	45,72
Coverage of social insurance programs in the 3rd quintile (% of the population)	51,33	48,13
Coverage of social insurance programs in the 4th quintile (% of the population)	51,98	49,87
Coverage of social insurance programs in the poorest quintile (% of population)	51,33	41,56
Coverage of social insurance programs in the richest quintile (% of the population)	48,10	44,48

*Source:* compiled by authors based on World Bank data

It is necessary to determine how to successfully modernize and digitize insurance, effectively address challenges and opportunities for transformation, to influence insurance business models, organizational strategies, and resources. It will also affect the very foundations of insurance technology, the transfer of outdated models to the digital age. For decades, insurance market participants have created reliable insurance models and processes backed by a strong IT foundation. They have developed advanced analytics for underwriting, risk assessment, and fraud management.

Alas, the new world needs profound change. Often built in isolation, supporting isolated departments or resulting in different levels of mergers and acquisitions (M&A), rigid outdated processes and systems fail to provide the speed, openness, and scalability that insurers need today. Insurers have already launched many modernization initiatives. The reasons for this are various: catching up with digital innovations, developing multi-channel insurance services, experimenting with cloud technologies, or even insurance based on the use of the Internet of Things. And while the success has been great, competition is growing from global technology market participants, and technology in insurance means insurers need to step up their efforts.

Preparing for a paradigm shift to meet the challenges of the digital world and gain a winning position in it, three key actions will be essential for insurers:

1) Transformation of operational insurance models to reduce maintenance costs by up to 50% and increase speed. This strategic step should include innovative business process outsourcing services, implementing intelligent automation through transformation and cloud infrastructure.

2) Modernization of major insurance platforms will allow insurers to adapt up to 40 times faster to market changes and respond to growing customer demands in real-time. This can be significantly accelerated through the latest migration, rewriting, re-platforming, and a major insurance technology transformation program.



3) Digitize insurance processes, services, and business models to increase customer proximity and create new revenue streams. From adaptation to claims management, the next level of interaction between customers and employees, intelligent automation, To create intelligent solutions in insurance services will need tools of artificial intelligence and the Internet of Things (AI, IoT).

To thrive, insurers need to create appropriate partnership services to enrich their offerings, monetize their data, and turn it into profit. Insurers need to start creating a new support information system today. The transition from claims-oriented to customer-oriented insurance requires strategic changes. From product design to financing using specific initiatives are necessary amplifiers.

Innovative insurance services can combine the latest IT management frameworks, automation tools, and hybrid cloud technologies, which reduce processing costs by 70% compared to traditional insurance systems. Advanced digital workstations allow you to combine and develop opportunities for collaboration and knowledge management, transform and increase productivity by up to 30%. Next-generation business process outsourcing can include an innovative combination of digital frameworks and services for process outsourcing, reducing costs by 30% or more.

Upgrading the core insurance platform can rely on robotic data, migration policy rules, and tools to replicate the platform, rewrite, and release precious resources blocked today in traditional outdated systems. This will allow for better alignment with business and future development drivers. Next-generation insurance platforms can leverage credit, the latest data-driven technologies, multi-channel and cloud technologies to streamline insurance processes, reduce risks and improve the customer experience. They will allow you to build basic insurance services on an innovative, competitive basis.

Security guidelines can use artificial intelligence, real-time monitoring, including automation to detect and prevent threats. Applications range from cybersecurity to fraud to compliance.

In the insurance process digitization model, multi-channel customer experience platforms (CX) allow you to personalize customer experience (CX) at all points of contact. Insurers should take advantage of these platforms, which typically improve market speed and customer satisfaction by more than 30%.

Robotic Process Automation (RPA), in particular, consultants and virtual assistants, can manage repetitive tasks and help reduce the cost of administrative and regulatory processes by at least 50%, improving quality and speed. Deploying the Internet says and offers endless opportunities for insurers, from underwriting models to providing products based on the use of dynamic pricing. Insurers can even change the rules of the game, moving from risk protection to risk prevention. Open insurance platforms and open application programming interfaces (APIs) can enable customer-centric insurance products and services that facilitate partner connectivity, and the creation of open insurance products is distributed and serviced by third parties. This helps to attract new partners and services into a single platform to serve the needs of ecosystems that go beyond insurance services. Thus, strategic transformation initiatives and digitalization trends will shape the future of insurance in Ukraine and the world.

### **5.6. Mega-trends in the field of financial services: preparation for fundamental changes**

Mega-trends affecting the financial services industry include:

1. The growing importance of the individual investor. Individual investors are accumulating wealth faster than in previous years, thanks to an aging population and the recovery of stocks and non-financial assets after the

2008 crisis. In developed markets, retirement savings have largely shifted from defined benefit plans to defined contribution plans, making people increasingly responsible for making investment decisions on their own.

2. Technology as a means of stimulation. Virtually all companies have become technology companies. With the acceleration of technology and cloud computing, financial services companies are limited only by their ability to imagine what is possible. Financial services and all other industries must use technology to provide greater and better value to customers.

3. Geopolitical changes and their economic impact. A number of interrelated trends are changing the geopolitical landscape of financial services companies. In terms of trade, there has been a retreat into globalization, greater freedom of action within borders, and increased restrictions within national borders. Restructuring traditional trade and financial relationships between emerging markets replaces long-standing trade ties. The effects of coronavirus force organizations to reconsider their future workplace.

Financial services companies have responded to these trends in two ways. First, they form strategic goals, evaluate their purpose in society, and relate that goal to what they do and how they do it. Second, they are increasingly looking for new ways to create value for all stakeholders - not just shareholders, but also customers, employees and the communities in which they work. Financial services companies, in particular, evaluate how they invest and how they work with a social goal in mind. And asset owners are increasingly thinking about the impact on society of each dollar they invest, taking into account environmental, social and environmental factors in their investment process. Table 3 shows the export and import of insurance and financial services in the studied countries and regions on average for 2000-2020.

**Table 3.** Exports and imports of insurance and financial services in the studied countries and regions on average for 2000-2020

Indicator	Ukraine	Latvia	USA	Eurozone	European Union	World
Insurance and financial services (% of exports of commercial services)	1,50	4,05	9,10	6,52	6,06	7,08
Insurance and financial services (% of imports of commercial services)	7,24	5,58	10,30	5,93	5,81	7,25
Insurance and financial services (% of exports of services)	1,47	4,05	8,61	7,83	7,20	8,96
Insurance and financial services (% of imports of services)	6,83	5,51	9,35	7,01	6,67	6,86

*Source:* compiled by authors based on World Bank data

The purpose of the business varies from company to company, so the ways in which asset owners, independent funds, investment management firms and corporations display environmental, social and corporate governance (ESG) in their investment habits will also differ. One organization may be more concerned about climate change and another may be more interested in social justice. This diversity of thinking is very powerful, because all companies work together to change the situation for the better. In the past, the lack of standardization of ESG investment practices has been an obstacle for investors in choosing how to allocate their investments according to ESG principles.

Creating new sources of value. Value is a simple concept that is difficult to achieve: it shows how companies provide their customers with better solutions at a lower cost, with less risk and tighter controls to achieve better results for customers. This pursuit of value encourages investment firms to become even more efficient in providing products and services to their clients. Achieving value in this way requires companies to use technological data and digital approaches.

To enhance digital transformation and digital implementation, a modular approach with an open architecture is needed, in which companies from all over the industry work together to provide customers with a choice of suppliers. As companies think about the next few years, the ability to align their goals with what they do and how they do it will remain important. The ESG review will continue to climb up the value curve for investors. This value will depend on what stakeholders expect from their suppliers or whether citizens want more from their public funds; retirees have higher expectations for pension funds; or clients who expect more from their investment managers. Similarly, companies will continue to seek value and evaluate it in terms that can be quantified and understood. Companies that can effectively implement digitalization trends in their operations can be those that not only survive but also thrive in fast-changing times.

### **Conclusions**

The scientific novelty of the study is to assess the general model of determining the impact of the external environment on the efficiency of economic entities, which has five dimensions: political environment, technological environment, economic environment, competitive environment, financial environment. The scientific value of the results is to determine the impact of digital innovation on key economic fluctuations and security; substantiation of trends that will improve financial services in 2022-2025; analysis of trends in the digitalization of the insurance market.

Examining the trends of globalization and security of the financial sector, it can be drawn the following conclusions:

1. Digital technologies in the financial sector help reduce the cost of collecting, storing, processing, and sharing information - including search, replication, tracking, and verification costs. In finance, this can help borrowers find a suitable loan offer faster, or help investors find an investment product that suits their specific needs.

2. Blockchain technologies provide a set of basic opportunities that facilitate the work of individuals and enterprises, interaction on an "equal-equal" basis, even if they do not know each other in advance (distrustful context). Financial sector players use technology to solve the problem of economic fluctuations. They can close information gaps and reduce the cost of reducing information asymmetry.

3. Data and automation facilitate the execution and monitoring of complex contracts and the creation of fuller markets. Traditional core banking systems and sales channels have been built on standardized products and have not contributed to a consumer-oriented approach. More individual services, such as loans, investment advice or retirement planning, which can take into account the individual circumstances of the borrower for different results and conditions, required highly qualified and expensive experts.

4. Automation of processes with the support of financial technologies reduces the cost of customization for individual products and can track various unforeseen situations in a wide range of results. Digital marketing systems allow you to find a sufficient customer base for specialized products. Increased data availability and computing power can improve price risk, tailor a product or service to a customer's needs, and potentially design a range of products that are executed and monitored through smart contracts or other new financial technologies.

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**Svitlana KHALATUR**

ORCID ID: 0000-0001-8331-3341

**Halyna PAVLOVA**

ORCID ID: 0000-0002-1400-7348

**Lesja VASILIEVA**

ORCID ID: 0000-0001-6728-8895

**Daria KARAMUSHKA**

ORCID ID: 0000-0001-6637-8231

**Alina DANILEVIČA**

ORCID ID: 0000-0002-2749-2725

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## BIBLIOMETRIC ANALYSIS OF THE TRANSFORMATIVE SYNERGIES BETWEEN BLOCKCHAIN AND ACCOUNTING IN THE UPROOTING OF ECONOMIC CRIMINALITY

Veronica Grosu<sup>1</sup>, Daniel Botez<sup>2</sup>, Anatol Melega<sup>3\*</sup>, Rozalia Kicsi<sup>4</sup>, Svetlana Mihaila<sup>5</sup>,  
Anamaria – Geanina Macovei<sup>6</sup>

<sup>1,3,6</sup> “Stefan cel Mare” University, Faculty of Economics, Administration and Business, Department of Accounting, Audit and Finance, Suceava, Romania

<sup>2</sup> “Vasile Alecsandri” University, Faculty of Economics Science, Department of Accounting, Auditing and Economic-Financial Analysis, Romania

<sup>4</sup> “Stefan cel Mare” University, Faculty of Economics, Administration and Business, Department of Management, Business Administration and Tourism, Romania

<sup>5</sup> Academy of Economic Studies of Moldova, Department of Accounting and Economic Analysis, Chişinău, Moldova

E-mails: <sup>1</sup> [veronica.grosu@usm.ro](mailto:veronica.grosu@usm.ro); <sup>2</sup> [daniel63331@yahoo.com](mailto:daniel63331@yahoo.com); <sup>3\*</sup> [melega.anatol@gmail.com](mailto:melega.anatol@gmail.com) (Corresponding author);  
<sup>4</sup> [rozaliak@usm.ro](mailto:rozaliak@usm.ro); <sup>5</sup> [svetlana.mihaila@ase.md](mailto:svetlana.mihaila@ase.md); <sup>6</sup> [anamaria.macovei@usm.ro](mailto:anamaria.macovei@usm.ro)

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**Abstract.** The impact of globalization and the growing digitalization of the economy is becoming increasingly felt in the area of economic criminality, and we therefore believe that it is a matter of urgency to seek viable and effective solutions to manage this area of concerns, thus preventing the contamination of the borderline that currently separates legal and illegal technologies, depending on how they are regulated or not. In this light, the aim of our paper is to explore those instances in which blockchain accounting has the potential to be a viable solution to guarantee the security and legality of economic and financial transactions, thereby significantly mitigating the impact and frequency of economic criminality. The main objectives we pursue are to define the nature of the interrelation among the concept of blockchain, accounting and economic criminality and to evaluate the potential advantages of implementing blockchain technology in the accounting system. The main findings are a comprehensive mapping of the network that links blockchain technology, accounting and economic criminality employing the clustering method. These are likely to be of valuable assistance not only for the legislator, but also for the shaping of future research paths in this field and, last but not least, for an essential group of stakeholders such as computer scientists, accountants, auditors and national governments.

**Keywords:** Blockchain; accounting system; economic crime; digitization; bibliometric analysis

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## **1. Introduction**

Our global economic system is defined by a significant level of cross-border transactions of varying degrees of complexity, which are driven by the substantial values involved, the level of security provided and the efficiency of the system for exchanging economic and financial information among the multiple actors involved. In this respect, the legality and morality of the operations entailed in these transactions are questionable, as they very often conceal cases of economic delinquency with massive prejudice. In view of these reasons, we considered it appropriate in this paper to investigate to what extent the blockchain accounting system may be the most suitable response to this global challenge that significantly affects national economies. The implementation of blockchain into the operational system of economic entities has proven that it can play an essential role in protecting data from possible manipulation, while also ensuring that the software meets the legal requirements for keeping accounting data, which has obviously led to a higher level of data protection and security than other previous technologies.

It is already evident that blockchain will emerge as a central feature of the digital economy and will be employed in all contexts where it is crucial to guarantee the integrity of digital values and information. Like other technologies, blockchain is frequently used without full knowledge of the implications and consequences; for example, there are companies that have made advances in the use of these technologies and others that still do not recognize the intensity of the changes that have taken place in today's global economy. In terms of eradicating the phenomenon of economic criminality by applying blockchain accounting, this will certainly be achievable, as the vanishing of cash transactions (cash flow) will be regarded as the main way of tackling fraud and tax evasion. Of course, one should not overlook the potential negative effects that the application of blockchain may have on stakeholders. In this contextual framework, the aim of our paper is to explore those scenarios in which blockchain accounting might be a feasible tool to ensure the security and legality of economic and financial transactions, thus significantly mitigating the impact and frequency of economic criminality, while at the same time enhancing the transparency and the immutability of accounting information. The main objectives are focused on (O1) establishing the relationship among the concept of blockchain, accounting and economic criminality in SCOPUS and Web of science and (O2) ascertaining the advantages of applying blockchain technology in the accounting system.

## **2. Literature Review**

Blockchain technology can best be described as a distributed peer-to-peer digital ledger used to record all transactions since its creation in a sequential and continuous manner. As a peer to peer distributed ledger, there is no central authority or entity controlling the processing of transactions (Ma, Deng, He, Zhang & Xie, 2021; Atanasovski, Trpeska & Lazarevska, 2020). The use of this technology in accounting is an extensively discussed topic, because at its core, blockchain is a digital ledger of accounting records (Hong & Rong, 2018; Deloitte, 2016), and its application will lead to major changes in accounting and even auditing (Pedreño, Gelashvili & Nebraska, 2021). There have been many technological innovations affecting accounting over the past decades, but the traditional method of double-entry bookkeeping has not changed (we still need a third party to provide credibility to transactions), though the implementation of blockchain technology could lead to a fundamental change. The third party can be substituted by a mechanism relying on the mutual consent of all parties in the ledger, i.e. all users of blockchain technology. In order for a transaction to be authorised via blockchain technology, it will have to go through a verification and validation process from all nodes involved: producer, supplier, customer, investor, CEO, financial institution, public authority and others (Bonsón & Bednárová, 2019), which enhances its security, transparency and legality, which provides stakeholders with a trustworthy accounting record that shows the actual origin and destination of the resources exchanged.

In this way, blockchain technology ensures transparency of transactions while simultaneously eliminates the possibility of manipulation of inputs (Schmitz & Leoni, 2019; O'Leary, 2017; Dai & Vasarhelyi, 2017), thereby contributing to the fundamental change and improvement of what is known as triple-entry accounting (O'Leary, 2017; Brandon, 2016). Therefore, we then conclude that the use of blockchain technology will have a powerful impact on the accounting field, changing the way information is gathered, reported and audited (Fullana & Ruiz, 2021). Moreover, the implementation of blockchain technology in the accountancy profession would make it impossible to manipulate, falsify or destroy any accounting transactions, as each transaction is cryptographically sealed (Bonsón & Bednárová, 2019), becoming permanent, incorruptible and irreversible (Cai & Zhu, 2016). This is the context in which the first research objective is grounded, namely, the nexus among blockchain technology, accounting and economic criminality.

One of the major benefits of blockchain technology is the substitution of the traditional invoicing, processing, recording, inventory and payment method by the employment of a digital ledger that will be synchronized by the parties who use it (Kwilinski, 2019). Jayasuriya Daluwathumullagamage & Sims (2021) consider smart contracts, which we may describe as a feature of blockchain technology, the key to the development of this technology, as they are capable of automatically executing the contractual terms and clauses encoded in the procedure, i.e. carrying out automated transactions without the intervention of an intermediary. Of course, such significant benefits that this technology entails for the accounting system and accounting operations have not gone unnoticed by researchers in the field. They have also attracted the interest of the world's four largest accounting services companies (The Big Four), which have actively engaged in projects to implement blockchain technology in order to transform the traditional way of delivering accounting services as well as the way businesses operate (Bajpai, 2017), and foresee this as the next level that the accounting and auditing industry will need to reach and navigate (Madden, 2020). These were the premises that led to the second objective of this paper, namely, to establish the expected gains from the integration of blockchain technology into the accounting system.

For this particular reason, it is understandable why the adoption of blockchain technology will be transformative for the accounting field and, after a review of the literature, the following implications and insights are highlighted in Tab. 1.

**Tab. 1:** Meta-analysis of the literature on the Blockchain-Accounting-Economic Criminality triad

Author, Year	Purpose/ objectives	Results	Effect	Comments
Pedreño, Gelashvili & Nebrada, 2021	The application of blockchain technology is one of the most debated topics in literature, as it is expected that its application could change the mission of accountants and auditors. Therefore, the main objective of this paper was to review the existing literature on the role and importance of blockchain technology.	The literature review reveals that the benefits of technology will transform accounting and therefore the accounting profession and even the auditing profession.	Entities will no longer need to have an internal accountant, external auditor or expert to issue supporting documents. In addition, the identity of the accounting records made by the <i>stakeholders</i> is guaranteed, so there will be no need to issue a proof for final verification of the exchange of assets. The accounting information will not be able to be altered, which will act as a conflict minimization mechanism and increase the level of stakeholder confidence.	We see that the use of blockchain technology will improve the fight against fraud and corruption, with data being impossible to alter and stakeholders having access to it in real time.

Idehen & Mayor, 2021	To examine the use of blockchain technology for fraud prevention in small and medium-sized enterprises.	Blockchain technology, with all its features such as decentralization, immutable records, auditability, accuracy, verifiability and real-time information exchange, has the potential to transform Nigeria's business environment.	Blockchain technology, for all its attributes, has the potential to be transformational for business. Peer-to-peer connectivity can help detect network fraud. The capacity to exchange information in real time and the involvement of all network participants will curb fraud and some economic malpractices. Owners will be able to validate the authenticity and legitimacy of financial statements, as they will have access to all transactions of the entity.	Transparency and trust will be enhanced with the application of blockchain technology in accounting, which will lead to a decline in fraud and economic criminality. Since everything is transparent, including all entity transactions, owners will no longer have to depend on the verdict of auditors.
Basu, 2021	To study how blockchain technology, together with cloud technology, can help to achieve a platform where errors or fraud attempts are minimized.	Technology inclusion will be embedded everywhere in business by 2030.	The accountant's new role will be oriented towards the accounting management side. Auditors will have to adapt and use new digital tools and their role will change, focusing more on performing a real-time audit to prevent risks of digital crime, deletion, compromise, etc. of information held by the entity as efficiently and quickly as possible.	We agree with the conclusions of this study. We believe that in the future accountants will have the role of centralizing and analyzing data on the blockchain, and auditors will have the role of monitoring operating activity in real time, so with blockchain technology, crime and fraud will be much reduced and deterred.
Alkan, 2021	To Assess the benefits of blockchain technology by examining the effect of decentralization on the accounting information system.	The potential benefits of blockchain-based accounting have been identified and grouped into 4 focus points: transparency, trust, smart contracts, and continuous audit.	Blockchain technology will disrupt AIS, generating datasets that are verifiable in real time. Moving AIS from a periodic system to a continuous, i.e. real-time system will also implicitly result in a change of the way the audit mission is performed from a periodic inspection to one that can be performed in real time, leading to a decline in economic delinquency.	Economic crime will also be reduced through the use of <i>smart</i> contracts, an attribute of blockchain technology. These contracts allow assets to be transferred automatically when certain conditions stipulated by the parties are met. So smart contracts, together with real-time auditing will reduce fraud and economic crime attempts.
Nhat & Van Dung, 2020	To develop an insight into blockchain technology and examine the relationships between accounting, accounting information systems and blockchain technology.	Transactional instruments that use blockchain technology will enable the development of a platform. This platform will substitute the traditional bookkeeping methods.	Blockchain technology will provide new tools and platforms that will change the accounting field and the accounting information flow. There will be a more transparent, accurate and secure treatment because of the records made on the blockchain and their tracking will be much easier, with the role of accountants in the	Accountants will use the new platforms and tools to interpret data and to support the executive staff in making decisions in the life of the entity. At the same time, recording transactions on a common digital ledger reduces the risk of fraud and economic

			industry changing radically.	crime to a minimum.
Supriadi et al., 2020	To research the current use of blockchain technology and its applications, with a focus on economic and financial information.	Blockchain technology will change the old ways of recording, sorting, confirming and transmitting data. More and more applications based on this technology are emerging, but its use on a global scale has not yet been achieved.	Blockchain technology will be employed in the foreseeable future by entities focused on data quality, accuracy and the capability to upgrade accounting information systems.	As the technology is used, the accuracy and quality of economic data will be improved, which will increase stakeholder confidence. Over time, this technology will be embraced by more and more entities, leading to the use of a universal register, while economic crime will be significantly curbed.
Tan & Low, 2020	To discuss the prospects for the blockchain technology and the subsequent evolution of accountancy.	Certain features of Blockchain technology have not been thoroughly explored in the literature, and these may have a strong influence on the implementation of the technology, with related implications for the accounting profession.	Blockchain technology will change AIS ( <i>accounting information systems</i> ) at the basic level, i.e. it will change the way data is compiled. This and other changes will reduce honest errors and the immutability of the blockchain will deter fraud. Accountants will no longer be the central authority, but will remain responsible for financial reporting, with a strong influence on entity policies. Audit work will continue to be essential, with professionals expressing their opinion on the truth of financial statements.	While digitization and Blockchain technology in AIS will reduce the error rate, and the immutability of the Blockchain will reduce the opportunity for fraud, it will not guarantee that the financial statements will be accurate and true, because the preparation of financial statements is largely based on the entity's policies and the judgment of the accountants.
Kwilinski, 2020	To test the hypothesis that blockchain technology in accounting will ensure quality, transparency, efficiency and security of accounting and auditing processes.	The findings anticipate a complete automation of accounting in the future, with traditional double-entry bookkeeping disappearing.	Blockchain technology will allow both parties to simultaneously record the transaction in real time in a private ledger.	Synchronizing accounting records between entities will reduce economic crime and automate auditing. Auditors will only deal with complex non-standardized operations where their own professional judgment will be needed.

Kahyaoglu, 2019	To review the current audit procedures in practice for financial transactions using blockchain technology and recommend best practices.	Blockchain technology will add value to economic entities by enhancing the security, quality and accuracy of accounting data.	As a result of adopting blockchain technology, every asset, contract, process, mission, expense or any other transaction will have a digital record and signature, that can be authenticated, validated, stored and shared.  The authors believe that there will be no need for intermediaries such as accountants, auditors, lawyers, brokers, bankers, etc. One drawback to the technology is the trade-off between transparency and privacy	We expect that intermediaries will not be eliminated, but rather they will adapt to the new challenges that will emerge with the adoption of this technology. There will be concerns both during the introduction of the technology and afterwards, and professional judgement will be essential even in an automated world.
ICAEW, 2018	To assess the level of importance of blockchain technology in the future of accounting.	Ascertain blockchain's potential by cutting costs, attesting the validity of the entity's asset information.	The ownership transfer will be reshaped by blockchain technology and smart contracts. In addition, the operations of the accounting department will be streamlined or automated with the help of this technology.	This will increase the efficiency of accounting and significantly reduce the risk of unintentional errors, which will rise the need for other skills of the accounting professionals.

As shown in Tab. 1, most authors in the literature agree that blockchain technology will significantly change accounting and, of course, business in general. Considering the implications/effects of this technology as mentioned in Tab. 1, it is extremely important for professionals to understand the benefits and potential drawbacks. We agree that blockchain technology will decrease the risk of fraud and economic crime, but in order for this to happen, current and future professionals need to become familiar the technology and understand it, and through the use of new and emerging tools, these benefits envisioned in the literature may be fully achieved. This paper focused on the interrelationships of the Blockchain-Accounting-Economic Crime triad, in an attempt to capture an accurate picture of the impacts blockchain technology will have on accounting and its role in mitigating and controlling economic criminality.

### 3. Research Methodology

In order to achieve the research objectives, in our paper we have chosen bibliometric screening, performed with VOSviewer software on 5,584 papers in the research fields relevant to the selected topic, papers that were listed on the Web of Science and Scopus platforms between 2015 and 2021. Both of these platforms are known internationally for the quality of the papers they indexed.

The main phases of the research protocol are as below:

*a) Data collection*

At this stage, articles considered to be of interest for the purpose of building the archive were selected from both Web of Science and Scopus, as shown in Tab. 2.

**Tab. 2:** Collection of items

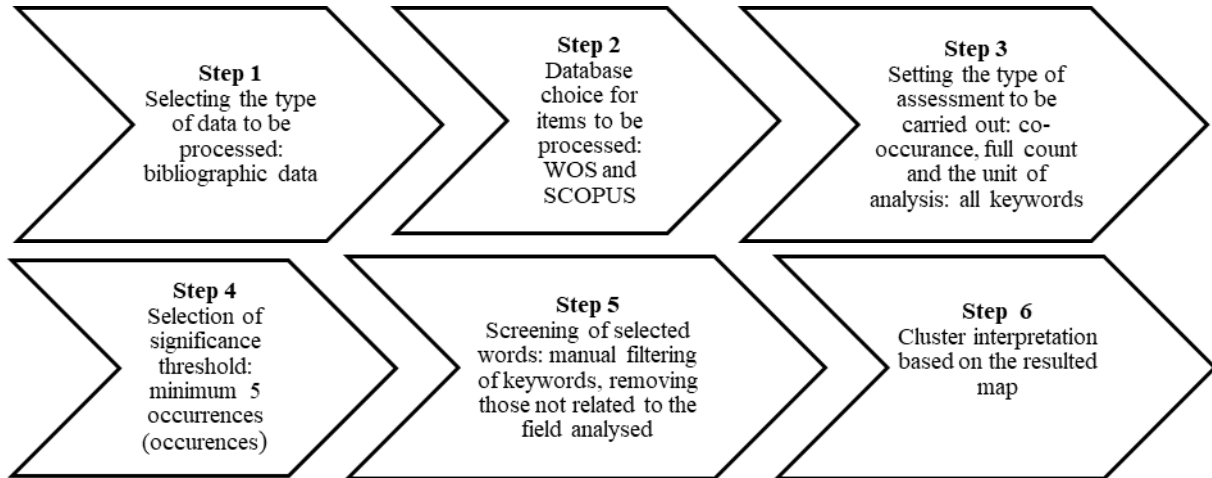
Platform	Web of Science		Scopus	
Topic	Blockchain	Economic Crime	Blockchain	Economic Crime
Period	2015-2021		2015-2021	
Results	1167 papers	595 papers	2942 papers	880 papers
Total articles	5.584			

*Source:* own research

The criteria for the selection of papers were based on a filtering approach. Thus, for papers on the Web of Knowledge platform, the search was carried out according to the topic blockchain and economic crime, and the most relevant areas were selected for the period 2015-2021. The search engine identified 1167 articles for the topic blockchain and 595 for economic crime. Similarly, on the Scopus platform, a search of relevant papers of interest to our research and published in the period 2015-2021 was performed according to the topic blockchain and economic crime, resulting in 2942 papers on the topic of blockchain and 880 papers on economic crime. Thus, our database consists of 5584 papers on the topic of blockchain and economic crime that were published between 2015-2021.

*b) Bibliometric analysis*

In order to detect and evidence the associations among blockchain technology, economic crime and different economic concepts found in the gathered scientific literature, as detailed in the previous section, a bibliometric approach, which is a quantitative method of retrospective analysis and description of published works (Ding, 2019) during the previously established period, i.e. 2015-2021, was carried out. The processing of the bibliometric indices resulting from the selection of articles (according to the research fields and the time period in which they were published) was carried out using the VOSviewer software and involved the accomplishment of the subsequent steps, which can be visualized in Fig. 1:



**Fig. 1:** Processing of collected papers in VOSviewer

*Source:* Own elaboration

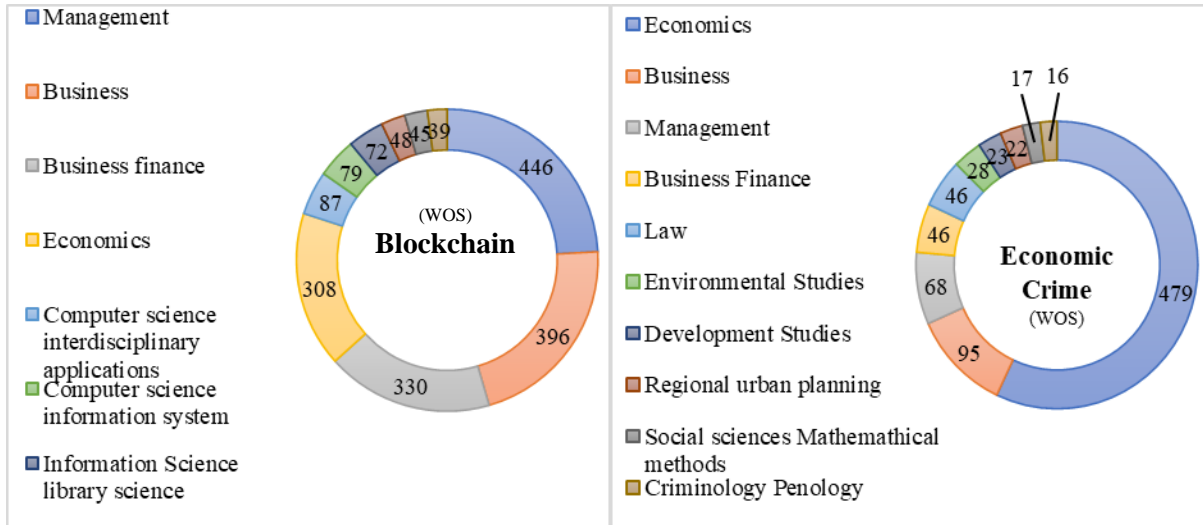
Consequently, the aforementioned database has been subjected to the six steps illustrated in Fig. 1, with the final aim of exploring the relationship of economic crime and accounting - blockchain technology. The data processed resulted in a number of different clusters, depending on the key concept under analysis and the research platform where the papers in which these terms appear have been indexed; each cluster has a number of distinct elements in terms of nature and frequency, the structure of which will be reported in the results and discussion section.

## 4. Results and Discussions

### *4.1 Overall trends in research streams on blockchain and economic crime*

In case of papers from the Web of Science database, during the paper gathering stage we identified 1167 papers on Blockchain and 595 on Economic Crime, whose profiles are depicted in Fig. 2.



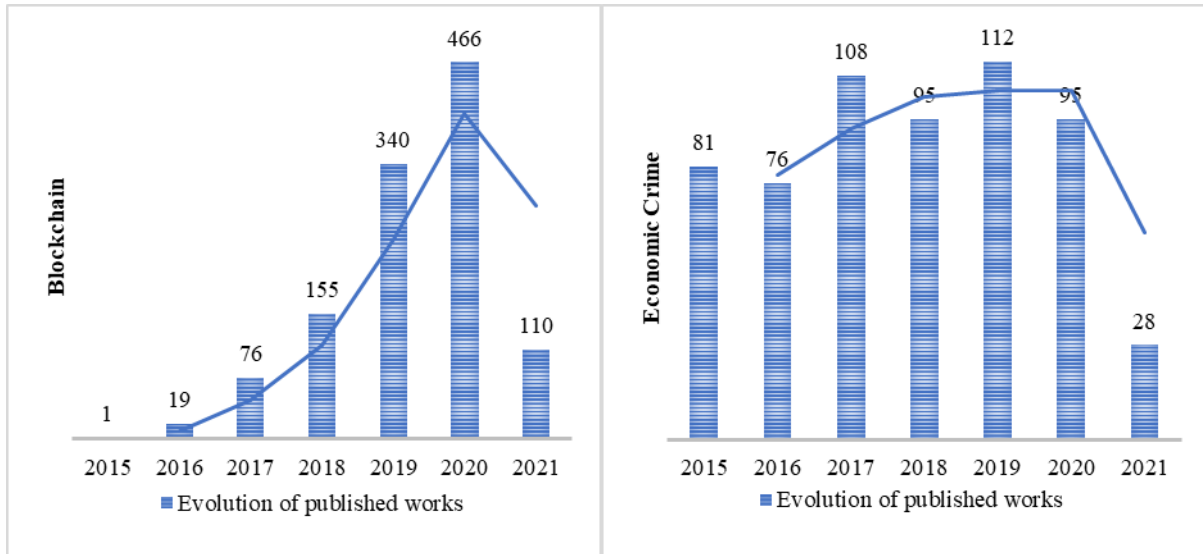


**Fig. 2:** Study areas interlinked with the topic of blockchain and economic criminality on the Web of Knowledge

Source: Own processing based on Web of Science data

The areas with which blockchain technology has the most impact/relationship are management, business, finance and economics, followed by IT and others, which highlights the considerable weight of this technology for the development and optimization of economic and financial processes in the context of a progressively growing digitalization of this field. With regard to the topic of *economic crime*, we can see that most articles related to economic crime correspond to the fields of Economics, Business and Management, which suggests that most situations of illegality are found in this area of business, with all that it implies: management, transactions, bookkeeping and others, as can be seen if we look back at the many cases of financial scandals that have been generated by non-compliance with the fundamental principles of bookkeeping and accounting, which highlights the need to implement a digital accounting system that no longer allows illicit entries or changes, that has a high level of security and verifiability and that ensures the mirroring of the real financial situation of an entity.

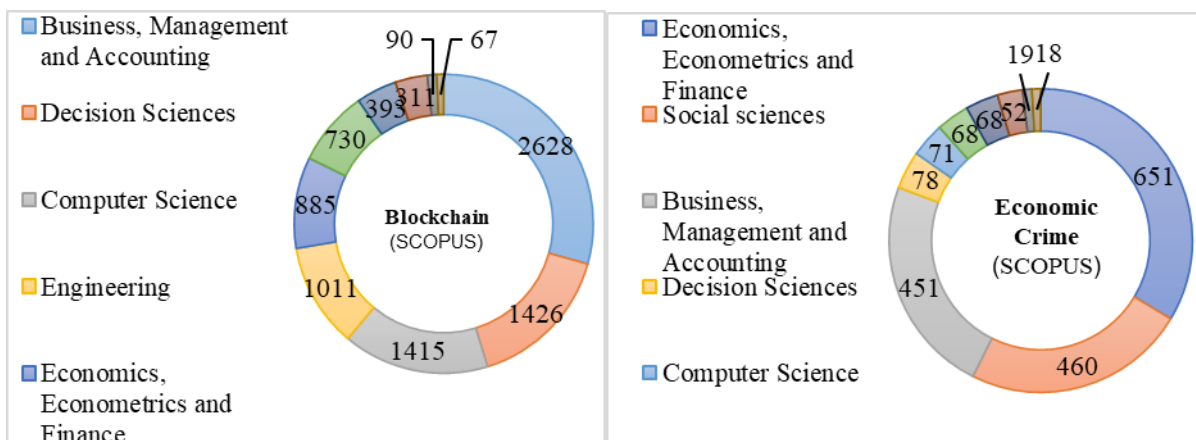
Over the last several years, there has been a growing interest in researching blockchain technology in conjunction with the economic and financial areas, which suggests a growing openness to the applicability of this technology in these areas of interest as well, while also highlighting the importance of our research in this paper. The evolution of the number of publications is depicted in Fig. 3.



**Fig. 3:** Trends in the number of papers related to blockchain and economic criminality on the Web of Knowledge

Source: Own processing based on Web of Knowledge data

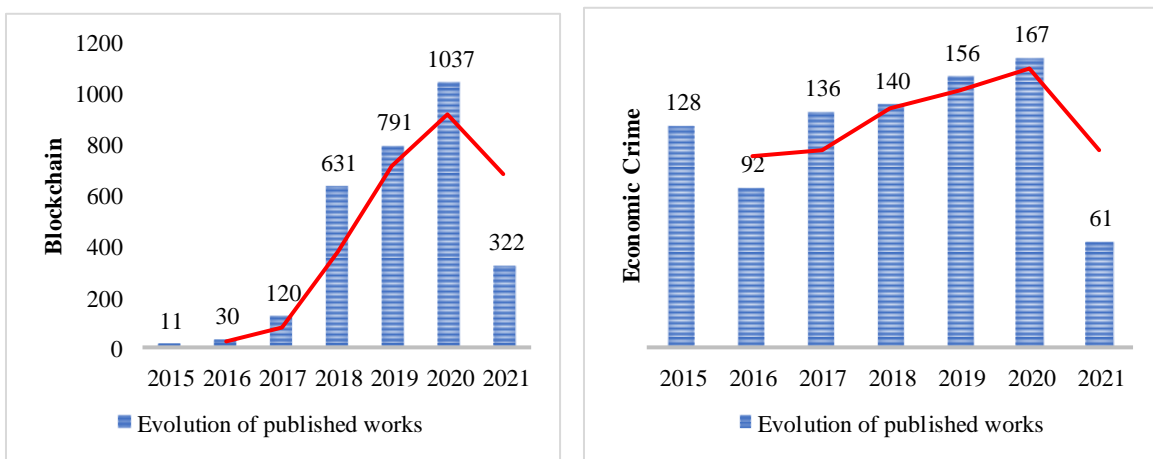
Unlike the papers related to blockchain technology, which experienced a permanent upward trend during the period 2015-2021, on the Web of Knowledge platform, publications related to economic crime show some fluctuations during the analysis period, with researchers' interest being less focused on the evolution of this phenomenon and more on ways to combat it. However, in the Scopus database, there is a different hierarchy of the impact of blockchain technology, with different areas of focus, as shown in Fig. 4, with the top place held by business, management and accounting, followed by decision science, computer science and others, which again highlights the significance of blockchain technology for the economic field. It is important to point out that many papers, although accepted for publication, encounter difficulties in publication and therefore indexing. Therefore, we are witnessing an atemporalisation of the dissemination of the latest scientific results.



**Fig. 4:** Study areas interlinked with the topic of blockchain and economic criminality in the Scopus database

Source: Own processing based on Scopus data

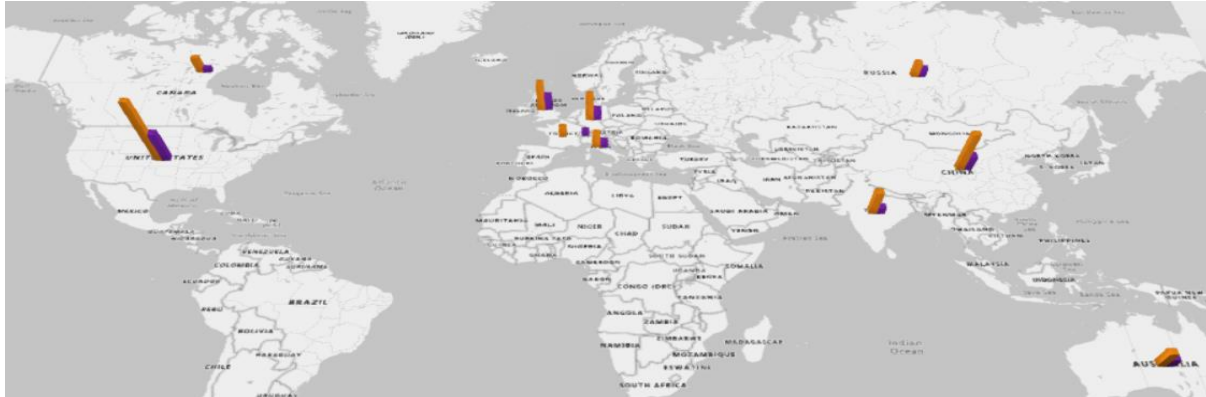
Concerning the papers on the topic of economic crime within the Scopus database, we observe that, as in the case of the papers within the Web of Knowledge database, the most of the papers are related to Economics, Econometrics and Finance. As regards the trend in the number of papers in Scopus, as in the case of the Web of Science, papers dealing with blockchain technology have begun to emerge since 2015, with the number of papers growing steadily since then, but more than double the number in Web of Science, which is a prerequisite for the development of a novel research and knowledge/information framework that suggests new directions of insight into the effectiveness and applicability of this technology. This increase in papers from the Scopus platform is graphically displayed in Fig. 5.



**Fig. 5:** Trends in the number of papers related to blockchain and economic criminality in SCOPUS

Source: Own processing based on data collected from Scopus

In the situation of the papers on economic crime in Scopus, we see a fluctuation of publications related to economic crime over the period 2015-2021, as in the case of those appearing on the Web of Science platform, with the highest number, of 167, in 2020. When looking at the output of publications at country level, the top 10 countries with the highest number of publications on both Web of Science and Scopus are depicted in Fig. 6.

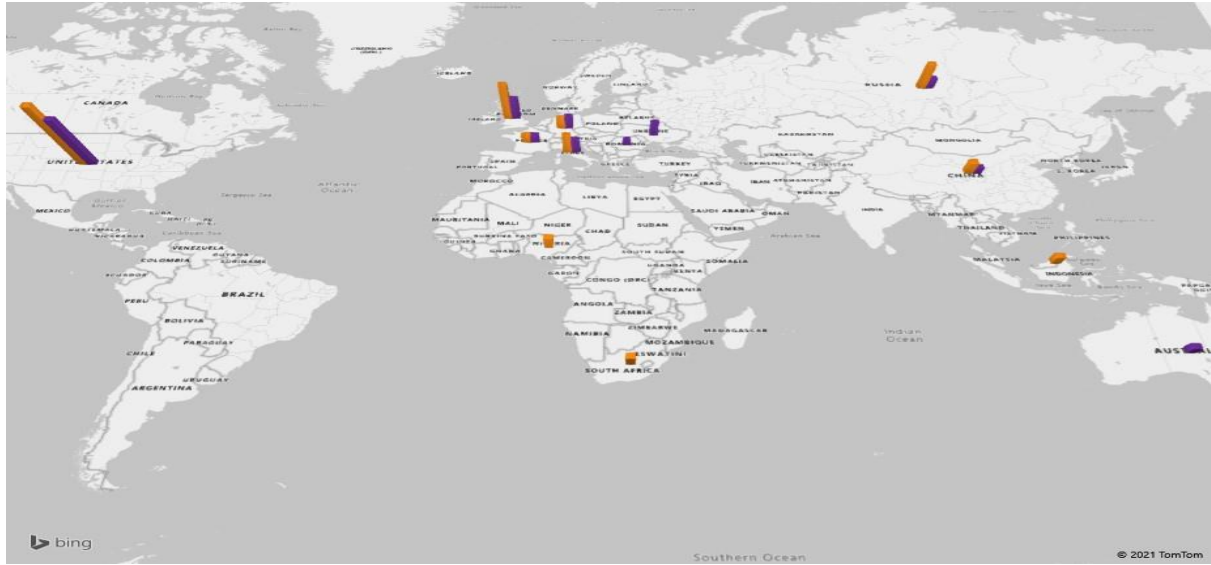


	USA	Australia	Canada	China	France	Germany	India	Italy	Russia	Switzerland	United Kingdom
SCOPUS	565	148	145	353	86	251	209	134	133		251
WOS	264	74	46	135		102	57	54	84	41	137

**Fig. 6:** Geographical distribution of blockchain technology papers retrieved from WoS and SCOPUS platforms

*Source:* Own data processing with PowerMap

First place on both platforms is taken by the USA, with 264 articles on WoS and 565 on Scopus. This is attributed to the increasingly widespread use of cryptocurrencies in various transactions, the level of digitization of accounting - and the economy in general - which is very high, and a strong academic research environment with researchers having easier access to information related to blockchain technology. We can see other countries in Europe, Asia and Australia, but none of them has more than half the publications of the US. China, the UK and Germany are next, with the ranking changing slightly depending on the platform under consideration. At a broader level, we can observe that almost the same countries - with small exceptions - are in the top 10 countries in respect of the number of subject-related papers on both platforms, which underlines the value and significant capacity of their human resources to conduct research, as well as their strong focus on innovation and development. Regarding the economic topic, the situation of papers published per country within both platforms is reported in Fig. 7.



	USA	United Kingdom	Italy	Ukraine	Germany	Russia	France	Australia	China	Romania	Nigeria	South Africa	Malaysia
SCOPUS	150	62	42	41	37	31	23	20	19	18			
WOS	191	109	58		32	77	25		36		33	32	26

**Fig. 7:** Geographical distribution of Economic Criminality papers retrieved from WoS and SCOPUS platforms

Source: Own data processing with PowerMap

It can be noticed that the US and the UK rank first and second, with the most economic criminality related papers on both platforms. As in the other cases, the leader in terms of papers related to economic criminality is again the US, with 191 papers on Scopus and 150 on Web of Science. We consider that with this overview we have fulfilled our part of the review of the overall research trends on blockchain technology and economic criminality, and we will proceed to the next section, in which we have completed the bibliometric analysis using papers retrieved from both platforms.

## 4.2 Bibliometric analysis

As mentioned in the first part of this paper, blockchain technology is at an early stage of research, development and implementation, arousing the interest and curiosity of specialists and researchers who have identified various interconnections and applications of blockchain technology, predicting that this technology will be a viable solution for the security and efficiency of digital networks in many areas of existing activity, given that most areas of social and economic life are in the process of digitization. We can therefore consider that this technology is also a perfect solution to most of the problems related to economic criminality, which are largely caused by a deliberately erroneous financial-accounting approach that does not reflect the economic reality existing at the time.

#### a) Web of Science

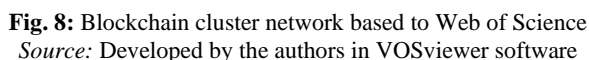
As pointed out in the research methodology section of this paper, in order to select the database for analysis, a query of papers in the Web of Knowledge platform was conducted using the terms blockchain and economic criminality.

When creating the cluster map related to blockchain technology, 236 keywords met the threshold of a minimum of 5 occurrences, of which only 170 were selected, and words considered irrelevant to our research, such as "design", "health", "behaviour", "energy", "gold", "china", "ecosystem" and others were eliminated. Fig. 6 displays the network formed by 9 clusters, each of them being assigned a specific color, allowing us to easily differentiate the keywords belonging to a particular cluster, as well as the meaning of their link with the basic keyword "blockchain", all of which are constructed from the values of the links attribute and the total link strength attribute, which reflect the frequency of connections of a particular keyword with other keywords, i.e. their strength. Thus, it can be seen that in the cluster network, the most prominent representation has the term "bitcoin", as it is the main virtual currency for trading within the blockchain technology, having a rather prominent history in the cryptocurrency market.

One can also observe a close connection between the terms "supply chain", "management" and blockchain, suggesting that the latter can be an effective management tool for supervising, controlling and securing activities, which would also simplify procedures within the supply chain process - especially when it is carried out with a new party - as a number of risks are eliminated, thus creating the concept of a "trustless" or "trust-free" transaction (Harz & Boman, 2019), i.e. the relationship between partners no longer needs to be based on trust, as blockchain technology ensures that the transaction is conducted in a fair, ethical and legal manner, in accordance with "smart contracts" or other predefined behaviours.

One can also see a quite significant link between the concept of blockchain and various notions in the field of digitization, automation or artificial intelligence, such as "digital currency", "digital economy", "machine learning", "internet of things", as well as "industry 4".0" that is considered by researchers as the "fourth industrial revolution" which, through connectivity/distance reduction and intelligence technologies, could bring radical changes to existing industrial, economic and social models (Lee & Lim, 2021). This underlines one more time that contemporary society is turning more and more towards digitization and automation, and these are widely considered as solutions for streamlining and optimizing operations, including in the field of finance and accounting, the one we are most focused on here (see Fig. 8).





It can also be seen that there is a connection between the concept of blockchain and those of "accounting", "auditing", "fraud" (these being positioned in the same cluster) and "money laundering". This demonstrates that studies have been made highlighting the role of blockchain technology in mitigating or eradicating economic criminality by enabling the development and implementation of a secure, real-time audited accounting system that no longer allows or encourages economic corruption. Of course, this could also be about strengthening the legislative systems in this area by closing loopholes and eliminating the high degree of interpretability, but this is another vast area of research on which we will not focus our attention now. This relationship between blockchain technology, accounting and economic crime can also be analysed in other scientific works on the Web of



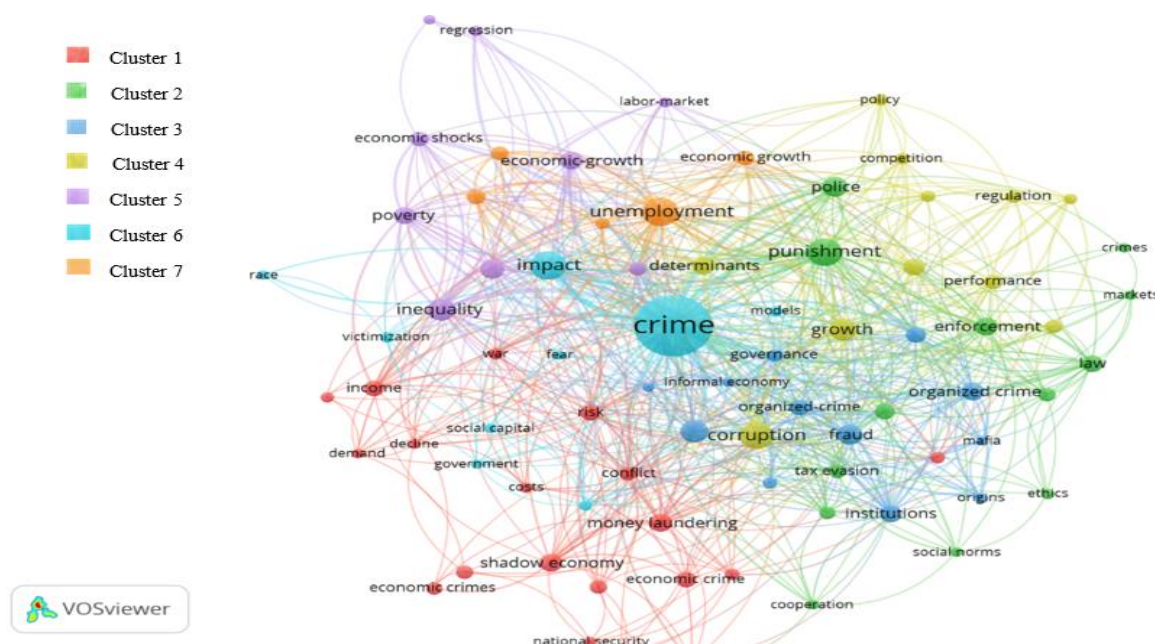
Knowledge platform, such as that of Bonsón & Bednárová (2019), Roszkowska (2021) and Cai (2021). This kind of studies highlight the critical role of triple-entry accounting - which can be employed in the context of cryptocurrency transactions practiced in blockchain technology - in reducing the risk of fraud in that, for example, in addition to the debit and credit (entries that are generated in the case of double-entry bookkeeping) a third cryptographically secure entry is generated that verifies the validity of the transaction, resulting in the creation of an immutable transaction history, thus providing auditors and other stakeholders with a source of reliable information that reflects the financial reality existing at a given point in time. Other works that examine the relationship between blockchain technology, accounting and economic crime, highlighting a beneficial relationship for each of the parties involved, include McCallig, Robb & Rohde (2019), Tan & Low (2019), Schmitz & Leoni (2019), Byström (2019) and Yu, Lin & Tang (2018).

In the works of Søgaaard (2021) and Karajovic, Kim & Laskowski (2019), blockchain technology has also been identified as a tool to reduce tax fraud, in particular value-added tax (VAT) fraud, which would be a real plus to the public budget and consequently a significant benefit to citizens to whom this plus is returned in the form of various services provided by the government. Esoimeme (2020) also find that blockchain technology is a key tool in the rapid detection of criminal/illegal activities by financial institutions, as it allows instant verification of the credentials of the parties involved in a given transaction, thus making it possible to identify any discrepancies in the information disclosed.

Regarding the cluster mapping the economic criminality, which can be viewed in Fig. 8, 115 words met the minimum threshold of 5 occurrences, of which 78 were actually selected for its generation, with the removal of some terms considered irrelevant to the research in question, such as "domestic violence", "women", "health", "civil conflict", "homicide", "cities", "incarceration" and the like, resulting a number of 7 clusters. Thus, we can observe a rather prominent connection between the concept of economic crime and the phenomenon of unemployment, which suggests that the former has a significant impact on the quality of people's lives and influences many aspects of their social life, potentially generating situations of inequality and poverty. Last but not least, there are also significant links between the concept of economic crime and that of organized crime, corruption, fraud, money laundering, shadow economy, tax evasion and social capital, all of which refer to the economic and financial field of interest here. That leads us to appreciate that when unethical and illegal interests exist they can be achieved through the use of various financial instruments to manipulate information or results, which has a direct impact on economic and social life as a whole. And this is precisely because the regulations and laws currently in force are not capable of addressing all the aspects and needs of a system based on a market economy that operates on the principle of free trade and therefore creates new contexts and challenges that need to be tackled.

Fig. 9 plots the average publication period of the papers that contain the keywords embedded in the cluster network, which supports the information displayed in Fig. 3, where it can be seen that most of the papers that formed the database were published in 2019 and 2020, thus evidencing the growing interest of researchers in this technology, which opens new horizons and possibilities for the analysis of this field.

93



**Fig. 10:** Economic crime cluster network according to Web of Science

Therefore, we can assert that in the substance of the Web of Knowledge papers the beneficiary impact of blockchain technology on accounting systems and on the level of economic delinquency has been evidenced quite consistently, which recommends it as a sustainable solution for the development, security and efficiency of the entire economic and financial system.

In a further effort to provide a broader picture of the level or magnitude of research on the link among blockchain technology, accounting and economic crime, we have also performed a bibliometric analysis of the scientific papers in this field found in the Scopus database, as we mentioned in the research methodology section of this paper. Out of the 2942 scientific papers from the Scopus database identified during the database generation for the purpose of this research, only the keywords related to the first 2000 papers were exported, i.e. 8928 words, of which only 531 reached the minimum threshold of 5 occurrences and 155 words were selected to actually shape the cluster map. Some words considered to be irrelevant to the research in question were removed, such as "crowdfunding", "ecosystems", "electricity transmission networks", "food supply", "healthcare", "machine learning" and others. Like in the cluster network on blockchain technology based on the data gathered from the Web of Knowledge we can see that also in this case, among the terms with the most prominent representation we can mention "bitcoin" (with a number of 162 occurrences, a link attribute value of 92 and a total link strength attribute value of 422) which is part of the "cryptocurrency" family, thus re-emphasizing the importance of this cryptocurrency for the workability of blockchain technology. Also representative links can be observed with terms from the field of digitisation or artificial intelligence, such as "digital economy", "internet of things", "cryptography", "digital finance", "distributed networks", "cryptoassets", "tokenization", all highlighting (as in the





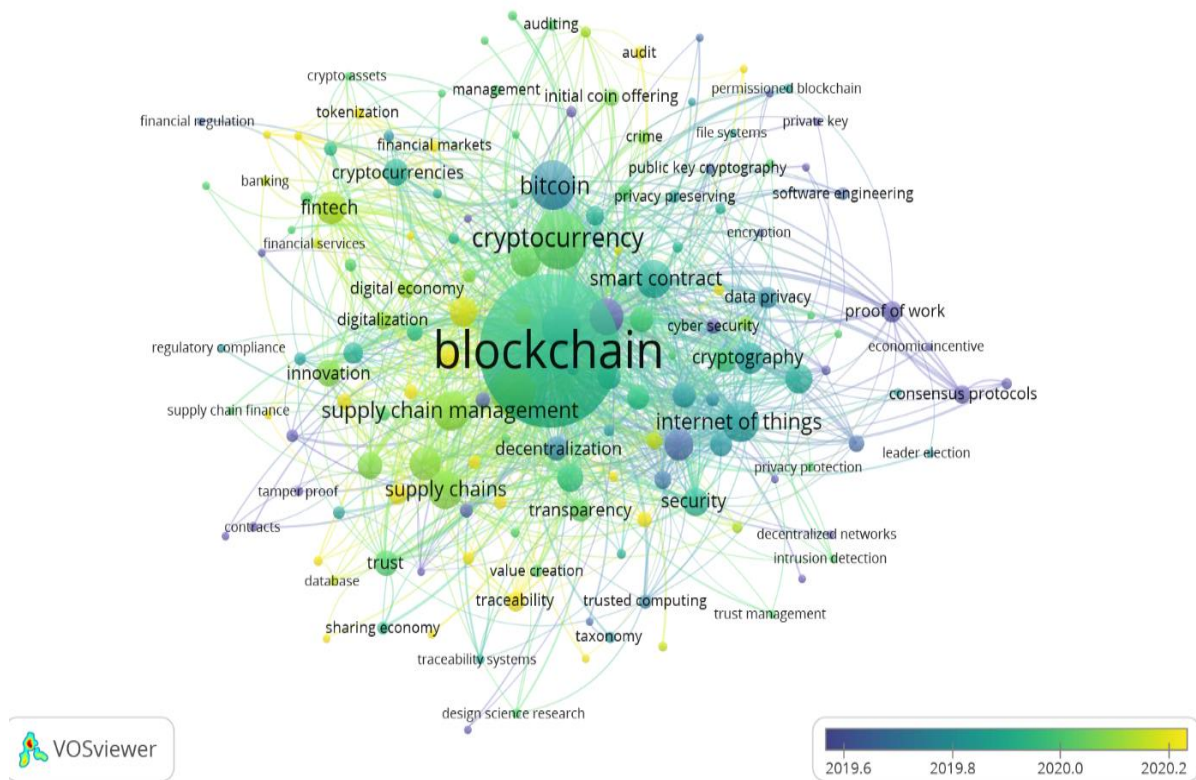
value of 10 for the link indicator and 22 for the total link strength indicator, and which can be viewed in Fig. 11, alongside "auditing" and "accounting", thereby fostering and challenging research activity in this field, as new ideas and niches for applying this technology to make the management and management of economic criminality phenomena more efficient will surely be found.

For example, of the papers on this topic published on the Scopus platform that highlight the significant and effective impact of blockchain technology on the accounting system in general and, implicitly, on reducing the possibility of fraud through the use of financial-accounting tools, we can cite: Bakarich, Castonguay & O'Brien (2020), Inghirami (2020), Bonyuet (2020), Rien & Susilowati (2019), ALSaqa, Hussein & Mahmood (2019) and Kwilinski (2019), Smith (2018), together with Søgaaard (2021), Roszkowska (2021), Cai (2021), McCallig, Robb, & Rohde, (2019), Karajovic, Kim & Laskowski (2019) and Schmitz & Leoni (2019), which were also found on the Web of Knowledge platform. As Tiron-Tudor, Deliu, Farcane, & Donțu, (2021) evidence through their research, it can also be assessed that in a world that is increasingly moving towards digitisation, it is essential that accounting and auditing service providers embrace blockchain technology as the basis for their business functionality - which implies the development through management of strategies, objectives and implementation tools - thus responding professionally to the demands of their clients. However, this can only be achieved by accounting and auditing professionals developing a set of skills and technical knowledge in managing advanced digital technologies, which according to Atayah & Alshater (2021) would be one of the new requisites in the job description of accountants and auditors, and this would almost completely change the traditional concept of accounting as it is currently known and practiced, an aspect also analysed by Fullana & Ruiz (2021) in their paper.

Sherif & Mohsin (2021) highlight in their recent study the significant impact of the trio of blockchain, Internet of Things (IoT) and artificial intelligence (AI) - all emerging technologies - on the quality of reasoning and decision-making of accounting and auditing professionals, mitigating the potential for intentional and forced fraud, with intentional fraud occurring under the influence of three circumstances: pressure, opportunity and reason, referred to by the authors as the "Fraud Triangle". According to them, each of the technologies indicated above entails certain benefits but also certain risks for the accounting system, yet when used together, most of the gaps generated by them can be closed, thus making it possible to achieve more efficient outcomes.

According to the research carried out on the scientific papers concerning the topic examined on the Scopus platform, we found that most of them focused on the features of blockchain technology and its applicability in the field of accounting and auditing, with little focus on its potential to reduce or eradicate the phenomena of economic criminality caused by the use of economic and financial instruments, an issue that was much more noticeable in the scientific papers on the Web of Knowledge platform.

Fig.12 plots an overview of the average years of publication of the papers mapped in the cluster, revealing that most of them were published in 2019 and 2020, which further supports the information displayed in Fig. 11, where a similar pattern is also evident. Therefore, we may again acknowledge that this field is becoming one of interest for researchers, which will undoubtedly open new horizons and opportunities for development.



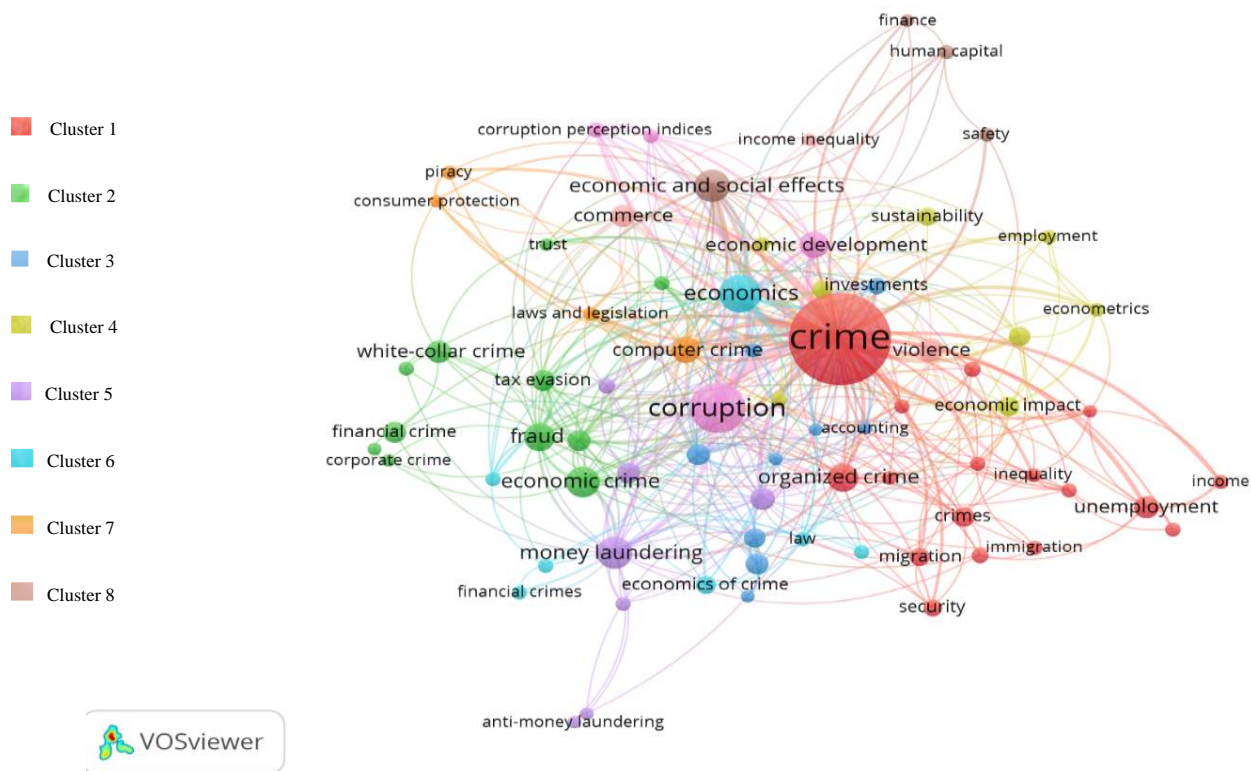
**Fig. 12:** Map of the average publication period of the articles under analysis related to blockchain technology on the Scopus platform

*Source:* developed by the authors in the VOSviewer program

As in the previous case, we also turn our attention to scientific articles related to economic crime - this time from the Scopus platform - again creating a cluster network related to it, in which 74 words out of 152 that reached the minimum threshold of 5 appearances were included, selected in turn from a total of 4096 words. Words such as "developing world", "gross domestic product", "panel data", "environmental regulations", "surveys", "policy making", "Africa", "Colombia", "United States", "deforestation", "drug trafficking" and similar words considered irrelevant to this research were excluded from the cluster network. Thus, we can see a clear link between the concept of economic criminality and issues that we could say that they significantly participate in its manifestation, having by their nature an illegal and immoral character, among which we can point out: "white-collar crime", "money laundering", "financial crime", "corporate crime", "economic crime", "fraud", "tax evasion", "the underground economy". All of these have a strong social and economic impact, potentially reflected in phenomena such as "immigration", "migration", "poverty", "inequality", "unemployment", that - as already mentioned - have a significant impact on the quality of social and economic life of ordinary people, which is much more fluctuating and sensitive than that of those with a certain social or financial status.

Last but not least, we remark the link between economic crime and the concept of "accounting", which shows a value of 8 for the links indicator and a value of 10 for the total strength of links indicator, which we consider to be a surprisingly low level, given that almost all economic criminality phenomena are structured around illicit and immoral concepts of "accounting creativity", which would make us expect this link to be more obvious and more intricate (see Fig. 13).

Even in this cluster map there is no link between the concept of economic criminality and blockchain, but from all the insights outlined above, we can together estimate that there is undoubtedly a strong causal link between these concepts, the implications of which can only enhance and further strengthen the functioning and evolution of our society.



**Fig. 13:** Cluster network on the topic of economic crime based on Scopus

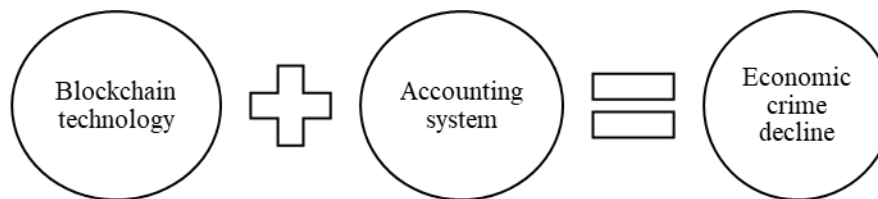
Source: developed by the authors in the VOSviewer program

As a result of the screening of scientific papers on the Scopus and Web of Knowledge research platforms - even if they are not in a highly representative number in regard to the field of analysis - numerous features have been revealed on both platforms by which the blockchain technology as applied to accounting can significantly mitigate the phenomena of voluntary or involuntary economic criminality. Of particular interest are the following:



- A high level of security of transactions and of the database built within the network, ensured by the limited access of participants to information and actions within the network and, of course, by the way the network is structured and programmed, which contributes to its independence and security, while avoiding the accumulation of tasks at different stages of the transaction (initiation, verification, authorization and audit) for a single participant, which would encourage illicit behavior on their part;
- The permanence, incorruptibility and irreversibility of accounting transactions and operations recorded in the network do not allow unilateral or multilateral interventions and subsequent modifications, which makes it impossible to apply "creative accounting" techniques of whose results, on the one hand, illicitly benefit a certain "target group" and, on the other hand, harm another group that may be: owners/associates of the enterprise, business partners, financial institutions, state authority and others;
- Smart contracts technology brings with it a considerable simplification of the tasks and responsibilities of accounting professionals, as it automatically operates certain predefined contractual provisions, which also reduces the possibilities of human errors and mistakes that are quite common in the traditional accounting system;
- Blockchain technology is built in a way that allows transactions to take place under the concept of "trust-free" or "trustless", which alleviates or even avoids the pressure or stress related to the business partner's behavior, ensuring an ethical response from the other party, proper to the nature of the relationship developed;
- The triple-entry accounting system, which can operate within blockchain technology, assures the legality and objectivity of every accounting transaction, which would firstly minimize the potential for fraud and secondly greatly ease the responsibilities of auditors.

All of these advantages, as well as others that have been discussed throughout this paper, may be described in a more succinct form, as depicted in the figure that follows (see Fig. 14).



**Fig.14:** Equation between blockchain technology, accounting system and economic crime

*Source:* Developed by the authors

The research also uncovered many areas of applicability of blockchain technology, the most significant of which include emerging technologies, information systems and networks, the world of cryptocurrencies, security, digitization, management, business, finance, taxonomy, banking, auditing, accounting and others.

## 5. Conclusions

Through the bibliometric review of the most relevant research papers on blockchain and economic criminality, we come to the conclusion that the advantages and solutions brought about by the adoption of blockchain accounting should not be disregarded, as contemporary society has to eliminate this cancer affecting national economies. These benefits have been identified mainly from the analysis carried out on the relationship and correlations among the topics of blockchain, accounting and economic criminality, an analysis that has enabled the delineation of three main standpoints, namely: blockchain technology as an engine for the development, streamlining and digitization of the accounting system; blockchain technology as a powerful enabler for detecting and tackling economic criminality; blockchain accounting as a prerequisite for resetting the perception or approach to the concept of economic criminality.

In terms of the first perspective we identified, we note that a link is being drawn between blockchain technology and accounting, acting as a tool to update and improve the accounting system, which will certainly boost the performance of this system's outcomes and not least "prepare" it for a digitised society in almost all aspects of economic and social life, where the expectations of the accounting profession and the understanding of its role and significance will be greatly transformed - compared to what we know today - so that the profession will also be able to integrate and identify well its new responsibilities and development directions in such a changing society. Therefore, blockchain technology may be seen as an enabler or driver through which the accounting field is upgraded and streamlined so that it can respond to the needs and requirements of the society in which it operates.

The second perspective or insight identified highlights a link between blockchain technology and economic criminality phenomena that are at a worryingly frequent level, affecting not only the functionality of the global economic mechanism, but even the quality of social life of citizens around the world. In the context of this paper, we can see that blockchain technology has the potential to secure any transaction environment, to prevent - through various verification keys - the proliferation of economic criminality phenomena, and to detect their appearance in any applicable field, be it finance, banking, taxation or accounting, be it digital technologies and networks or a state's national security or international relations. Therefore, through its features and functionalities, blockchain technology has a significant role to play in dissuading the practice of economic criminality phenomena in any field, which is a timely solution in the context in which our society is facing the results of these phenomena, namely: lack of social and territorial justice that causes inequality in terms of development opportunities for states - as well as individuals - by depriving some of certain well-deserved rights and resources, which in turn causes high levels of migration phenomena, unemployment, poverty, etc.

Consequently, we may consider that blockchain technology is really an effective tool to tackle and mitigate economic crime. Looking at the third perspective, we see that this time it reflects a relationship between blockchain accounting and the concept of economic criminality, with the former having the ability and role to change the perception of the latter. Given that a large part of economic criminality is rooted in accounting illegalities, once they tend to decline due to the difficulty or impossibility of practicing them in the context of an accounting system using blockchain technology, then the perception of economic criminality will also change, as it will no longer be seen as an imminent and common occurrence, but perhaps only as an exception. It is certain that, as accounting and the economy in general evolve and digitise, the understanding of economic criminality will be completely different, because the forms of its manifestation that it has today will no longer be possible - or will only be possible at a fairly low level - so perhaps we will see the construction of a much more transparent and ethical society, in which every state and every individual will have equal freedoms and opportunities for development and in which economic crime will no longer be such a common phenomenon. Of course, the self-interested and ill-intentioned could find 'solutions' to fraud in almost any context, no matter how secure or well-designed, but surely the level of economic criminality would be much lower than it is today.

To conclude, as we have at our command such an effective tool to solve one of the main concerns of contemporary society, namely the high level of economic criminality around the world, we believe that both researchers and accounting practitioners should increasingly focus on knowing, understanding and acquiring as much knowledge and skills as possible about what it would require to introduce blockchain technology into the traditional accounting system, in order to cope with the changes in the professional requirements of an accounting professional, which are certain to materialize in the foreseeable future. Even if this shift from the traditional accounting model to the digital or blockchain accounting model is a difficult, challenging, unknown and even "costly" one, we believe that it is fully rewarding all the effort and interest in this path, because the outcomes that will be reached will be a sufficient incentive to move forward, develop and improve this technology.

The main limitations of the research are:

- Our study has some limitations mainly due to the bibliometric algorithm, in the sense that only papers indexed in WoS and Scopus can be imported, processed, and interpreted, which excludes part of the existing literature on this topic and obviously omits the analysis of some pertinent contributions to our research area.
- Only scientific papers were considered, not books and book chapters or editorials (for the considerations mentioned above).
- Although the topic investigated in this paper is a very interesting and challenging one, but relatively new in the research field, the literature is not well advanced and we found that there is still no comprehensive and systematic review of the knowledge gained so far.
- It was only possible to consider papers published in English.

Future research directions may include:

- The topic of blockchain, accounting and corruption is currently enjoying increasing attention among practitioners, legislators, researchers and various other stakeholders and we can say that we are witnessing a rapid spread of these practices globally (e.g. cryptocurrency transactions, e-money platforms, e-business, etc.).
- The topic is particularly interesting, given that the specific connotations of this blockchain-accounting-corruption triplet currently concern almost all national governments, the European Commission, and not least, companies involved in large-scale transactions.
- The aim of this paper was not to provide a general understanding of how the blockchain-accounting-corruption triad works, but to provide a broad and systematic review of the literature on this topic that can serve as a stepping stone for new research directions, both quantitative and qualitative, research focused on the mechanism of operation of the blockchain-accounting-corruption system, on how this mechanism is taught by legislators, accountants and auditors, computer scientists, regulators, etc.

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**Data Availability Statement:** All data is provided in full in the results section of this paper.

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**Veronica GROSU**

ORCID: 0000-0003-2465-4722

**Daniel BOTEZ**

ORCID: 0000-0003-0986-7631

**Anatol MELEGA**

ORCID: 0000-0003-4763-0520

**Rozalia KICSI**

ORCID: 0000-0001-6712-4284

**Svetlana MIHAILA**

ORCID: 0000-0001-5289-8885

**Anamaria – Geanina MACOVEI**

ORCID: 0000-0002-7995-1145

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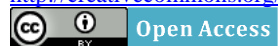
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## THE ESSENCE OF ENTREPRENEURIAL MANAGEMENT IN THE SME SECTOR IN POLAND

**Michał Igielski**

*Gdynia Maritime University, 81-87 Morska St., 81-225 Gdynia, Poland*

*E-mail: [m.igielski@wznj.umg.edu.pl](mailto:m.igielski@wznj.umg.edu.pl)*

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**Abstract.** The main objective of the article is an attempt to identify/identify the elements of entrepreneurial management, which are the most important for SME sector enterprises in Poland. The author will also try to indicate the key dimensions of entrepreneurial management in the surveyed entities and the dominant behaviors related to the concept of entrepreneurship among the owners of the surveyed companies. In addition to the literature analysis, as another research method, the author chose a survey in the form of a structured interview with business owners - the survey was conducted in 2020 in 200 purposively selected enterprises of the SME sector, which are based in Poland. After analyzing the literature on the subject and the results of the conducted survey, bearing in mind, of course, its pilot character, the author specified 4 dimensions of entrepreneurial management: competencies of decision-makers (management), entrepreneurial management practices, entrepreneurial culture in a given enterprise and innovation orientation/direction. According to the author, they form a construct of entrepreneurial management and allow to assess the level of enterprise development (direction and pace of changes) depending on selected factors of local and institutional environment, internal factors, level of achieved financial results, sources of financing.

**Keywords:** entrepreneurship; entrepreneurial attitudes; entrepreneurial management; entrepreneurial orientation

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**JEL Classifications:** L26, M10, M12, M21, O11

### 1. Introduction

Rapid changes in the economic environment of modern businesses, which are compounded by unique and large-scale technological advances, ubiquitous globalization, or global crises such as the global COVID 19 pandemic, are causing massive shifts in economic markets. In the 21st century, in the face of ever new challenges, the development of entrepreneurship has become an essential condition for the sustainable development of any country. So, who has the chance to succeed? Which enterprises will survive, and which will disappear from the economic map?

According to the author of the article, much depends on people - from owners to the staff of enterprises - on their attitudes. Active people are characterized by initiative, i.e., ability to initiate actions, come up with ideas. These people are also creative - capable of thinking creatively, breaking through stereotypes, and finding solutions that were previously unknown or applied in other situations.

In an environment where companies must constantly seek out opportunities, it is therefore important for them to have an entrepreneurial orientation, defined as the degree to which an organization is entrepreneurial with respect to strategy and resources. It is also one of its few characteristics that can account for competitive advantage (Semrau and all, 2016).

However, for the purpose of this article, the entrepreneurship that the author will be showing should be limited to the statement that business owners and their employees must apply in the process of launching and operating their organization, only such skills and knowledge that guarantee high growth of the potential of a given enterprise. This means that the contemporary view of entrepreneurial management differs from traditional operational management in the area of five key management issues: strategic orientation, resource commitment, resource control, management structure and growth opportunities (Hisrich and all, 2019; Snieska and all, 2020).

Hence, the aim of the study is to identify/identify the elements of entrepreneurial management that are most relevant to SME companies in Poland. The realization of the adopted objective will be achieved through a literature review presenting the results of research work on the nature of the relationship between entrepreneurial management and the development of a given enterprise and its ability to build competitive advantage. However, the most important element of the research work was to conduct a survey, (in 2020) in 200 purposively selected SME enterprises that are based in Poland.

## **2. Theoretical background**

In a group of people, we can easily observe that to a given situation each person reacts in his/her own way. Usually, this type of reaction is repeated - we call it an attitude. In psychological terms, by attitude we mean certain specific, constantly repeated patterns according to which an individual feels, thinks, and acts. From this we conclude that attitudes consist of emotions, thoughts, and predispositions to act. Attitudes can change - for example, when influenced by someone in authority or trusted by those around them. A change in attitudes can also occur because of a long-term educational process, as well as the influence of the media.

In contacts with other people, if you want to achieve your goals, you can neither be overly submissive nor aggressive. Success is ensured by an indirect attitude, called assertive. Professional work, the implementation of ambitious projects, require the display of initiative and creativity. To be in accordance with one's conscience and prevailing norms, an entrepreneurial person should demonstrate responsibility and honesty. One of the conditions of assertive behavior is also self-acceptance, which causes that a person (Semrau and all, 2016):

- likes and respects himself - approves of his appearance, his tribe and nationality, takes care of his health;
- believes in his/her own abilities - values his/her knowledge and skills;
- consistently fulfills assigned tasks;
- is aware of his/her faults and works on them;
- wants to develop and improve.

Self-acceptance helps to feel more confident. Assertive people are able to defend their rights in a decisive manner, without violating the rights of others. Assertiveness is an attitude being a compromise between excessive submission and aggression. An assertive person does not feel ashamed when he/she does not know or understand something, but asks appropriate questions without hesitation. They are willing to help others, but can refuse to do favors when they cannot do them.

On the other hand, it is very important to be active - active people are characterized by initiative, that is, the ability to initiate action, come up with ideas. These people are also creative - able to think creatively, break stereotypes, and find solutions that have not been known before or applied in other situations. Initiative and creativity are associated with mastery of skills such as (De Clercq and all, 2009):

- the ability to define a problem and the ability to set goals and objectives;
- ability to find as many solutions to a problem as possible;
- ability to choose the best ideas;
- consistency in completing tasks.

To sum up, for all of us who would like to be perceived as entrepreneurial people, equally important is the readiness to take risks closely connected with responsibility and honesty. We know very well how big negative social consequences are caused by omnipresent corruption, which is, next to tax fraud and unfair competition, one of the most dangerous phenomena related to business activity on the market. And yet corruption is practically a manifestation of the lack of ethics of both the person who accepts benefits and the one who offers them. Responsibility and honesty should therefore characterize every person, and even more so an entrepreneur who cares about the welfare of his or her business.

Recent economic changes, which are intensified by progressive globalization, confirmed by the labour market research and the analysis of expectations of most employers, indicate new skills and attitudes, which are becoming more and more desirable in the XXI century, and which are usually appropriate for a few employees - knowledge workers.

However, this is not a very up-to-date issue, as new expectations concerning human resources were noticed by Polish employers already in the early 90s, at the beginning of the Polish transformation.

A. Maciejczyk (2018), former representative of the Confederation of Polish Employers, pointed out that in the face of the increasing participation of employees in management processes, they are expected to have creative thinking expressed in the ability to plan, analyze and evaluate the results of their own work, responsibility, independence and the ability to draw conclusions from their own successes and failures, as well as continuous learning. He also stressed the importance of entrepreneurship, both of employees and business owners.

In research on the labor market, when asked about the characteristics of the ideal candidate for a job, increasing their attractiveness regardless of the job position, employers most often indicated (Jobs for People, 2019):

- communicativeness and ability to work in a group;
- activity and initiative;
- independence and ability to organize their own work;
- involvement in their work, manifested among others by the compatibility of the performed tasks with their passion, or appropriate adjustment of their predispositions and experience to the position;
- flexibility, i.e. ability to adapt to changes and readiness to continuous learning and improvement.

Based on the study by B. Minkiewicz and P. Bielecki (2017) we can rank the most important skills along with knowledge desired in employees in the modern labor market:

- problem-solving skills;
- cognitive skills and theoretical knowledge;
- communication skills;
- teamwork skills;
- professional - practical knowledge.

Interpersonal skills and personality predispositions necessary for a job candidate were also identified, namely (Dietl & Sapijaszka, 2019):

- communication and teamwork skills;
- creativity and openness to experience;
- independence in making decisions in the area of competence resulting from the scope of responsibilities;
- analytical skills;
- willingness to learn;
- availability
- motivation and enthusiasm
- resourcefulness
- honesty;
- regularity.

In turn, G. Drydon and J. Vos (2003) believe that in the modern world, where everyone has the opportunity and should be able to manage their own life, the set of necessary skills should include: creative problem solving, critical thinking, leadership skills, ability to see the big picture, self-confidence. They allow one to take full part in deciding the future of the whole even society and to plan one's own life in times of great changes. In turn, W. Rabczuk (2018) points out that the basic requirements of the modern world of work are: competence, creativity, adaptability, love of contacts and work in teams, transfer of skills, independence and the ability to cope with unpredictable conditions.

This type of image of a modern employee is also reflected in job offers formulated by employers. A typical set of characteristics appearing in job advertisements for various positions is commitment, initiative and creativity.

In summary, we can say that the knowledge related to the above-mentioned competences concerns mainly the identification of available opportunities for personal and professional activities, and the recognition of broadly understood issues constituting the context of work and life. The necessary skills relate mainly to the proactive management of various undertakings (projects), the ability to work, both individually and in groups, and to identify and assess one's own strengths and weaknesses. An entrepreneurial attitude is characterized by initiative, activity, independence and innovation both in personal and social life and in the workplace.

Shaping entrepreneurial attitudes of students is one of the proven educational strategies in Western Europe and the U.S. that foster good preparation of students to meet the challenges of the modern world. It should be implemented basically from the beginning of the education process. Shaping of entrepreneurial attitudes is not isolated in the form of one or several subjects. It refers to integrated action of teachers and the school as a whole, regardless of subjects or the level of education. Entrepreneurial education is not directly aimed at preparing entrepreneurs - owners and managers of companies. Its main objective is to stimulate the development of entrepreneurial thinking and acting skills as well as to shape attitudes conducive to taking such actions. Such actions, on the other hand, may be reflected in a certain level of involvement in the work situation, in rationalization ideas, improvements, initiative and innovativeness. A person demonstrating an entrepreneurial attitude goes beyond the scheme of his or her own job and is able to recognize the interdependencies between his or her tasks and other jobs and has a reflective attitude (Zajac and all, 2010).

Therefore, an entrepreneurial person can be defined as a person who (Gibb, 2016):

1. Is a pioneer, taking on new and non-routine activities.
2. Likes adventure and acting under uncertainty.
3. Thinks and acts independently, is courageous and optimistic.
4. Attaches importance to own development.
5. Is self-confident, aware of his/her strengths and weaknesses.

6. Is ambitious, shows initiative in action.
7. Is responsible in work and activities performed.
8. Is creative and persuasive.

People who possess the above-mentioned characteristics are often referred to in the literature as intrapersonal entrepreneurs - this means that they manifest the entrepreneurial activity developed in salaried employees in companies. This is characterized by their demonstration of commitment, creativity and innovation beyond the standard requirements for the job.

In addition, it is worth noting that entrepreneurial education assumes that each student has a certain innate level of entrepreneurship that can be raised in the educational process. However, the level of entrepreneurial behavior in individuals varies. Some are more creative while others are more analytical. Some are more self-confident and open-minded, and cope better with unknown situations and uncertainty than others. However, it is possible to stimulate the development of entrepreneurial thinking and action by taking appropriate educational measures aimed at developing the skills and qualities inherent in an entrepreneurial person (Cotton, 2016).

Thus, moving to the essence of entrepreneurial management, it is worth starting with the concept of entrepreneurial orientation of the organization. The most adequate definition of the organization's orientation in the context of this study can be taken as the opinion on this subject by P. Won, Y. Ho and E. Autio (2005), who argue that it is a set of particularly important criteria that serve decision-making at all levels of management, as well as principles that guide the conduct of employees in their operational activities.

However, despite the intensity of scientific inquiry and the many studies carried out, the term entrepreneurial orientation has not yet lived to see a uniform definition, there are many in the literature. Let us start with the 1970s when H. Mintzberg (1973) stated that entrepreneurial strategy making is determined by the active search for new opportunities and dramatic leaps forward in the face of uncertainty. In the 1980s, a trend emerged, led by D. Miller and P.H. Friesen, (1982) who believed that entrepreneurial firms are those that boldly and regularly innovate while taking significant risks in their market and product strategies. In the nineties G.R. Merz and M.H. Sauber (1995) began to treat the entrepreneurial orientation as a degree of proactivity (aggressiveness) of the company in a selected market segment and the willingness to innovate and create new offers. At the beginning of the 21st century, the opinion emerged that entrepreneurial orientation is the ability of a company to take risks, be innovative, proactive, autonomous and aggressive towards competitors, which leads to changes in the organization or market position (Voss and all, 2005). Nowadays, the concept of entrepreneurial orientation is considered to encompass a set of distinct but related behaviors that have characteristics of innovation, proactivity, competitive aggressiveness, risk-taking, and autonomy (Pearce and all, 2015).

Analyzing the above-mentioned definitions, we can see that five dimensions of entrepreneurial orientation are most often mentioned: risk-taking, innovation, proactiveness, aggressive competitiveness and autonomy. According to the author, it is also worth noting that the multidimensionality of this orientation of the organization is closely related to the interdependencies between the various dimensions - its internal construction. And, as J. Karpacz (2016) claims, in the conceptualizations and operationalizations of the orientation there are two main methodological approaches clocking the entrepreneurial orientation as a one-dimensional or multidimensional construct, both of which assume that although there may be more than one dimension, they differ in their assumptions about the interdependencies between the distinguished dimensions.

However, there remains the issue of defining the term entrepreneurial management, which also raises many controversies. At the beginning of this road, we must note that traditional research on organizational entrepreneurship has focused mainly on the problem of launching new enterprises. After all, for a newly

established company the biggest barrier is precisely the lack of experience, that is: the lack of established rules, procedures and organizational culture, in which the employees are able to find goals and ways to achieve it.

On the other hand, for a company that has been operating on the market for many years, the problem is directly proportional - the obstacle to development is the practice established for decades. And here the key word is "entrepreneurship", when on the other side, in a company without seniority, this word is "management". However, regardless of whether we are talking about a large company with many years of experience, which can boast of its achievements for years, or about a small, family business, which is just taking its first steps in the market, the main determinant of its success is precisely entrepreneurship.

Consequently, we can assume that two premises are responsible for the emergence and spread of the concept of entrepreneurial management:

- social aspects related to the motivation of employees who strive for independence, self-realization - they want to satisfy these needs, to have more decision-making freedom and responsibility in the organization;
- the search by managers for sources of competitive advantage in new managerial and organizational methods and techniques - the constant detection, reaction, and sometimes the formation of new opportunities and the implementation of appropriate changes.

Thus, entrepreneurial management can be considered a set of opportunity-based management practices that can help an organization maintain or gain a key position and contribute to the creation of value for it as well as for society (Stevenson, 1983). In turn, D.L. Day (2002) described this concept as the totality of management activities that are based on making decisions on the development of innovations on the basis of new or differently configured already possessed resources in different organizational spheres.

To sum up, according to the author of the article, entrepreneurial management in the XXI century is, first of all, the ability to flexibly adapt to changing conditions of the environment - counteracting threats and, more importantly, using emerging opportunities and chances to become more and more competitive. It is also a constant readiness to solve emerging problems in a creative way and to take key decisions for the company at an adapted pace to changing economic determinants. And, of course, developing such behaviors among the entire staff of the company in order to jointly create what is most important for each company - a unique value proposition for customers, which will perfectly respond to their needs.

### **3. Research Methodology and data**

The main basis for the conclusions briefly described in the chapter (described in detail by the author of the article below) was a study involving the assessment of elements of entrepreneurial management in the sector of micro, small and medium enterprises - based on the opinions of entrepreneurs and analysis of actions taken. The main objective of the survey was an attempt to recognize/identify elements of entrepreneurial management, which are the most important for enterprises in the SME sector in Poland. The author has also tried to indicate the key dimensions of entrepreneurial management in the surveyed entities and the dominant behaviours related to the concept of entrepreneurship among the owners of the surveyed enterprises. Author had to apply the following set of research methods:

1. Analysis of the literature on the subject - to systematize the language of concepts related to entrepreneurship, entrepreneurial introduction and entrepreneurial management.
2. Questionnaire in the form of a structured interview with business owners - the main element of research work. The author conducted research in 2020 in 200 intentionally selected enterprises from the SME sector, which are based in Poland and were established in the last 5 years (Table 1). The information and opinions obtained in this way referred to the current situation of the enterprise.



Unfortunately, due to financial and organisational limitations, the collected sample does not have the characteristics of the entire population (it should be 72 thousand entities). Therefore, the presented research results are not a complete set - they are the basis for extending the research process in the future - it is a pilot study for now. The author created the questionnaire himself. He chose entrepreneurs as respondents, because they have the greatest knowledge about their companies. The author used the evaluation method to determine the elements of entrepreneurial management and actions taken in this area to build a competitive position on the market, in the face of new economic challenges. The author used the evaluation method to determine the determinants of entrepreneurship development and actions taken in this area, in the face of new economic challenges. Of course, the author agrees with the opinion that evaluation is always in some way a subjective method. However, it is difficult to find a more objective research tool that would be simple enough to induce respondents to participate in the survey. In turn, the author used Statistica version 12. and a Microsoft Excel spreadsheet to carry out statistical calculations.

**Table 1.** Description of the group of respondents

companies					
200					
size					
micro		small		average	
56		53		91	
kind of					
business activities		ltd.		partnership	
98		80		32	
life span					
up to 1 year		2 to 4 years		4 to 5 years	
63		97		40	
industry					
maritime	food	construction	transport	commercial	advisory
30	25	39	36	39	30
entrepreneur					
200					
sex					
women			Men		
89			111		
Age					
up to 30		from 31 to 50		over 51	
25		113		62	
Education					
professional		average		higher	
21		61		188	

Source: own study

#### 4. Results

In the first part of the research, based on the result of in-depth analysis of available literature that deals with entrepreneurial management, the author extracted and identified 9, in his opinion, key dimensions - they are described in detail in table 2.



**Table 2.** Key dimensions of entrepreneurial management in polish enterprises

No	Entrepreneurial management dimension	Description of dimension of entrepreneurial management
1	Performance orientation-	<ul style="list-style-type: none"> <li>- learning organisation</li> <li>- open organization</li> <li>- perpetual striving for efficiency improvement</li> <li>- the most important are effects, not rules and principles</li> <li>- treating a company as an innovator</li> </ul>
2	Resource orientation	<ul style="list-style-type: none"> <li>- efficient use of resources</li> <li>- resource redundancy</li> <li>- diversification of resources</li> <li>- searching for new resources</li> <li>- combining existing resources</li> <li>- aligning resources with innovative activities</li> <li>- minimising resources</li> <li>- optimising the use of resources</li> <li>- easy access to key resources, which are not in possession of the company</li> <li>- lack of problems with using resources dispersed in the organization</li> <li>- maintaining balance between tangible and intangible resources</li> </ul>
3	Strategic orientation	<ul style="list-style-type: none"> <li>- taking advantage of opportunities</li> <li>- building a market position on the basis of exploiting opportunities rather than the possessed resources</li> <li>- having and implementing a vision and mission</li> </ul>
4	Orientation to innovation	<ul style="list-style-type: none"> <li>- lack of anxiety while introducing changes/ open treatment of changes/ change is an opportunity and not a threat</li> <li>- openness and receptiveness to innovations</li> <li>- investment in innovation</li> </ul>
5	Orientation to opportunities	<ul style="list-style-type: none"> <li>- more focus on action than on plan</li> <li>- quick implementation of needed changes - focus on action</li> <li>- taking advantage of opportunities, regardless of the level of resources</li> <li>- involvement of employees at all levels (not only at managerial level) in the process of seeking and exploiting opportunities</li> </ul>
6	Growth orientation	<ul style="list-style-type: none"> <li>- rapid growth is the main goal of the company</li> <li>- readiness to take risks in development activities</li> <li>- failure to seize development opportunities is a missed opportunity</li> </ul>
7	Entrepreneurial culture	<ul style="list-style-type: none"> <li>- the employee is an intrapartner</li> <li>- delegate authority and responsibility to employees</li> <li>- create an entrepreneurial climate</li> <li>- encourage creative activities</li> <li>- partnership system</li> <li>- no barriers between the employee and the manager</li> <li>- open communication</li> <li>- management through conflict</li> </ul>
8	Remuneration philosophy	<ul style="list-style-type: none"> <li>- reward for performance</li> <li>- a bonus system proportional to participation in the creation of added value of the company</li> <li>- rewarding creativity and entrepreneurship</li> <li>- use of innovative incentive and bonus methods</li> </ul>

9	Management structure	<ul style="list-style-type: none"> <li>- flat organisational structure - no hierarchical levels too extensive</li> <li>- activities based on informal relationships</li> <li>- small working groups - combining them into project teams</li> <li>- decentralisation of authority</li> <li>- flexibility in action</li> <li>- different management styles</li> <li>- strong emphasis on employees' self-responsibility and self-control</li> <li>- education replaces training</li> <li>- quick response to changes in the environment</li> <li>- sensitivity to customers' needs</li> <li>- high autonomy of employees</li> </ul>
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Source: own study

As we can see, already after the first analysis, identified key dimensions of entrepreneurial management are primarily relevant to large companies, which have complex organizational structures and cover most of the market. Their specifics are completely different from those of smaller organizations, which have much smaller resources at their disposal, and thus build their competitive advantage on the market in a completely different way. The author of the article focused on clarifying this issue in the second part of the research.

In this part of the study, the author, attempted to find out from the group of respondents what is important to them when running their own business. In this way, the author attempted to detail the key dimensions of entrepreneurship for the SME sector from the previously identified dimensions for the entire group of businesses. The prepared questions were developed based on the analysis of the descriptions of entrepreneurship management dimensions described in Table 2.

The first analysis of the incidence of entrepreneurial management dimensions focused on organizational culture and compensation philosophy (Table 3). Respondents were asked questions about, among other things, remuneration and motivation systems and about the human relations prevailing in their organizations.

**Table 3.** Elements of entrepreneurial culture and compensation philosophy identified by respondents

THE DIMENSION OF MANAGEMENT PHILOSOPHY			
Principles of evaluation and remuneration of employees			
	not important	important	very important
for work input	12%	41%	47%
for activity and effectiveness	9%	31%	60%
for creativity	8%	20%	72%
Motivation system used in the company			
coercive tools	23%	47%	30%
tools of encouragement	11%	31%	58%
persuasion tools	42%	32%	26%
Instruments of motivation			
base salary	8%	13%	79%
bonuses and allowances	13%	16%	71%
punishments, reprimands	82%	16%	2%
strict supervision	79%	14%	7%
additional benefits	5%	21%	74%
training	34%	37%	29%
team-building trips	67%	24%	19%

opportunity for promotion	82%	13%	5%
flexible working hours	30%	29%	41%
participation in management	2%	39%	59%
Entrepreneurial culture dimension			
responsibility of employees for achieving company objectives	78%	14%	8%
managers' trust in employees	9%	39%	52%
correct communication within the company	1%	21%	78%
encouraging employees to have an entrepreneurial attitude	2%	22%	76%
intensity of contacts between employees and their superiors	small	medium	high
	14%	69%	17%
nature of workers' contacts with their superiors	free	formal	very formalized
	87%	9%	4%

Source: own study

As we can see, the dimension of remuneration philosophy is practically insignificant in small enterprises, which focus strongly on creating an entrepreneurial culture. Remuneration is treated as "payment for work", which depends, for example, on seniority or on the position held, and not on the employee's contribution to the creation of value for the enterprise. The dimension of remuneration philosophy is practically absent - it is covered by the dimension of entrepreneurial culture, which manifests itself in the promotion of employees' creativity, because without it a company in the 21st century cannot compete in the market.

A similar situation occurred in the case of verification of entrepreneurial management dimensions of productivity orientation and growth orientation, which practically did not occur in the surveyed entities (Table 4). But the author of the article drew attention here to the importance attached by the respondents to the person of the manager, to his competence and skills. We can see that in each case the compliance of answers was close to 100%. This prompted the author to isolate a separate dimension of entrepreneurial management, only for the SME sector - competencies of decision-makers.

**Table 4.** Elements of performance orientation and culture growth indicated by respondents

PERFORMANCE ORIENTATION DIMENSION			
Forms of employee control			
	not important	important	very important
formalised	82%	5%	13%
partnership	13%	9%	78%
ongoing	10%	14%	76%
final	75%	15%	10%
evaluation of the company's business model	82%	9%	9%
knowledge sharing among employees	64%	16%	18%
knowledge sharing among managers	5%	8%	87%
performance orientation	33%	34%	33%
managers helping their employees	4%	10%	86%
Growth orientation dimension			
interaction with other companies.	76%	4%	20%
cooperation with business support institutions	73%	7%	20%

Source: own study

The opinion of respondents to the management structure dimension did not change either, the components of which were mostly not indicated by respondents, except for issues related to management style (Table 5). Therefore, the author of the study decided to create a new dimension - dedicated to the SME sector - and call it entrepreneurial management practices. This is due to the fact that the owners of the enterprises that participated in the study strongly emphasized the necessity of partnership relations on the line manager - employee. They believed that only such an approach can ensure success on the market.

**Table 5.** Elements of the management structure dimension indicated by respondents

MANAGEMENT STRUCTURE DIMENSION			
The way objectives are set within the company			
imposed by management	11%		
consulted with employees	34%		
jointly determined	55%		
Type of organizational structure			
matrix structure	15%		
linear structure	3%		
functional structure	1%		
no formalized structure	81%		
Management style (respondents could mark more than one answer)			
intuitive management	45%		
democratic style	77%		
autocratic style	12%		
technocratic style	69%		
management by delegation	82%		
leading by exception	83%		
entrepreneurial leadership	85%		
	not important	important	very important
Degree of formalization of plans	91%	6%	3%
Participation of subordinates in the decision-making process	9%	21%	70%
Employee training	43%	39%	18%

Source: own study

The situation related to the innovation orientation was quite different, as this dimension fits this type of enterprises like no other (Table 6). It shows that SME owners are aware of the importance of this type of activities in building competitive advantage and they strive to create more and more new solutions.

**Table 6.** Elements of innovation orientation indicated by respondents

INNOVATION ORIENTATION DIMENSION			
Approach to implementing innovations			
Based on current procedures	6%		
Top-down - management reports	45%		
Bottom-up - employee initiatives	49%		
Degree of assessment of the difficulty of implementing innovations			
very easy	1%		
easy	3%		
difficult	79%		
very difficult	16%		
not possible	1%		
	not important	important	very important
Necessity of increasing innovativeness of a company	9%	15%	76%
Impact of innovations on the financial result achieved	8%	19%	73%

Source: own study

While discussing this dimension, we must necessarily point out that out of 200 enterprises, only 5 indicated that they have not implemented and do not plan to implement any innovations in their structures. This information should be very encouraging for us, because it shows that companies from this sector know that in the XXI century only constant development guarantees success on the market.

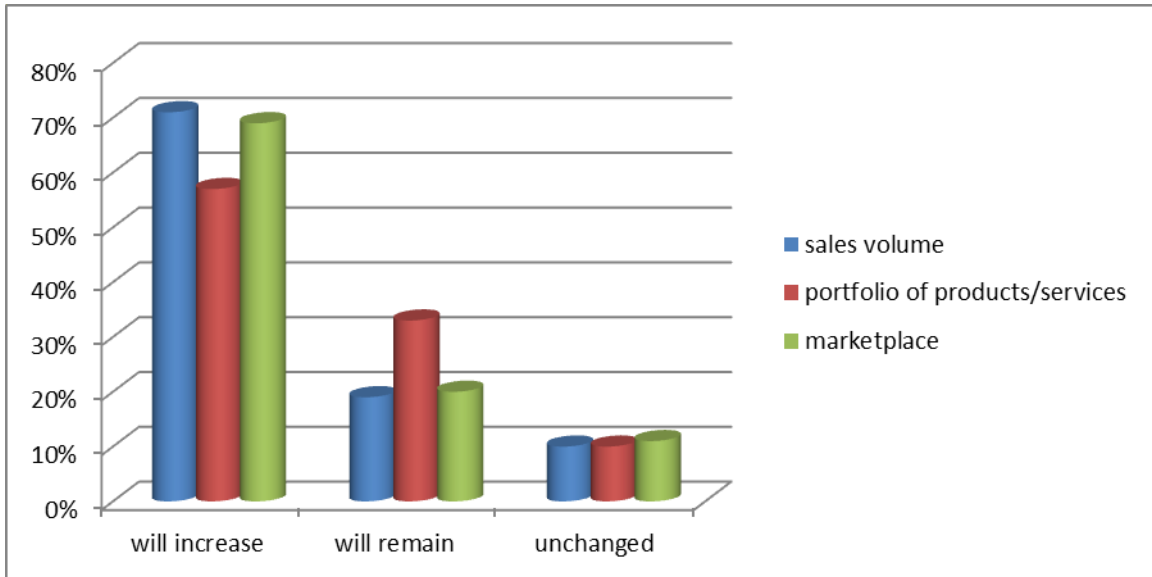
The biggest surprise for the author of the article, was the fact that the dimensions: resource orientation, strategic orientation (this area was particularly neglected) and opportunity orientation are practically absent in this type of companies. In this case, the author asked questions such as:

- the company's orientation toward vision, mission, and strategic goals;
- planning horizon;
- the use of external sources of financing;
- the plan for the use of available resources;
- the company's attitude towards risk and change;
- knowledge storage and sharing.

In this situation, the author decided to omit these dimensions - he did not even try to create any additional one (affirmative answers oscillated in the area of 1-5%). This is probably the result of the fact that people managing smaller companies need to focus on what is now and what is important/strategic for their point of view.

On the other hand in the third part of the research the author decided to check which of the four key dimensions of entrepreneurial management for companies in the SME sector have the greatest influence on building a sustainable advantage in the market of this group of companies.

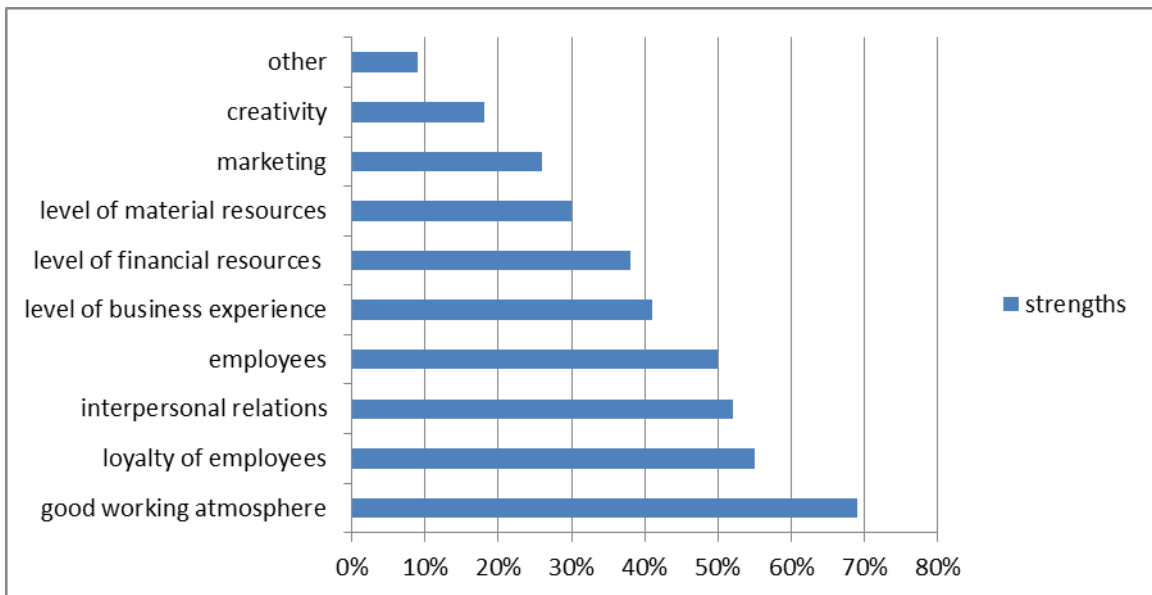
In their attempt to assess the possibilities of development of their own company, the respondents strongly emphasized three main areas of their activity: the level of sales, the portfolio of products/services and the sales market. What is important in their forecasts, they looked positively into the future - more than 70% of the respondents believed that they would increase their sales thanks to the extended portfolio (71%), and 69% of them were sure to increase their current sales market (Figure 1).



**Figure 1** Assessment of the respondents' own business development opportunities

Source: own study

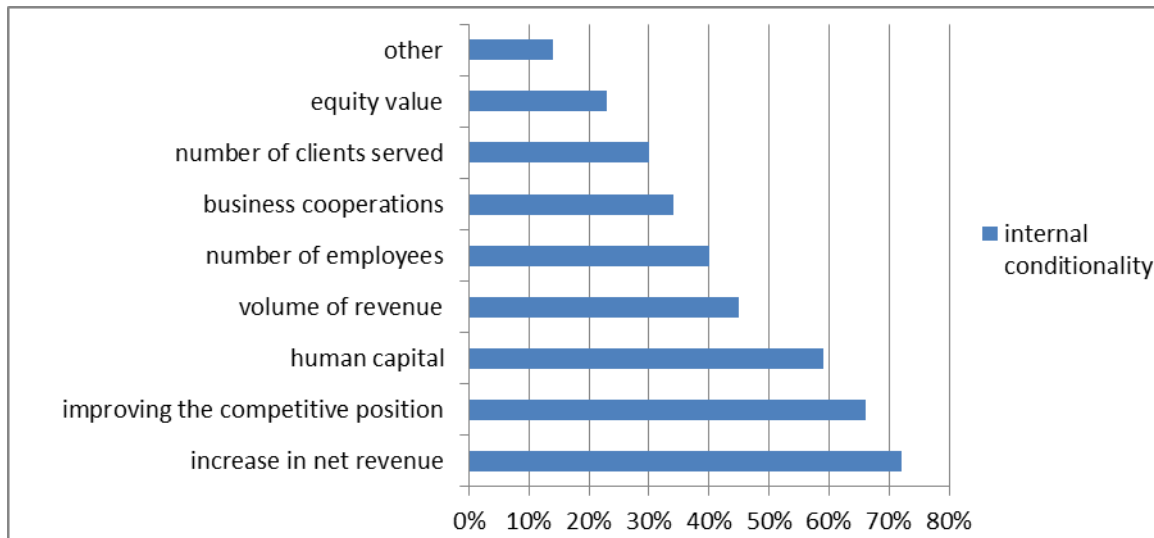
Such plans of the respondents are, of course, associated with the need for their companies to gain an advantage over their main competitors. They were to be helped by the advantages described in Figure 2. They put good atmosphere at work, employee loyalty, interpersonal relations and level of business experience in the first place. They considered the level of financial resources or creativity to be less important, but this cannot come as a surprise after previous data analysis.



**Figure 2.** Strengths in building competitive position of the surveyed companies

Source: own study

In this part of the analysis of research results, the author decided to focus on the internal conditions of enterprise development, i.e. determinants related to the characteristics of enterprises, their management systems and actions taken by entrepreneurs. The obtained data and conclusions are certainly consistent with modern business models of enterprises, which in the era of knowledge-based economy, attach great importance to human capital, business cooperation and intense competitive competition. Taking into account the functioning of the surveyed enterprises in terms of the number of employees, served clients, the value of equity capital, the size of revenues, the author noted that the vast majority of respondents stated an improvement in the situation in their enterprises. Most people referred to the increase in the value of net revenues - for 72% of entities and to the improvement in the competitive position of entrepreneurs - 66% of entities.



**Figure 3.** Conditions for internal development of enterprises

*Source:* own study

To sum up, if we want to evaluate the dimensions of entrepreneurial management in SME companies, first of all it is cooperation that bypasses existing structures and divisions. In many companies a very big problem is the separate functioning of people responsible for business and separately for technology. This effectively makes it difficult to take advantage of the opportunities presented by economic change. Of course, it is also necessary to have clear leadership that does not run away from difficult decisions and treats subordinates as partners. And most importantly, you need to identify your opportunities and develop strategies so you don't fall behind. After all, the key dimension of entrepreneurial management is not the technology itself, but the people who can use it effectively. But on the other hand, why is it so difficult for small businesses to grow? Are their owners/decision makers unable to use the potential of people as a weapon in the fight against new challenges? But are we forgetting the need for systemic solutions (as big companies do) - starting with changes in organizational structures and culture? These questions are undoubtedly the starting point for a full identification of the elements of entrepreneurial management, which should indicate the direction of development in the new, very difficult, economic conditions.



## 5. Discussion

In the XXI century, companies to gain a lasting competitive advantage must quickly respond to very intensive and unprecedented changes that occur in their environment. Entrepreneurial management, which as the author of the article wrote is a very broad, multifaceted, and interdisciplinary issue, is supposed to help them in this.

In scientific literature we can find many definitions of entrepreneurial management and entrepreneurial orientation, and we can also notice some evolution of views, which emphasize different aspects of them. In the case of entrepreneurial orientation, in the dimension of behavior, it is identified with the tendency to make strategic decisions that favor actions with uncertain consequences (Anderson and all, 2015). On the other hand, entrepreneurial management, in the behavioral dimension, means the constant willingness and ability to undertake creative and innovative solutions to a variety of problems, the ability to take advantage of opportunities and opportunities that arise, as well as flexible adaptation to changing operating conditions, creating value for customers and developing this type of behavior among staff (Mieszajkina, 2018). The author also assumed, due to one part of empirical research, that the development of the enterprise is an aggregate of its growth, development, competitive position, development intentions and the current balance of the enterprise, both in the material and social sense.

However, returning to the entrepreneurial management, which today is responsible not only to give the right hints in the development process, to stimulate knowledge transfer and diffusion. It is simultaneously supposed to support organizational learning and, as a consequence, lead to the development of dynamic capabilities. After all, nowadays, in building competitive advantage it is not only the bundle of resources that matters, but also the capabilities. In view of this, the mechanisms by which organizations can develop these capabilities and then reconfigure resources are important. This also confirms that dynamic capabilities, which are built on knowledge and linked to an entrepreneurial orientation, underpin the generation of new products, processes or services.

Currently, there is no fixed list of entrepreneurial management dimensions for enterprises - even less so for those in the SME sector. Their variability is due to the fact that different studies usually establish new factors that significantly determine their development and growth processes. An example of such a factor is the so-called entrepreneurial orientation, which is an aggregate of the desire to implement innovative solutions that refresh and improve the market offer, the ability to take risks in implementing unproven solutions and greater activity in exploiting market opportunities than rivals. Other variables of this type are market orientation, which is related to monitoring the market and introducing new business models. It can also be the introduction of human resource management models that are based on participation, engagement and activity.

And even if we assume that the author has succeeded in accurately identifying the dimensions of entrepreneurial management for businesses, we certainly cannot assume that they are universal and fixed. This was certainly proven by the research results and their overall analysis presented earlier. It turned out that out of the nine identified dimensions, after modification, only four fit for SME companies. However, let's start with the most obvious dimension - innovation orientation, which in entrepreneurial management means orientation towards implementing different types of innovations. The condition is one - the involvement of a possible large number of employees. And whether the company has a system for implementing innovations (the domain of large organizations), or whether they are implemented accidentally (a frequent situation in smaller organizations), is of lesser importance. Though, we have to remember about deficiencies in system solutions, which occurred in the surveyed entities, and may be crucial in the process of their development.

Another dimension of entrepreneurial management (for SMEs) that has been identified and isolated is the entrepreneurial culture in a given enterprise. In addition to this dimension, the author has included the dimension of the philosophy of remuneration, which is understood in the entrepreneurial approach as a permanent setting of

rates for employees, based on their contribution to the creation of company value. This is due to the fact that this dimension is practically absent in the SME group, and activities related to motivation and remuneration include precisely the dimension of entrepreneurial culture. In turn, this dimension is most often understood as management in an entrepreneurial way - encouraging staff to be creative, experiment, generate ideas, i.e. engage in all activities that may lead to the implementation of creative solutions.

The next two dimensions identified for all companies, i.e. performance orientation and growth orientation, after analysis of respondents' opinions, have been replaced, for the SME sector, by the dimension of competences of decision-makers (management). The created dimension is a kind of a foundation for these dimensions - it is a result of research and analysis of available sources, where the basis for growth and efficiency of enterprises is considered to be, first of all, adequate managerial behaviours - it is on these people (including SME owners) that the use of all growth opportunities and improvement of operating efficiency depends. Very strongly related to this dimension is the fourth dimension identified by the author - entrepreneurial management practices, which is derived from the organizational structure dimension. As the analysis of the research shows, the respondents do not attach any importance to the traditional aspects of the essence of organizational structures - what matters for them is the right approach to management (style and techniques of leadership, communication). In small enterprises the influence of individuals on the final result is very significant. Also, often the functions of owner and manager are combined. And so, as J.G. Covin. and D.P. Slevin (2011) argue, the content of strategy at the business level is defined in terms of a general set of management practices (business practices), which include: setting directions, human resource issues, operations, resource acquisition, working with partners, and others. And entrepreneurial management practices are specific mechanisms created by the creative workforce that allow companies to reach their markets and realize their vision for growth.

In summary, a survey of 200 business owners in Poland from 2020 onwards allowed the author to collect data that he believes will allow an attempt (this is a pilot study for now) to create a construct of the entrepreneurial management dimensions described earlier. The author assumed that entrepreneurial management in SME companies consists of four dimensions: entrepreneurial culture in a given company, competencies of decision makers (management), entrepreneurial management practices and innovation orientation. These measures were used in the analysis, as dependent variables, of the effects of specific groups of factors. This means that the sequence of research tasks carried out in this article allowed, in the author's opinion, to develop and implement the main objectives of the prepared material assumed at the outset. On the other hand, the obtained conclusions can find theoretical and practical application - to serve better cognition, understanding and improvement of management dimensions of entrepreneurial management in the face of new challenges.

On the other hand, it can be stated with certainty that the dimensions of entrepreneurial management will remain an element of management - because they have become material assets, organizational structures, strategies, processes, systems, financial and information resources. If we consider the permanent changes that are taking place in the economy, then the determinants related to the development of entrepreneurship will also change - and this is the most important value for the economy of the 21st century. Even more so in the face of the fifth industrial revolution. In science, on the other hand, it is hoped that the need to develop these and new conceptual frameworks, along with methods for studying the dimensions of entrepreneurial management, will not fade away. The author also hopes that the research presented in this paper is headed in the right direction

## Conclusions

In this article the author has attempted to identify the elements/dimensions of entrepreneurial management that are most important for companies in the SME sector, according to their owners. In his research he has drawn attention to the differences in the dimensions of entrepreneurial management and their number that we can observe between large entities and those smaller.

The developed and presented dimensions of entrepreneurial management for these smaller companies consist of four identified and described elements. According to the author, the first and most important dimension is the entrepreneurial management practice, which allows for the inclusion of all employees in the process of creating and implementing entrepreneurial strategies for the development of the company, which are based on the exploitation of market opportunities. The second dimension, equally important, is the competence of decision-makers (management). Without a proper approach, knowledge or skills of people in managerial positions, we cannot even dream about the realization of the first dimension. It is also entrepreneurial and visionary attitudes combined with the ability to effectively cooperate with the external and internal environment, which give the whole enterprise management. The third dimension, which is the result of the first two is the culture of entrepreneurship, which is responsible for creating and developing an entrepreneurial atmosphere throughout the organization. The last dimension, i.e. orientation/direction towards innovations cannot be missing in a modern enterprise, because without these activities the company will not develop, which leads in the XXI century even to "going backwards".

According to the author, it should also be noted in conclusion that the respondents, i.e. the owners of the surveyed companies, are perfectly aware that the right proportions of the implementation of activities from the identified dimensions of entrepreneurial management, lead their organizations to build a sustainable competitive advantage in the market.

Of course not everything is so ideal, because as the analysis of the research results has shown, very often there is a clear lack of implementation (observance) of permanent system solutions, which are characteristic for large enterprises. On the one hand, there seem to be structures conducive to creating an entrepreneurial culture, but there are no formalised tools to utilise the potential of all employees. On the other hand, the managers seem to have appropriate qualifications and knowledge to apply partnership management systems, but they lack the tools. In such conditions, unfortunately, it is very difficult to achieve far-reaching goals.

Moreover, the collected empirical material shows that entrepreneurs perceived the importance for the development and success of their enterprises in the identified dimensions of entrepreneurial management - they attributed great importance to innovative management methods and human capital. They also did not forget about increased competition and competitive activities, in the face of market saturation with entities of similar size, which in their offer have similar or even identical products or services. Certainly, an important factor associated with entrepreneurial management is the management - their personality traits, professional competence or consistency in action.

The analyses and studies presented in the empirical part may in the future provide practical guidance for building a dynamic and competitive organizational structure in an uncertain and changing environment. In this approach, we can assume that the pursuit of developing dynamic capabilities is realistically achievable through a partnership management style and organizational learning that are supported by increasing levels of entrepreneurial management. Of course, assuming that cognition is a phenomenon with a high degree of subjectivity, further development of the undertaken topic, in the future we will be able to achieve by expanding the quality and scale of qualitative research. According to the author, this will allow to further define the role of

entrepreneurial management in the development of capabilities of dynamic enterprises, precisely from the SME sector.

In conclusion, according to the author of the article, the current trends in the global economy favor the development of enterprises based on entrepreneurial management. This optimistic attitude has its basis in the analysis of research results, as it was possible to identify (not only but as much as) 4 dimensions of entrepreneurial management in the surveyed entities from the SME sector. Importantly, the results of the study apply to the period after 2020 and, according to the author, already reflect the economic landscape affected by the conditions of the COVID-19 pandemic - that is, the difficult economic situation and turbulence in the labor market. Certainly, in connection with the dynamic changes taking place in the economic markets and the growing demand for information on the dimensions of entrepreneurial management in the SME sector, the author of the article plans to carry out the described study on a larger group of entrepreneurs and their companies, so that the results obtained are adequate for the entire population.

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**Mchal IGIELSKI Ph.D.**, Gdynia, Maritime University. Research interests: human resources management, entrepreneurship, competitiveness

**ORCID ID:** [orcid.org/0000-0003-4680-3733](https://orcid.org/0000-0003-4680-3733)

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## THE IMPACT OF SOCIAL MEDIA MARKETING ON YOUTH BUYING BEHAVIOR IN AN EMERGING COUNTRY

**Rizwan Ali <sup>1\*</sup>, Vera Komarova <sup>2</sup>, Tanveer Aslam <sup>3</sup>, Kęstutis Peleckis <sup>4</sup>**

<sup>\*1,3</sup>*Lahore Business School, The University of Lahore, 1-KM Defence Road, Lahore, Punjab, Pakistan*

<sup>2</sup>*Institute for Humanities and Social Sciences, Daugavpils University, Vienības 13, LV-5401, Daugavpils, Latvia*

<sup>4</sup>*Vilnius Gediminas Technical University (VILNIUS TECH), Sauletekio 11, LT-10223, Vilnius, Lithuania*

E-mails: <sup>1\*</sup>[rizwan.ali1@lbs.uol.edu.pk](mailto:rizwan.ali1@lbs.uol.edu.pk) (Corresponding author); <sup>2</sup>[vera.komarova@du.lv](mailto:vera.komarova@du.lv);  
<sup>3</sup>[tanveer.aslamlic@gmail.com](mailto:tanveer.aslamlic@gmail.com); <sup>4</sup>[kestutis.peleckis@vilniustech.lt](mailto:kestutis.peleckis@vilniustech.lt)

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**Abstract.** The research aims to investigate the impact of social media marketing (SMM) on youth buying behavior in Pakistan. This study is empirically supported by the results of a survey conducted by the authors in ten universities in Lahore city (Pakistan) in March-June 2020 on a sample of 244 students (social media users) aged from 18 to 35. By conceptually dividing social media marketing into SMM advantages and website design & features, the purpose of this study became more specific: (1) to find the relationship between SMM advantages (convenience, timesaving, security of knowledge) and youth buying behavior; (2) to find the relationship between website features & design and youth buying behavior. Results of the analysis of the aggregate influence of SMM advantages on Pakistani youth buying behavior showed that they increase the intention to purchase by 42.9%. At the same time, website design & features used within social media marketing have even more positive effects on youth buying behavior, increasing the intention to purchase by 55.2%. Young buyers in Pakistan prefer attractive and well-designed websites or social media with many unique features for buying products and services. Thus, all research hypotheses are proved based on the survey data: social media marketing raised by unit positively affects Pakistani youth buying behavior by 53.5%, and the rest 46.5% could be conditioned by other non-market external and internal factors. The novelty of this study lies in investigating behavior patterns of the fast-growing segment of consumers of Pakistan, which, are the most active consumers of goods and services and social media users today and in the future.

**Keywords:** social media marketing (SMM); consumer buying behavior; youth; Pakistan; regression and ANOVA analysis.

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**JEL Classifications:** M31, D12, C12

**Additional disciplines:** sociology, communication science



## **1. Introduction**

Since its inception in 1996, social media has managed to infiltrate half of the 7.7 billion people in the world (Dean, 2021). Social network platforms almost tripled their total user base in the last decade, from 970 million in 2010 to the number passing 4.48 billion users in July 2021 (Dean, 2021). Social media help companies to successfully organize their communication with target consumers. Social media marketing (SMM) refers to the commercial behavior initiated via social media (Zhang and Daugherty, 2009; Kazaka, 2009, 2012; Harvey et al., 2011; Tiago and Veríssimo, 2014; Jankovic, 2020). There are two types of SMM: user-generated content-based and social-based SMM (Mangold and Faulds, 2009; Chan and Guillet, 2011; Zeng and Wei, 2013; Alves et al., 2016). Such social media as blogs and micro-blogs, social networks, content communities, forums, and wiki are becoming increasingly popular among users. It also motivates companies to communicate in this environment (Kazaka, 2011).

Social media has been widely used by firms as a marketing strategy tool. In 2021, 91.9 percent of the USA marketers in companies largest than 100 employees were expected to use social media for marketing purposes (Statista Research Department, 2022a).

Social media marketing has acquired surprising changes in the way by which companies interact with customers by offering their goods and services. Buying behavior of consumers influences the advertisers. A need to understand consumers' needs arises. It is especially important to understand the needs of growing consumer segments. In emerging countries, as a rule, youth is a growing segment of consumers. Besides, digital technologies have already impacted the lifestyle of youth the most, almost in all countries, irrespective of their development stage. The research aims to investigate the impact of social media marketing (SMM) on youth buying behavior in Pakistan. We believe that the study, ultimately, could be instrumental in finding the consistent patterns of the buying behavior of youth of similar emerging countries too.

The research is vigorous and has explicit implications for the marketers to efficiently use the internet for positioning their products. Social media marketing opens new horizons for marketers through its latest strategies of promoting services and products, these styles cannot be experienced while using old traditional styles and practices. In the present, organizational survival in the market and their efficiency in generating more profit with performance can be influenced by investigating buying behavior and customer satisfaction. Therefore, firms are more sensitive to evaluate the effectiveness of their marketing strategies in determining consumer buying behavior. This study is empirically supported by the results of a survey conducted by the authors in ten universities in Lahore city (Pakistan) in March-June 2020 on a sample of 244 students (social media users) aged from 18 to 35. Survey data is processed using the regression and ANOVA analysis methods.

In the next chapter of the article, the authors provide a relevant literature review to form the theoretical background and shape the originality of this study. Then a conceptual framework of the study and research methodology is described, then research results and discussion are provided, as well as conclusions and recommendations for future research on the relationship between social media marketing (SMM) and youth buying behavior.



## **2. Literature Review**

The process of communicating information, by employing non-personal and openly sponsored communication to promote/sell any idea, goods and services is known as advertising (Hee and Yen, 2018). Centuries ago advertisements were used as a tool to promote a firm's services, information, and goods that a business or market wants to sell to customers. After it, social media advertisements have evolved as giving a message about the usefulness of a good or service to attract customers. Nowadays, there is a different kinds of advertising channels, for example, covert, social, print, celebrity, broadcast, surrogate, and outdoor advertisements, etc., used by firms as a medium to market their products while informing the customers about the promotion of products (Nartey, 2010).

The findings of José García et al. (2009) have different implications for research and also practical use. First, helpfulness, perceived trust, and convenience are basic to the accomplishment of a web-based exchanging framework. Second, perceived protection influences consumers' convictions in trust. Since trust and helpfulness are the most vital forerunners of social expectation, managers can increase turnover by improving customers' opinions about security instruments a company is using.

At the cultural level, the consumption patterns of a particular society impact the buying behavior of people. Some previous research showed that Muslims would buy a product based on advice from the religious community, or others; whereas the Chinese would never buy products by consulting other on their opinion since they rely on their own opinion on products or services they need (He et al., 2010). At the social level, the opinion may vary across social classes with low, middle, and upper income due to different priorities and consumption structures, e.g., consumers with lower income may seek to fulfill their needs rather than find advertised and high-quality products. On the other hand, buying decisions in higher social classes may differ as they may seek to obtain advertised and branded products (Chahal and Rani, 2017). In addition, psychological factors, such as 'word of mouth' influence the consumer perception through social media and social networking sites (Cetinã et al., 2012; Javaria et al., 2020). To conclude, understanding of factors, impacting consumers' preferences facilitates the formulation of successful marketing strategies tackling selected segments of consumers (Muniady et al., 2014).

Nowadays, marketing endorsements have become a key factor in attracting consumers; they are used to achieve a company's goals and good reputation (Lim et al., 2017). In the age of globally connecting technology known as the Internet, media influencers have emerged as endorsers of marketing (Freberg et al., 2011). Media influencer engages the consumers by updating them regularly with the latest knowledge about the most recent information (Liu et al., 2012). According to Lim et al. (2017), social media marketing has become the most effective and cost-efficient marketing tool. Perhaps in recent years, social media marketing has proved it as a potential endorser. Most companies invite social media marketers such as bloggers, vloggers, social marketers, website marketers, etc. to be their brand ambassadors.

According to results of Stephen (2016), buying behavior based on social media marketing is growing rapidly due to the increase in technology use. Social media information is becoming one of the major influencing factors for consumer decision-making. His research was realized to elaborate on how consumers are influenced by the social environment. Furthermore, his research elaborated on consumer issues. He identified five dimensions such as consumer social culture, mobile environment, effects of social environment on buying behavior, responses to social advertising, and 'word of mouth (WOM) (Stephen, 2016). Previous articles collectively shed light from a different perspective on the social media marketing environment and its influence on consumer buying behavior (Harvey et al., 2011; Kazaka, 2012; Jankovic, 2020). Although, there is still a necessity to understand more deeply social media marketing advantages as a part of the consumer social experience.

In the world, the total number of people using social media grew by 9.2% between April 2019 and January 2020 (Dean, 2021). When looking at the number of social media users growing by region, Europe had the slowest increase of new active users at 4.9%. Whereas Asia was the most considerable social media user base growth at 17.0%, followed by Africa increasing by 13.9% (Dean, 2021). Thus, social media marketing is a big challenge for Pakistan, where active social media penetration in January 2022 was lower than the worldwide average and lower than in many countries of Asia. In Asia, the UAE is the leader with an active social network penetration rate of 106.1%. Malaysia ranked in second place with 91.7% and South Korea ranked third, with 91.2%. In January 2022, the overall worldwide average social media penetration rate was 58.4% (Statista Research Department, 2022b). The specifics of Southern Asia (also Pakistan) is 27% female vs. 73% male users of social media (in Western Europe, 50% female vs. 50% male users) (Dean, 2021). At the same time, the specifics of Pakistan itself is a relatively low share of internet users in the country: 55.6% of the population in 2021 (in India – 61.6%, in China – 70.8%, in Latvia – 82.2%, in the USA – 95.5%) (Statista Research Department, 2021).

Advertising has emerged as means of developing customer loyalty, sales efficiency, and awareness, in the recent decade marketing trends had changed a lot (Wymbs, 2011; Cole et al., 2017). Social media marketing has attracted the attention of researchers (Lamberton and Stephen, 2016). Lamberton and Stephen (2016) worked on the exploration of mobile and social media marketing from 2000 to 2015. Over these 15 years, social media marketing has revolutionized the traditional marketing concept. It has created more ways to sell, engage, learn, and provide marketing services to consumers. Their research found differences in perspectives on the above three marketing ways from 2000 to 2015 (Lamberton and Stephen, 2016).

Dahiya and Gayatri (2018) studied social media marketing used by the automobile industry of India. They noticed, that many other businesses such as music, fashion, banking, clothing, books, gaming, etc. were using social media marketing too. The purpose of their research was to understand the influence of social media marketing on consumer buying behavior in the passenger cars market. Dahiya and Gayatri (2018) used a mixed methodology for their study. Researchers concluded that most of the respondents (75%) used websites as a social channel of communication, while buying a car they used social networking sites. Results of Dahiya's and Gayatri's study suggested that social media marketing was capable of triggering awareness of mega-brand products such as automobiles. In addition, it appeared, that the consumers were engaged by communicating with each other on social platforms.

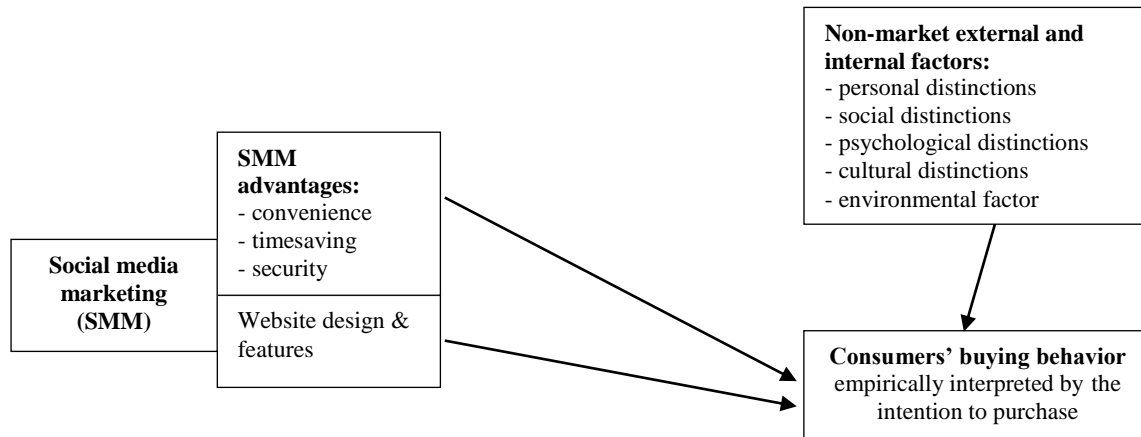
Haider and Shakib (2017) revealed the impact of social image on buying behavior of customers. In their research, the scientists suggested a conceptual model that embraces the impact of four independent variables on consumer buying behavior. Primary and secondary data were collected for analysis. The obtained results showed a statistically significant positive relationship between familiarity, social imaging in an advertisement, advertisement spending, and consumer buying behavior (Haider and Shakib, 2017). This study shed light on some very important factors that can be instrumental for promotional and advertisement business.

Therefore, the conclusions drawn from the above literature review are that there is still a gap in research about the impact of social media marketing on youth (as more active internet and social media users) buying behavior. Especially this is topical for emerging countries, such as Pakistan, which still are on their way to gaining momentum in economic development. This gap needs can be filled by examining the effect of social media marketing on buying behaviors of this rising sector of consumers. The authors hope to contribute to narrowing this gap through their original research based on an empirical survey of Pakistani youth on how their buying behavior hypothetically is influenced by social media marketing.

### 3. Conceptual Framework and Research Methodology

Consumer buying behavior is the main concept of this study that includes individuals, groups, and organizations' activities of selection, purchasing, disposal, or use of goods, services, experiences, or ideas to meet the demand of customers suggested by Shih et al. (2015). According to Dudovskiy (2013), consumer buying behavior is related to buying and disposing of goods to get the satisfaction of physical, emotional, and other needs. Consumer buying behavior is the intention to buy a good or service. The consumer always has the power and right to decide between buying (Young Kim, & Kim, 2004). According to Shethna (2019), four main external factors that influence the consumers' buying behavior are personal, social, psychological, and cultural distinctions. In turn, Haider and Shakib (2017) suggested also considering an environmental factor while investigating the impact of social media marketing on youth buying behavior.

The next figure presents the conceptual framework for the investigation of the impact of social media marketing on consumers' buying behavior. It includes, firstly, the authors' conceptual understanding of the social media marketing (SMM) as the combination of SMM advantages (convenience, timesaving, security) (Haider and Shakib, 2017) and website design & features (Ranganathan and Ganapathy, 2002) and, secondly, the conceptual understanding of the consumers' buying behavior empirically interpreted by the intention to purchase. Consumer buying behavior is hypothetically influenced by both social media marketing as a market factor and a set of non-market external and internal factors (Figure 1).

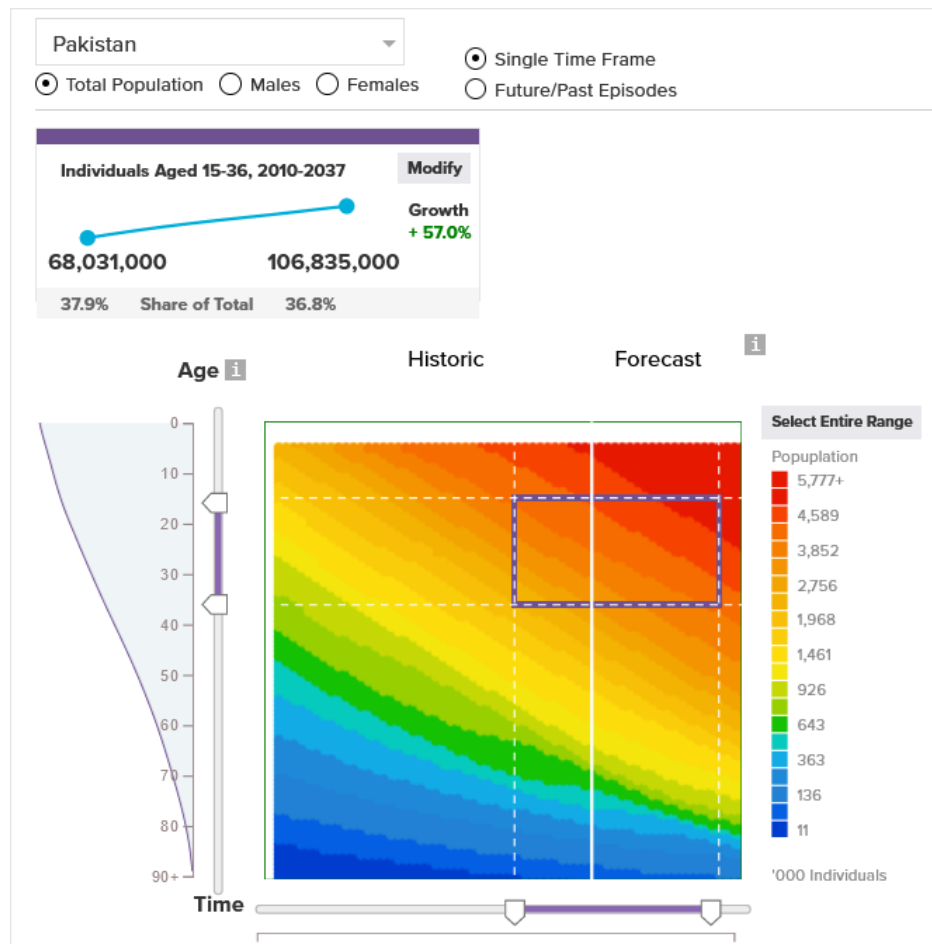


**Figure 1.** The conceptual framework for the investigation of the impact of social media marketing on consumer buying behavior  
*Source:* elaborated by the authors based on Young Kim, & Kim, 2004; García et al., 2009; Stephen, 2016; Haider and Shakib, 2017; Shethna, 2019.

Thus, by conceptually dividing social media marketing into SMM advantages and website design & features, the purpose of this study became more specific:

- (1) to find the relationship between SMM advantages (convenience, timesaving, security of knowledge) and youth buying behavior;
- (2) to find the relationship between website features & design and youth buying behavior.

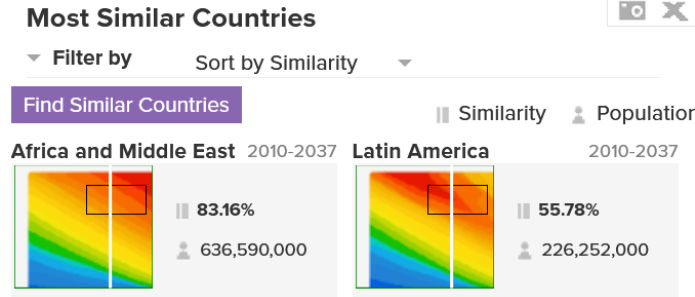
As was already mentioned in the introduction to this article, the research object of this study is youth, i.e. people aged from 18 to 35. To the surprise of many observers, Pakistan's last census revealed faster-than-expected population increases. High fertility continues to drive substantial population growth in the world's fifth most populated country (Goujon et al., 2020). Figure 2 presents the actual and forecasted demographic structure in Pakistan. It clearly shows that individuals, aged from 15 to 36 comprise the most important part of the economically active population. Forecasted data until the year 2037 shows, that this segment will grow by 57%. Therefore, it is very important to understand patterns of reasons for buying behavior of people belonging to this group since that would allow using their buying capacity.



**Figure 2.** The actual and forecasted demographic structure in Pakistan

Source: Passport (Euromonitor International)

<https://www.portal.euromonitor.com/portal/dashboard/dashboarddetails#/>



**Figure 3.** The actual and forecasted demographic structure in the most similar regions

Source: Passport (Euromonitor International)

<https://www.portal.euromonitor.com/portal/dashboard/dashboarddetails#/>

The Figure 3 above presents two the most similar regions by the population structure and its forecast, filtered automatically by Passport database. We see that similarity level of Asia and Middle East region is 83.16%, and, respectively, Latin America is found to be similar by 55.78%. This similarity allows to assume, that results of the research may allow to reveal consistent patterns of youth buying behavior in other similar emerging countries too.

The following hypotheses were framed, in tune with the above research objectives:

Hypothesis 1: Social media marketing advantages influence Pakistani youth buying behavior positively.

Hypothesis 1a: Convenience in social media marketing influences Pakistani youth buying behavior positively.

Hypothesis 1b: Timesaving by social media marketing influences Pakistani youth buying behavior positively.

Hypothesis 1c: Security of knowledge in social media marketing influences Pakistani youth buying behavior positively.

Hypothesis 2: The website's unique features & design influence Pakistani youth buying behaviors positively.

Hypothesis 3: Social media marketing influences Pakistani youth buying behaviors positively.

This study involved respondents-students from ten universities in Lahore (the largest city in Punjab, Pakistan). The convenient sampling technique was used, to calculate the sample size (Table 1). The data were collected through a questionnaire, which was designed according to the conceptual framework for the investigation of the impact of social media marketing on consumer buying behavior (Figure 1). The survey consisted of two parts. The first part was to understand the socio-demographic profiles of respondents, using a nominal scale. The second part covered the perception of respondents, regarding the constructs of the conceptual framework (Figure 1), using a five-point Likert scale. The questionnaire was distributed among university students in Lahore city (Pakistan) from March to June 2020.

In this research primary data was collected by using a structured questionnaire. Respondents were selected by non-probability sampling due to time and resources constraints. Both self-administered paper-based surveys and online surveys were conducted. 300 questionnaires were distributed. To fill out the questionnaire, it took on average 10-15 minutes by hand or online. An online questionnaire was developed on Google drive and distributed through e-mails and social networks. Out of 300, 150 questionnaires were sent online, and the rest 150 were distributed offline. Out of 150 online questionnaires, 130 were returned and from offline distributed questionnaires 114 were returned. So, a total sample of 244 respondents-students was considered as a final sample of this study.

The instrument has been designed based on a five-point Likert scale, from ‘strongly disagree’ to ‘strongly agree’. The scale for consumers’ buying behavior starts from 1 for ‘never’, then 2 for ‘very rare’, 3 for ‘sometimes’, 4 for ‘often’, 5 for ‘very often’. The respondents were asked to select one degree, which is suitable in their opinion. The authors used statistical methods of regression and ANOVA analysis, and SPSS software for analyzing variables and quantifying relationships between them.

#### 4. Results and Discussion

The data in Table 1 shows the demographic profiles of 244 respondents in this survey. Most of the respondents are male (57.4%), the age of 63.1% of respondents is between 18 and 20 years, the education is usually BSc / BA (42.6%), but there are also MSc / MA and MPhil is about to employed of private workers and their response rate 48.4%.

**Table 1.** The summary of socio-demographic profiles of respondents, n = 244, March-June 2020

Variables	Positions	Frequency	%
Gender	Male	140	57.4
	Female	104	42.6
Age	18-20	154	63.1
	21-25	72	29.5
	25-30	8	3.3
	31-35	10	4.1
Education	Intermediated	75	30.7
	BSc / BA	104	42.6
	MSc / MA	46	18.9
	MPhil	19	7.8
Employment	Employed government official	78	32.0
	Employed private worker	118	48.4
	Business owner	34	13.9
	Unemployed	14	5.7

*Source:* calculated and elaborated by the authors using their data an SPSS software

The results of reliability analysis show that Cronbach’s Alpha is above 0.70 (0.817, number of items – 26), which means that the data and instrument are reliable for further analysis.

Furthermore, the data in Table 2 shows that all SMM advantages, as well as website design & features, influence consumers’ buying behavior positively, increasing the estimated frequency of purchases. They have the greatest

positive effect (42.9%) in the aggregate. If we will analyze them separately, the time-saving advantage has the most positive effect (42.6%) on buying behavior. Although, even more than SMM advantages, website design & features influence consumers' buying behavior – by 55.2%. Social media marketing has positive relation and affects Pakistani youth buying behavior by 53.5%. These results are in line with findings of the previous studies conducted in different countries in Asia (Teo and Yeong, 2003; Young Kim and Kim, 2004; Haider and Shakib, 2017; Hee and Yen, 2018).

**Table 2.** Results of the regression analysis, n = 244, March-June 2020

Variables	R	R Square	Adj. R Square	Std. Error
Convenience	0.271 <sup>a</sup>	0.073	0.069	0.56812
Timesaving	0.426 <sup>b</sup>	0.181	0.178	0.53392
Security of knowledge	0.278 <sup>c</sup>	0.077	0.073	0.56692
SMM advantages	0.429	0.184	0.180	0.53315
Website design & features	0.552	0.304	0.302	0.49215
Social media marketing as a whole	0.535	0.286	0.283	0.49215

*Note:* The dependent variable is the intention to purchase.

*Source:* Calculated and elaborated by the authors using their own data an SPSS software.

The data of Table 3 shows the results of ANOVA analysis for social media marketing (SMM) advantages (convenience, timesaving, security) as well as website design & features effects on consumers' buying behavior measured by the frequency of purchases. From the table data, it can be observed the value of F is greater than 2, and p-value is significant, which means there is a significant relationship between independent and dependent variables also found by Teo and Yeong (2003), Haider and Shakib (2017), Young Kim and Kim (2004), Hee and Yen (2018).

**Table 3.** Results of ANOVA analysis, n = 244, March-June 2020

Variables	Indicators	Sum of Squares	Df	Mean Square	f-stats	Sig.
Convenience	Regression	6.168	1	6.168	19.111	0.000 <sup>a</sup>
	Residual	78.107	242	.323		
	Total	84.276	243			
Time-saving	Regression	15.287	1	15.287	53.626	0.000 <sup>b</sup>
	Residual	68.988	242	0.285		
	Total	84.276	243			
Security	Regression	6.498	1	6.498	20.218	0.000 <sup>c</sup>



	Residual	77.778	242	0.321		
	Total	84.276	243			
SMM advantages	Regression	15.486	1	15.486	54.480	0.000
	Residual	68.789	242	0.284		
	Total	84.276	243			
Website design & features	Regression	25.661	1	25.661	105.947	0.000
	Residual	58.614	242	0.242		
	Total	84.276	243			
Social media marketing as a whole	Regression	24.137	1	24.137	97.131	0.000
	Residual	60.138	242	0.249		
	Total	84.276	243			

*Note:* The dependent variable is the intention to purchase.

*Source:* calculated and elaborated by the authors using their own data an SPSS software.

Results of the analysis of the aggregate influence of SMM advantages on Pakistani youth buying behavior showed that they increase the intention to purchase by 42.9%. At the same time, website design & features used within social media marketing have even more positive effects on youth buying behavior, increasing the intention to purchase by 55.2%. Young buyers in Pakistan prefer attractive and well-designed websites or social media with many unique features for buying products and services. Thus, all research hypotheses are proved based on the survey data: social media marketing raised by unit then positively affects Pakistani youth buying behavior by 53.5% and rest 46.5% could be other non-market external and internal factors such as personal distinctions, social distinctions, psychological distinctions, cultural distinctions, or environmental factor (Figure 1).

## 5. Conclusions

This study was empirically supported by the results of the survey conducted by the authors in ten universities in Lahore city (Pakistan) in March-June 2020 on a sample of 244 students (social media users) aged from 18 to 35. The study aimed to examine the relationship between social media marketing (SMM) advantages (convenience, timesaving, security) and website design & features conceptually included in social media marketing as a whole and the Pakistani youth buying behavior. Regression and ANOVA analysis of the survey data was conducted, and it was found that social media marketing (especially website design & features) influences buying behavior, statistically significantly increasing the Pakistani youth's intention to purchase.

Based on the authors' elaborated conceptual framework for the investigation of the impact of social media marketing on consumer buying behavior (Figure 1), firm managers and marketers can understand the effects of the market and non-market factors. Young consumers, who are interested and looking for further information about products, can enhance their knowledge about the product from websites. The results of this study show in sequence such as convenience, timesaving, and security's p-value 0.000 clear evidence that it has a positive and significant impact on Pakistani youth buying behavior. Furthermore, F-value of social media marketing advantages, website design & features, and social media marketing, which is more than 2, and p-value = 0.000

show the existence of a statistically significant positive relationship between a dependent (youth buying behavior) and independent variable.

The main limitation of this study is the specific object of study - Pakistani university students from one large city located in the east of the country. This means, firstly, that the survey respondents were active educated social media users, which is not typical for the entire population of Pakistan. Secondly, the survey respondents were urban people from one region of the country.

These limitations make it possible to extend the results of this study only to digitally active and interesting to marketers and businesses segment of the population of Pakistan, which, nevertheless, are the most active consumers of goods and services and social media users today in the future.

The authors, therefore, believe that the results of this study would be practically valuable and helpful for Pakistani company managers, academic communities as well as potential investors to design successful policies by considering the significant positive influence of social media marketing (especially of its element as website design & features) on Pakistani youth buying behavior. Further research in this area can be done to find and analyze the new social media marketing (SMM) advantages, as well as to study the gender specificity of consumer buying behavior and social media use in Pakistan, and other emerging countries.

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**Rizwan ALLI, Dr.**, Assistant Professor in Marketing at the Lahore Business School of University of Lahore (Pakistan). His research interests are in consumer behaviour, marketing communications, pricing and consumer psychology. He has published his work in well reputed journals such as Psychology in the Schools, International Journal of Business Environment amongst others.

**ORCID ID:** <https://orcid.org/0000-0001-6551-2152>

**Vera KOMAROVA, Dr.oec., Mg. transl.** the leading researcher at the Social Investigations Centre of the Institute of Humanities and Social Sciences of Daugavpils University (Latvia). She has the status of the expert of Latvian Council of Science in the field of economics and entrepreneurship, economic and social geography, sociology, and the external expert of the COST Association. Her research interests are in regional economics, sustainable development, creative economy, social research methodology, quantitative research methods

**ORCID ID:** <https://orcid.org/0000-0002-9829-622X>

**Tanveer ASLAM, PhD scholar** at the Lahore Business School of University of Lahore (Pakistan). His research interests are in consumer behavior, international relation. He has published number of papers in reputed journals.

**ORCID ID:** <https://orcid.org/0000-0002-2048-9515>

**Kęstutis PELECKIS, Dr.**, professor at the Department of International Economics and Management of Vilnius Gediminas Technical University (Lithuania).

**ORCID ID:** <https://orcid.org/0000-0001-9886-2431>

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## THREATS AND THEIR TRIGGERS IN THE GLOBALIZED ECONOMY\*

Dagmar Kopencova <sup>1</sup>, Vladimir Sulc <sup>2</sup>, Roman Rak <sup>3</sup>, Magdalena Naplavova <sup>4</sup>, Frantisek Vlach <sup>5</sup>

<sup>1,2,3,4,5</sup> Department of Security and Law, AMBIS University, Lindnerova 1, 180 00 Prague 8, Czech Republic

E-mails: <sup>1</sup> [Dagmar.Kopencova@ambis.cz](mailto:Dagmar.Kopencova@ambis.cz); <sup>2</sup> [Vladimir.Sulc@ambis.cz](mailto:Vladimir.Sulc@ambis.cz); <sup>3</sup> [Roman.Rak@ambis.cz](mailto:Roman.Rak@ambis.cz);  
<sup>4</sup> [Magdalena.Naplavova@ambis.cz](mailto:Magdalena.Naplavova@ambis.cz); <sup>5</sup> [FVlach@avs.justice.cz](mailto:FVlach@avs.justice.cz)

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**Abstract.** The paper deals with security issues in a globalized, economically oriented world. The authors present a general, theoretical-practical view of a systemic, object-process approach to analysing security threats of various categories. The paper generally analyses and categorises the sources and characteristics of threats according to various factors, which in practice may pose a threat to objects of interest or processes that have significant value for their owners. Emphasis is placed on threats of an economic, social, societal, or political nature that are typical of societies today, primarily unilaterally oriented towards economic gain. The authors' approach is purposefully general so that it can be applied to all sectors where security analysis is necessary i) to identify threats, weak spots in protected objects, states, or processes, ii) to discover vulnerabilities, iii) to realistically assess risks and propose protective measures.

**Keywords:** Threat; hazard; threat source; agent of threat; vulnerability; threat impact; economy; security; risk management

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**JEL Classifications:** C88, H56, J11, J15, F22, F24, F52

**Additional disciplines:** security, risk management, sociology, information system, informatics

## 1. Introduction

A globalized economy is not just a global market for products or services. The global economy is also strongly interconnected with raw materials and energy resources (Androniceanu, Căpălescu, Tvaronavičienė, Dobrin, 2021; Borodin, Tvaronavičienė et al., 2021), which can become significant threats to individual states and their economic groupings if the global balance is disturbed (Alanen, Linnsmaa et al., 2022). With the change in the global division of the world, the transport routes for energy, raw materials, and goods have also changed (Hudecova, 2021a; Hudecova, Chriastel, 2021).

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Today, security is part of every human activity (Adams, Chisnall et al., 2021). There are countless theoretical definitions of security, one more complex than the other (Hudecova, 2021b). However, from the simplest point of view, security is the preservation of the continuity of a particular state, process, or object. This can be our health, life, employment, the existence of a company, its sustainable development, business continuity, economic prosperity, a prosperous national economy, etc.

In a globalized world, sustainable development can therefore be understood as a security phenomenon in today's highly competitive environment full of diverse threats and the resulting risks (Tušer, Hoskova-Mayerova, 2020a; 2020b).

For effective security analysis, including economic security, it is, therefore, useful to look systematically through the prism of elementary objects, states, processes and the properties that determine their behaviour, including strengths and weaknesses, such as vulnerability in an environment full of real threats. We can understand security both regionally and globally (Chehabeddine, Tvaronavičienė, 2020). At present, threats involve digital technologies and cyberspace (Manulis, Bridges et al., 2021) more than ever before. Hybrid threats are also becoming part of the scene (Atkinson, Chiozza, 2021).

The impact of various events on an object is either neutral, positive, or negative, each object having its own resistance to a specific type of negative event (threat). This resistance is a property an object possesses, one which indicates a certain limit (boundary), with the object usually being resistant to several types of threats (Hammoudeh, Watters et al., 2021).

## **2. Material and methods**

We encounter the term “threat” in all security analyses. Threats exist in all fields of human activity - in industry, energy, economics (Periokaite, Dobrovolskiene, 2021), healthcare (Kharaishvili, Blake et al., 2021), military, critical infrastructure, information technology (Rak, Felcan, Kopencova, 2021), social sphere (Jackulikova, Vrankova et al., 2022; Jůzl, Vlach, 2022), politics, social sciences, etc. Generally speaking, threats can be any theoretical phenomenon that can negatively impact a protected object (protected asset), i.e. it has the potential to cause damage or injury.

At the Academy of the Police Force in Bratislava (Slovak Republic), a scientific research task was initiated to establish the new scientific field of Security Sciences. This new scientific discipline should theoretically address general safety in any field of human activity. One of the first tasks was to compare and unify the basic definitions used in domestic and foreign literature (Botrugno, Malagnino et al., 2022; Ansari, Pandey et al., 2022). In the first phase, an extensive literary search was conducted as part of the solution of the theoretical task (Ajdari, Asgharpour, 2011; Dirnbach, Kubjatko, 2020; Rak, Kopencova, Felcan, 2021). It was found that basic concepts are perceived differently by various security entities - security forces, scientific institutions, companies, and government institutions. The same concept can be perceived or defined identically, similarly, or even oppositely (Ni, Zou and Chen, 2022). The different perceptions of security concepts depended mainly on the field of human activity. For this reason, literary searches were repeated in several subsequent iterations for sources of domestic and foreign literature (Matuszak, Jaskiewicz et al., 2015; 2017). A dictionary of basic security terms and their definitions was then created. In the next phase, the Delphic Fortune Teller method was applied, whereby leading security experts were invited to comment on the results obtained from the search or to define or clarify the basic concepts themselves. Their comments were analysed and subsequently subjected to a complex synthesis. This gave rise to the definitions of threat, hazard, agent of threat, and their further subdivisions. For a better understanding, graphical methods were used to illustrate process relationships and dependencies.

### 3. Hazard

A **hazard** is understood to be the possibility to activate danger (a threat) in a specific time and space, respectively the source, actor of possible death, injury, or damage to health, causing damage or injury. In literature, a hazard also indicates all factors (threats) that can cause negative phenomenon. A hazard exists independently of the activities and behaviour of the reference object (subject) and the object causing the threat (Buzalka, Blažek, 2011). We can understand a hazard as being a security event.

A **hazard** is a condition affecting humans, objects, systems, processes, or the environment arising from activities (events, processes), whose hazardous properties have not been fully taken into account in ensuring security. Hazard reduction is achieved by minimising the acting agents (causes, sources of threats) implementing organisational and personnel measures, and through the design of a number of active and passive security elements (modified, expanded according to Šimák, 2015).

Within the field of occupational health and safety, various authors have defined a hazard as follows:

1. A **hazard** is a source of possible damage or injury to an object, process, or system from certain exposure and under certain conditions.
2. A **hazard** is a set of conditions created by humans or their interaction with natural influences or technical equipment, which results in the possibility of damage or injury to objects, processes, or systems.
3. A **hazard** is an active property of an object, process, or system (e.g. material, machinery, work activity, technical equipment, technology, or the specific situation) that causes a negative phenomenon that results in damage or injury. A hazard is only present if a person, the environment, property, or other values can potentially be exposed to an activated hazardous property.

A **hazard to an object** can be more narrowly defined as **the process resulting in the threat to an object being activated, whereby the limit (boundary) of the object's resistance has not yet been exceeded, i.e. no damage or injury has (yet) been caused**. When a hazard to an object occurs, object monitoring is usually activated and possible security measures implemented if the resistance limit is exceeded, or to prevent further hazard to the object or to increase its resistance.

*Example:*

*A tree bends strongly in a storm, but the branches and the trunk of the tree do not break. For preventive reasons, objects in the surroundings that could be damaged by falling branches or the trunk are cleared away and the area is closed off to the public. If it concerns a small tree, a stake is hammered into the ground to support it in the storm.*

If the limit of the object's resistance to one threat is exceeded, the process of destruction of the object due to damage, violation of its integrity, functionality, etc., begins. In practice, we perceive the threat to the object and the subsequent process of destruction of the object as a **security event involving the object**.

The hazardous state always lasts a certain time. Threats and the activation thereof can have a domino effect. Even if one threat stops, it could trigger another adverse event that further threatens or damages the object.

**Endangerment by a threat** is defined as the set of maximum impacts of the threat, which can be expected in a given place for a specified time interval with a probability equal to a specified value. According to norms and standards, this is determined by the magnitude of the threat that will occur with a probability or frequency distribution equal to 0.05 for a time interval of 100 years.

We can also understand a hazard to be an **emergency**. In the event of a hazard, no damage or injury will occur until the resistance limit of the object is exceeded. During an emergency, various active, usually known or planned procedures, are therefore implemented to delay the resistance limit being exceeded or to strengthen the resistance of the object so that there is no deformation or damage to the object and its functionalities (Buzan, Wæver, 2003). Unfortunately, such measures are not always effective.

#### 4. Agent of threat

Within the context of security terminology, the term “agent” has synonyms like source, originator, initiator, actor, attacker, or cause.

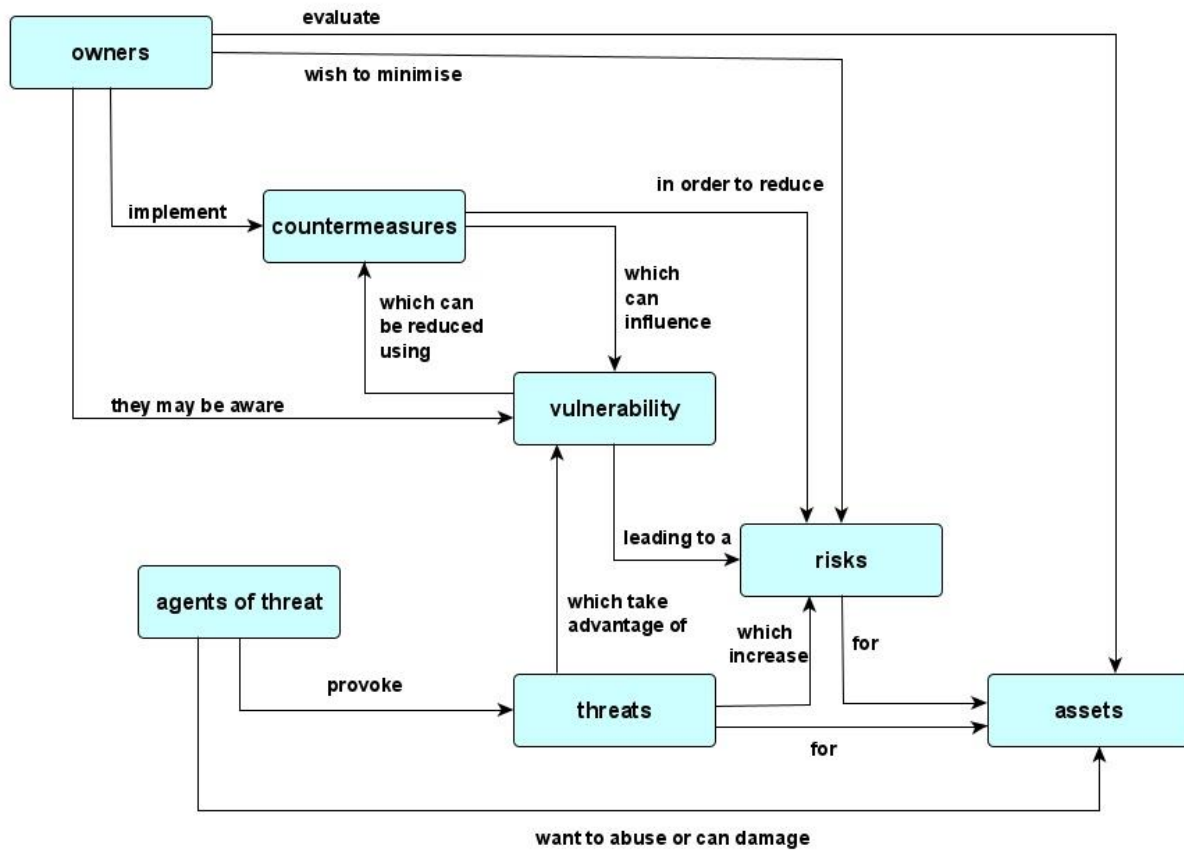
An **agent of threat** is an entity, object, or process that initiates or triggers a threat. In professional literature, synonyms include **source, originator, initiator, actor of the threat, attacker, or cause of the threat**. A threat can be triggered by several agents at the same time. Examples of threats and their agents are presented in Table 1 below.

**Table 1.** Examples of threats and their agents.

Agent of threat	Threat
Undersea earthquake.	Tsunami wave.
Igniter.	Bomb, grenade explosion.
Low salaries.	Key employees leaving a company.
Dissatisfaction, frustration, burnout.	Loss of loyalty, betrayal, employee leaving to join a competitor.
Inattention, ignorance, irresponsibility in inspecting technical equipment.	Occurrence of a failure, subsequent aircraft crash, vehicle brake failure, etc.
The extreme-left or extreme-right coming to power.	Violation of democratic principles in a country, threat to constitutional security.
Human inattention.	Traffic accident.
Unsecured money deposits, low morale.	Theft of money.
COVID-19 pandemic.	Diseases, deaths, declining economic productivity, social unrest, political instability.

*Source:* Authors

In other literature, **agent of threat** is synonymous with **motivation**, as defined by an interest in initiating a threat to an asset (Smejkal, Rais 2013). However, this definition is only applicable to intentional threats. Flow diagram of the dependencies of basic security elements (concepts) within security management is presented below in Figure 2.



**Figure 1.** Flow diagram of the dependencies of basic security elements (concepts) within security management. Processed according to ČSN ISO/IEC 15408-1.

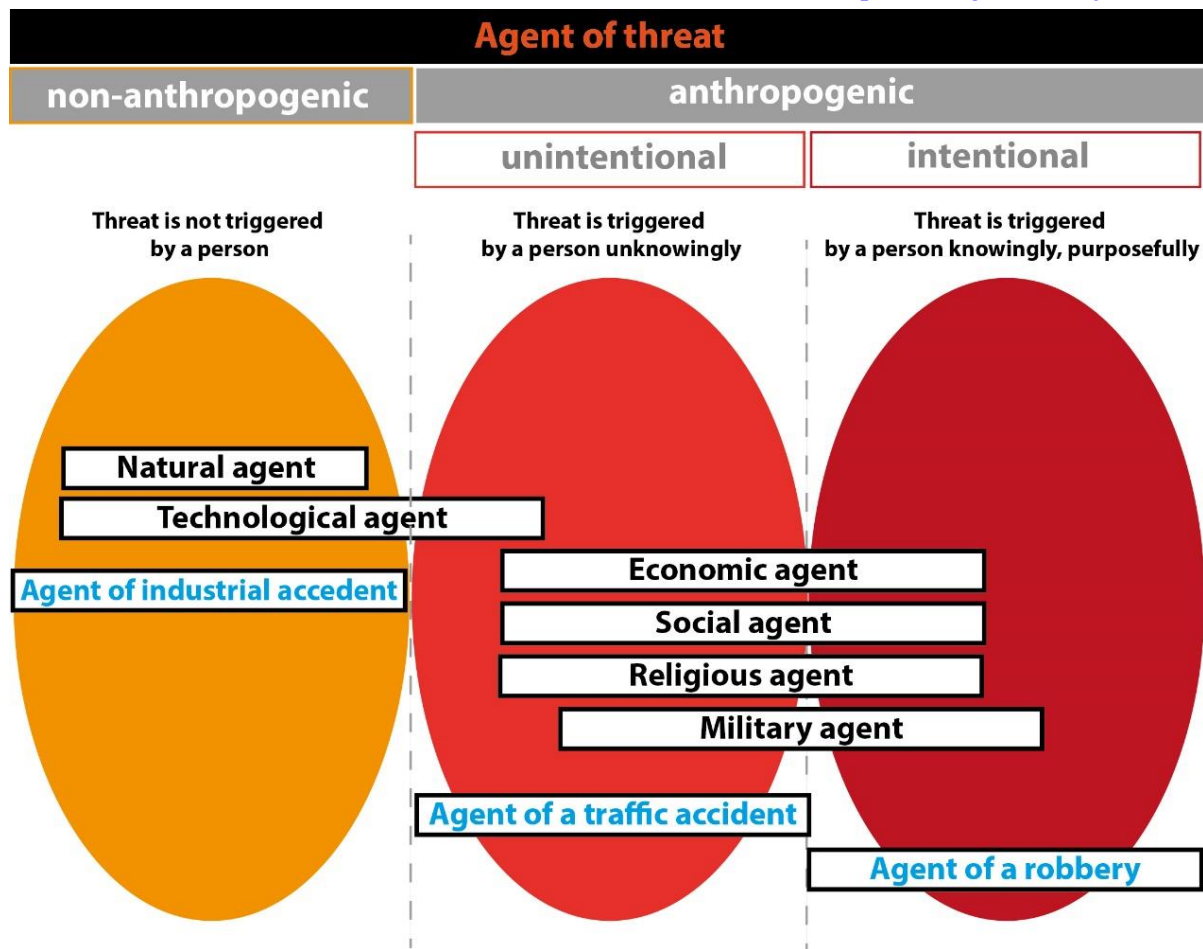
Source: Roman Rak

The behaviour of agents of threat can be predictable, completely unpredictable, random, and without any obvious context (Dirnbach et al., 2020).

Agents of threat can be natural processes and technological processes from which unintentional threats arise. However, an agent of threat can also be a person, different groups of people, associations of different organisational forms and institutions. Threats can then be triggered knowingly (intentional threats) or unknowingly (unintentional or unwanted threats).

In the case of intentional threats and events, the motivation is usually conditioned by the value of the object of interest (material goods, information) and the values or motivation of the “attacking” object - a person (revenge, the instinct for self-preservation, etc.).

In practice, for some threats, it is imperative that they are prevented from becoming reality. This can be done by “eliminating” the actor of the threat, which then cannot activate (initialise, trigger) the threat to the object(s), so the threat is not carried out (see Figure 3).



**Figure 2.** Agents of threat can be divided into non-anthropogenic (not triggered by a person) and anthropogenic (triggered by a person). These are further divided into unintentional (unknowingly triggered) and intentional (knowingly triggered). Agent of industrial accident - in this case, it could concern a situation in which a failure occurs due to material fatigue in hitherto unknown operating conditions. Humans created the technology but could not influence it in extreme conditions. Agent of traffic accident - driver inattention, fatigue (unintentional anthropogenic agent). Agent of robbery - desire for profit, planned robbery.

Source: Roman Rak

## 5. Basic and specific agents of threat

In practice, agents of threat can be divided into the following **basic types** (although, significantly more exist depending on the point of view and the depth or accuracy of their classification):

- **Natural agent** - the trigger of the threat is nature itself, natural phenomena, events, and processes. It is usually not possible to stop this type of agent, i.e. prevent the threat from being activated at all, so that it does not freeze, the wind does not blow, there is no earthquake or tsunami, measles and smallpox do not spread in developing countries, etc.
- **Economic agent** - this agent triggers threats based on economic characteristics and indicators (*high exchange rate of the domestic currency prevents economic development; non-payment of child support, risks distraint*) (Nálepová, 2020; Kliková, 2017).

- **Societal agent** - the threat is triggered by something that happens in society (Jakulikova et al., 2020) (*for example, “when those who rule can no longer rule in the current way and those who form the mass of the people no longer want such a government”*).
- **Religious agent** - the trigger of the threat can be ideological, religious beliefs, opinions, requirements, which in their essence promote other religious or power interests; they are in conflict with other ideas, religions, etc.
- **Military agent** - the trigger for the threat is the transition from solving problems or conflicts by political means to their solution by weapons and military force.
- **Technological agent** - the threat to the object is activated by a certain technology, created and (not) controlled by man. The moment of launch or activation of the threat can be accidental (fault, defect, etc.) or planned at a certain point in time (Kubjatko et al., 2018; Böhm et al., 2020). For example, a terrorist bomb is detonated by a mobile phone or a time trigger. The threat activating technology agent is therefore the mobile phone or timer. In this case, the technological agent is subordinated (controlled) by an anthropogenic, intentional agent.
- **Anthropogenic agent** - the initiation always involves human factor, i.e. a person or a group of people. The threat can be activated by an individual or a group of people of various sizes (institutions), either knowingly (*intentional threat*) or unknowingly (*unintentional threat*), etc. It is important to realise that the anthropogenic agent does not have to trigger or activate the final threat immediately, but gradually, with time delays and through other agents (anthropogenic and non-anthropogenic) (Stieranka, Busarova, 2017).

In general, activating various threats through agents can be done gradually.

Example:

*Poor quality materials in a thermostat prevent the circulation pump from switching on. The temperature of the coolant rises. The warning light comes on, but the driver doesn't notice. Due to the lack of refrigerant, which begins to evaporate, the engine temperature rises and the engine stalls.*

*In this case, there are de facto two agents responsible for the threat of stalling: poor quality materials and an ignorant or inattentive driver, who should have noticed the temperature indicator light come on and prevented a further temperature increase by taking specific, known measures.*

Similar dependencies of the actors of the threat and danger can be observed in intentional and unintentional anthropogenic agents. The human race is characterised by organisation, which can be hierarchical, flat, etc.

Different entities (individuals, organised groups of people in various forms of institutions) can then act in sequence (gradually over time) on other anthropogenic subjects, both intentionally (consciously, knowingly) and unintentionally (unconsciously, unknowingly) and ultimately activate a specific threat. The activation of the final threat can take place in several successive steps. The final threat can be, for example, terrorism, organised crime, the penetration thereof into political and executive structures (Kotlan, 2020), a political coup, social or economic instability, revolution, war, etc.

According to their interests, **anthropogenic agents** can be divided into the following **specific types**:

- **Minority or individual interest agents (executive agents)** - these agents are usually at the lower level of the human process management hierarchy. They carry out, knowingly or unknowingly, certain activities usually ordered by their superiors, or have and assert personal interests or the interests of small groups of people. In some cases, they may not be aware of the threats they cause, e.g. duress within the field of



forensics. From a global perspective, the impacts of these threats on society do not have to cause significant damage or injury to the state (even if these result in substantial financial costs or cause harm to the health and lives of many people). The options for these agents to hide their interests or activate threats vary; their own interests are limited from society's point of view because they have probably already appeared in some form in the past and therefore are more determinable and predictable in terms of risk analysis and agents than the following two types of agents.

- **Agents of political, national, and supranational interests (ideological agents)** - their official interests externally have a strong programmatic character, which is constantly declared to the public (during elections, political negotiations, disputes, etc.). In addition to official interests, there may also be purely intra-party, intra-group interests, which may be pursued in a hidden manner (e.g. the promotion of restitution on the one hand and personal enrichment resulting from it on the other). This type of agent already has great power, strength, and support from allies with regards to promoting programmes and activating various threats, including international ones (the emergence of nationalism in the interwar period in Germany, the uncontrolled and uncontrollable influx of immigrants, the abuse of the institutes responsible for light fuel oils and solar energy for own enrichment, etc.). Agents of this type often have executive power. They can assign tasks, command, transfer responsibility to subordinates, and hide evidence. They can also influence the decisions or investigations of security forces, becoming a dangerous threat to them (for certain independent, loyal entities). In addition to political interests, this category can include economic, political, supranational, and other interests. From the point of view of risk analysis, the activity (including the activation of specific threats) of this type of agent is complicated to predict because, within a large number of positive actions for the benefit of society, less frequent actions with a negative impact on society may be hidden. If the agents of threat are foreign entities (political parties, governments, powers, government executive bodies, etc.), they can initiate other professional entities, their own specialised institutions (intelligence agencies, security services, the army, etc.), to promote their interests. In some cases, the interests and the initiation of threats are professionally hidden (secret) at the very highest levels and it is not a trivial matter to identify them, whereas in other cases, they are quite evident (deterrent threats by force, open declaration of military technology, technological sophistication, etc.).
- **Agents of private, oligarchic, and global interests (hidden, ideological agents)** - this type of agent is usually under-represented in society, but is all the more influential for being so. These are usually very rich, privileged, often educated individuals and small groups of people who have acquired their current wealth and property by both legal and illegal means and are interested in further expanding their wealth, influence, or power. These agents then directly, but far more often in a secret manner, lobby or order various activities to be carried out to achieve their goals. The activities in their final form can also be violent and brutal (in less socially developed countries - murders, kidnappings, extortion, Nazism...). These agents include individuals, small groups of people, controlling international economic groups, multinational companies, but also organised crime, mafias, etc. They can also include the heads of churches, religious sects, and secret societies (e.g. Masonic lodges, "Brotherhoods"), which then exercise influence over politicians, the performance of state authorities, etc. This type of agent is very well aware of the need to keep its activities highly confidential and hidden from the public. It is therefore probably not possible to work with them in terms of risk analysis, their activating agents, and subsequent threats. On the whole, evidence of such activity is lacking.



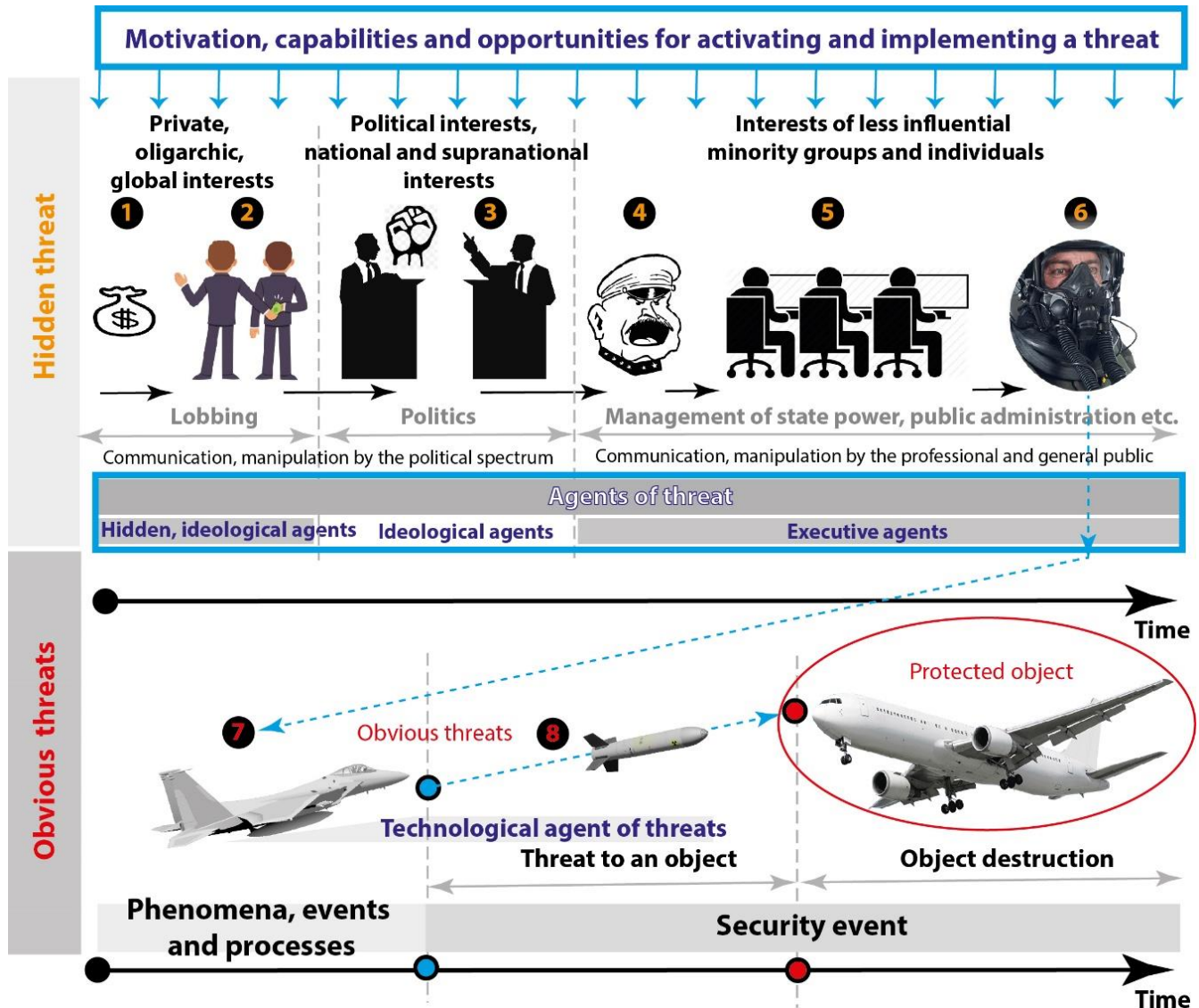


Figure 3. Explanation of the term agent of threat (originator, initiator)

Source: Roman Rak

The above division of anthropogenic agents into specific types helps to improve understanding of the dangers and threats that these agents potentially trigger. Many dangers and threats can be hidden during a security risk analysis. After all, we may not be aware of them because of a lack of knowledge of all the anthropogenic agents, let alone their interests, goals, and motivations. This is especially true when these anthropogenic agents professionally hide and even consciously conceal their interests (only a small group of people with strong influence, status, wealth, etc. know about their real interests, goals) and manipulate the lay and professional public with the help of substitute, insignificant interests, and the use of a variety of manipulative techniques to work with individuals, groups, and large swathes of the population. Hidden, classified threats or their anthropogenic agents can be detected, for example, by a group of professionals (intelligence agencies and security services, etc.) who are trained in such activities on a long-term and professional basis. In practice, a problem may arise and usually does when institutions (e.g. government, politicians) and individuals (representatives of government, politicians, etc.) who, based on information from security services and intelligence agencies, have to make executive decisions, but do not trust or do not want to trust security professionals, questioning them accordingly.

Categories of agents of threat can interact in all directions: the individualists (executive agents) may try to get into politics (ideological agents) and trigger various events (which can pose a threat to other entities) or, after obtaining significant resources, gradually work their way into oligarchic groups, where they then secretly influence politicians (hidden, ideological agent). Conversely, a politician (or even an individual from a lower category of agents of threat) can use (abuse) another person to activate a threat (e.g. the transfer of money obtained through organised crime as part of a laundering process).

For some agents (see Figure 2) it is not always easy to decide which category (intentional, unintentional) the anthropogenic agent of threat belongs to. This depends on the point of view or the specific threat. This division is profound if a large number of people in a historically and geographically large area participate in certain processes and the resulting threats. This applies in particular to, for example, economic, social, religious agents, etc.

Example:

*How do we identify the agents of a religious threat such as the Hussite Revolution? On the one hand, the agent or cause can be considered to be the general religious conflict between the Czech- and German-speaking populations. On the other hand, the agent can be considered to be Jan Hus, who managed to show the contradictions in such a way that he won masses of Czech believers over to his ideas. Were it not for Jan Hus, another person would probably have appeared on the scene. In terms of risk analysis and the search for causes, triggers - agents of threat, the intentional and unintentional components of the anthropogenic threat must be identified. The unintentional component, in this case, is the objective religious conflict that was not caused by the general population; the intentional component is the teachings of Jan Hus, which consciously aimed to change and remedy the situation. In making an analysis, it is important to always be aware of dependencies, the primary nature of threats and their agents, and to subsequently decide which agent of threat or threat to eliminate first, insofar as this is possible and intentional (the church could not accept the objective truth of Jan Hus and therefore burned him at stake).*

It is important in life (practice) to be able to correctly distinguish the nature of agents of threat, the threats themselves, and their impacts (caused damage and injury) on the security of the (protected) object of interest. If we want to eliminate a threat, it is often necessary to “eliminate” the launch or activation of the threat, thereby eliminating the agent of threat. From the point of view of investigations and court proceedings in relation to negative events that have already occurred, it is also important during the process of clarification and investigation to prove the intentionality of the launch of the threat, i.e. the conscious or unconscious involvement of the person in the crime.

In our opinion, this strongly depends on what threats exist, which agents these involve, and how they are perceived, evaluated, and managed in real time. In practice, we may respond to partial, acute threats and, at the same time, far greater threats we cannot identify that may have more far-reaching consequences. An example of a possible basic view is given in the following Table 2.

**Table 2.** Examples of threats, agent of threat, and elimination of threats.

Threat	Agent of threat	Elimination of threat
Missile fired from an aircraft.	Fighter jet and its pilot.	Shoot down the missile. Guide the missile to a decoy target. Maneuver the passenger aircraft to avoid the missile.
Aircraft with attack capabilities.	Military order, air traffic control centre, communication between air traffic control and the pilot.	Force the aircraft to leave the airspace, disrupt communication with the aircraft, radio-electronic warfare, shoot down the fighter jet.
A political situation that can result in a military conflict.	Government decisions, orders from army command, lack of discipline, initiative of subordinates.	Political negotiations, international peace activities, international treaties, pacts, strengthening one's own army, security forces.
Penetration of organised crime, oligarchies into the public administration, executive bodies of a democratic system.	Secret, non-public, private, oligarchic, global interests of groups of influential, criminal and lobby groups; their motivation to gain power, control over processes, benefits, resources, raw materials, etc.	Transparency of the political, governmental and social systems, the fight against organised crime, the independence of the security forces, the judiciary, independent controls and audits.

Source: Authors

Example:

- For a passenger aircraft, the threat is a missile aimed and fired at it from a military aircraft. The agent of threat is a fighter jet and its pilot. The pilot of the passenger aircraft has few options to deal with the threat, which must be solved immediately.*
- Another threat is the same military aircraft in the airspace of another state. This military aircraft can shoot down more passenger aircraft and attack other objects. The agent of threat is the pilot's superior commander, the air traffic control centre.*
- Military orders, air traffic control centres, and other combat control centres are agents for military threats to the invaded country and can activate other threats.*
- A military solution for a specific situation, military threats activated by political situations, the decisions of politicians (governments, etc.). These are agents of military threats.*
- A country's politics may also be dominated by hidden oligarchic groups that have secret, private, global interests. These groups are agents of threat to politicians. Oligarchs are interested in a country's mineral wealth and may provoke the downing of the passenger aircraft in order to instigate a political crisis and to be able to seize raw material reserves for their multinational companies through subsequent planned activities.*

*In practice, the primary motive for the shooting down of a civilian aircraft may be seen (by the public and investigators) as a terrorist act. However, in reality, the attack can be put down to a group of supranational oligarchs trying to obtain minerals in a particular country for their manufacturing plants, whereby the shooting down of the civilian aircraft is purely considered a means to an end.*

The human factor is very complex. Its effect does not always have to be direct, but it can have a subsidiary character, i.e. the character of subordinate articles (Velas et al., 2019). To properly manage security and understand the variety of threats that exist, it is necessary to think systematically, to clarify the links between anthropogenic agents that can trigger different types of threats on objects of interest. The basis of this principle is that it can be applied in general.

## Threat impact

The **threat impact** is the negative result of a realised threat on a protected asset (object, process, interest) that causes damage or injury. In professional literature, the word “consequences” is also synonymous with “impact”.

The **threat impact** is the adverse effect of an undesirable event at a given place and time on a protected asset or against an interest (Božek, 2015).

The purpose of risk management is to minimise the impact (consequences) of threats (undesirable situations) to zero or at least an acceptable value. If the impacts can be quantified in units (e.g. money), we speak of damages. If the impact is not quantifiable, we speak of injuries (e.g. harm to health, reputation, brand damage, etc.).

In the first case, this concerns a **quantitative impact assessment** (damage assessment), in the second case, this concerns a **qualitative impact assessment** based on, among other things, verbal expressions or a description of the characteristics of the injury caused.

## 6. Discussion

Threats precede adverse events. Threats are phenomena that can occur and can have adverse effects, thereby causing damage and injury. Adverse events can escalate into crises and disasters. If such events are to be prevented, it is necessary to be able to correctly identify threats, including the impacts and risks thereof, in a timely and appropriate manner, so that appropriate measures can be put in place. Unfortunately, these may not be adequate.

Many anthropogenic disasters arise for the convenience of going mainstream. There is often a lack of perspective on different sides, which is fueled by the absence of discussion, the search for the truth and the real causes of problematic situations. To accomplish this, the scientific and professional discussions must be apolitical to objectively recognise the world as it is, regardless of the desire for it to be as we want it to be at all costs.

The end of the 20th and the beginning of the 21st centuries created a whole new digital world thanks to the invention of the Internet. However, its virtuality is often outside the real world and, combined with the existence of a physical, global world, brings entirely new threats that can fundamentally change our world and lead to devastating global conflicts.

Today, however, politics is not created a priori by politicians, but by the mass media or those who control them (own or paid). As a result, politics lacks real personalities that are able to see the world in a broader context with a view to the more distant future. Mass media spread a huge amount of misinformation, which in turn, adversely and unilaterally affects weak secondary politicians who do not solve problems and who, with their narrowly focused orientation or lack of insight, deepen or create new problems.

Globalized conflicts are often accompanied by information and economic wars. An economic or financial war is waged through the implementation of various restrictions. Unfortunately, these restrictions can prove very problematic because they tend to be created and decided politically at a time when emotions are running high. The impact of such restrictive measures is also often exacerbated by the fact that they are not consulted with experts. Their hasty adoption then poses considerable threats, which over time can turn against the instigators of the restrictions themselves.

## 7. Conclusion

To manage the security of objects, states, and processes, it is necessary to be able to identify potential and real threats correctly, whilst taking into account the vulnerabilities of the entities that need to be protected. To do this, it must be possible to realistically estimate all potential phenomena that may escalate into events with adverse effects. Phenomena with adverse effects on protected entities are threats. Being able to categorise threats correctly is an essential precondition for determining how to face them in practice and prevent their further development.

Threats have their initiators, triggers. Unfortunately, in a profit-oriented economy, private interests and the interests of oligarchs and elites, which may be behind political, national, or international interests, are frequently motivational factors. In practice, this motivation for triggering threats can turn into real threats to national interests, the economy, etc.

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**Dagmar KOPENCOVA, JUDr., PhD.** teaches forensic science and criminal law. She conducts practical exercises at Ambis University. For many years she worked in the elite units of the Police of the Czech Republic. She has successfully dealt with drug-related crime and organized crime. She deals with breeding and training of rescue dogs. ORCID ID: <https://orcid.org/0000-0003-4934-160X>

**Vladimir SULC, Dipl. Eng., PhD.** he works not only as a security consultant, but above all as an academic personnel at the Department of Security and Law of the AMBIS University. Brno, Czech Republic. He deals professionally with issues of management, information and cyber security. He has been publishing in this area for a long time, participating in and lecturing at international conferences and cooperating with other experts in the field of various research projects. ORCID ID: <https://orcid.org/0000-0003-2061-888X>

**Roman RAK, Prof. Dipl. Eng., PhD.** is a professor at the Department of Security and Law of the AMBIS University. Prague, Czech Republic. He deals professionally with the issues of technical aspects of forensic sciences. His professional activity is focused on the forensic identification of objects (persons, vehicles), vehicle crime, concepts and implementation of critical infrastructure information systems. Author of several dozen professional books, over 300 articles. ORCID ID: <https://orcid.org/0000-0002-9792-1572>

**Magdalena NAPLAVOVA, Dipl. Eng., PhD.** is a graduate of the Faculty of Military Leadership at the University of Defence in Brno, where she received her PhD from the Department of Crisis Management in the field of Protection of Troops and Population in 2017. As part of her doctoral studies, she dealt with the issue of risk management and health risk assessment. She currently works at the Department of Security and Law as a member of the academic staff and secretary of the department, where she is the guarantor of the subject Protection of the Population and also participates in teaching subjects related to risk management. She regularly publishes her results in domestic and foreign journals and at relevant conferences. <https://orcid.org/0000-0002-3590-2245>

**Frantisek VLACH, Ph.D. MBA, LL.M., colonel** is the Director of the Academy of the Prison Service of the Czech Republic. Research interests: prison staff training and education, employees, professional development, prison service. He also deals professionally with process optimization and human resource management. He cooperates externally with the Ambis University. Dr. Vlach is the author of a professional book and dozens of professional articles. ORCID ID: <https://orcid.org/0000-0002-7598-8370>

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## ENTREPRENEURIAL UNIVERSITY: TOPICALITY OF CREATION, INTERNATIONAL EXPERIENCE, SITUATION IN LATVIA\*

Vladimir Menshikov<sup>1</sup>, Oksana Ruza<sup>2\*</sup>, Irena Kokina<sup>3</sup>, Iluta Arbidane<sup>4</sup>

<sup>1,2</sup> Daugavpils University, Parades Str. 1, Daugavpils, LV-5401, Latvia

<sup>3</sup> Daugavpils University, Vienibas Str. 13, Daugavpils, LV-5401, Latvia

<sup>4</sup> Rezekne Academy of Technologies, Atbrivoshanas Avenue 115, Rezekne, LV-4601, Latvia

E-mails: <sup>1</sup> [vladimirs.mensikovs@du.lv](mailto:vladimirs.mensikovs@du.lv); <sup>2\*</sup> [oksana.ruza@du.lv](mailto:oksana.ruza@du.lv) (Corresponding author); <sup>3</sup> [irena.kokina@du.lv](mailto:irena.kokina@du.lv); <sup>4</sup> [iluta.arbidane@rta.lv](mailto:iluta.arbidane@rta.lv)

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**Abstract.** The university, understood in a simplified way as an institution representing the system of higher education, is distinguished by longevity. However, it also underwent evolution at the turn of the century under the influence of various conditions. As a result, various models of the university are emerging with the most promising one known now as the entrepreneurial university. This model implies greater openness of the university to the socio-economic environment, flexible adaptation to the needs of customers, stakeholders and the market, market competitiveness based on marketing and the ability to diversify sources of income. Particular attention is paid to creating and increasing the entrepreneurial potential of students. *The aim of the article* is to consider issues related to the prerequisites and ways of developing University 3.0 in Latvia. *The objectives* of the article are as follows: to find out the main external and inter-university prerequisites and barriers to creating entrepreneurial universities, to study international experience in the formation of prerequisites for the creation of entrepreneurial universities, to assess the major prerequisites for the establishment of entrepreneurial universities in Latvia. Causal analysis and comparative analysis were used as the major research method. An empirical assessment of the prerequisites for the development of University 3.0 in Latvia is given on the basis of our comparative analysis of the parameters of the Global Competitiveness Index. It is proposed to discuss the need for a state programme of at least a pilot project for the creation of two or three entrepreneurial universities so far, which will allow us to have our own experience in removing economic, social and cultural barriers to the modernisation of our higher education, the emergence of our own strong entrepreneurial leaders in higher education.

**Keywords:** entrepreneurial university; students; Latvia; prerequisites

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## 1. Introduction

The transformation of a traditional research university into an entrepreneurial university is being accelerated by the decrease of the state funding of universities and the constant emergence of a competitive market for research and education. A new approach has emerged to promote the dissemination of knowledge through university entrepreneurship. Creating an entrepreneurial culture is a difficult task that requires the efforts of many dedicated people. Universities as centres of knowledge creation and dissemination can and must be used to ensure future economic growth (Bukhari et al., 2021; Radko et al., 2022). For small countries in transition, it is important that universities act in accordance with policies that encourage entrepreneurship and innovation. Entrepreneurial education for young people is a very valuable training for the constant changes in the labour market. Entrepreneurial education is critical to helping young people develop entrepreneurial skills, qualities and behaviour and to pursue entrepreneurship as a career option (Arnaut, 2020; Girdzijauskaitė et al., 2021; Ead et al., 2021; Pugh et al., 2022).

We believe that identifying entrepreneurship as a separate discipline in higher education institutions would contribute to the development of many areas of the economy, the creation and implementation of start-ups, since the current study directions do not always meet the tasks of forming an entrepreneur.

Historically, the role of the university has changed depending on economic and social conditions, they have new functions, which is reflected in the characteristics of the models:

University 1.0 - educational institutions that train specialists for professional activities in certain sectors of the economy and the social sphere. The main mission is education;

University 2.0 - educational institutions in which research plays an important role. The main mission - education, is joined by a new function - conducting scientific research for various areas of the economic and socio-cultural life of society.

The complication of the whole range of problems of international competition and the transition of economic life to a new technological order requires universities to make a more active contribution to the development of the knowledge-based economy through the commercialization of the results of research activities and the creation of new knowledge-intensive enterprises. These tasks are fully met by the model of an entrepreneurial university or University 3.0 (Balashov, 2019; Burawski, 2013; Etzkowitz, 2008; Lupianez, 2005; Piotrowska-Piatek, 2015; Wójcicka, 2006; Badri & Hachicka, 2019; Kayed et al., 2022).

The concept of "University 3.0" was developed in 1998 by Burton R. Clark (Clark, 1998) and he also introduced the term "Entrepreneurial Universities" into scientific circulation (the term "University 3.0" is also used in the scientific literature). However, an unambiguous definition of this concept has not been developed yet. Most researchers are of the opinion that University 3.0 is an institution of higher education that is able to attract additional financial resources to ensure its activities, a university that uses innovative teaching methods, a university that establishes close interaction with the business community, where the developments of university researchers are being introduced, including from among the students. To date, researchers distinguish two models of an entrepreneurial university: entrepreneurial by results - teachers, students and graduates create innovative companies; entrepreneurial by the type of action of the managerial team (entrepreneurial university). The first model provides for the formation of favourable conditions for students, teachers and graduates to create high-tech

start-ups and spin-off companies. The second model provides for the creation of a powerful scientific centre that produces and launches new scientific and technical products to the market, thereby attracting financial resources and increasing its independence from the state resources. (Lawskiego & Pilichiewicz, 2018), (National., 2021)

## 2. Entrepreneurial University: the international aspects of research

Entrepreneurial university has responsibility to grow entrepreneurial intentions and potential of students (Turnea et al., 2020; Liu, & van der Sijde, 2021; Karim et al., 2022; Valencia-Arias et al., 2022).

In March 2021, the researchers V. Menshikov, O. Ruza, I. Kokina at Daugavpils University (Latvia) and G. Bedianashivi at Tbilisi State University (Georgia), a year after the onset of the Covid 19 pandemic, began to study the issues of increasing the entrepreneurial potential of students in the context of a protracted crisis.

The number of respondents comprised 122 people at Daugavpils University (hereinafter referred to as Latvia) and 145 people at Ivane Javakhishvili Tbilisi State University and European University (Georgia). The data of sociological surveys in Latvia and Georgia indicate the presence of a big socio-economic problem - a significant number of our students wishing to start entrepreneurship and a relatively modest percentage of those who are already active entrepreneurs (Menshikov & Ruza, 2021). At the time of the sociological survey, 8.2% of respondents in Latvia and 16.6% in Georgia had their own business, which is largely due to the specific profile of their educational programmes. Those who wish to engage in entrepreneurship among the respondents in Latvia amounted to 58.2% and 74.6% in Georgia. 59.8% of respondents in Latvia and 72.9% in Georgia have an idea that they would like to commercialize (start their own business and make a profit).

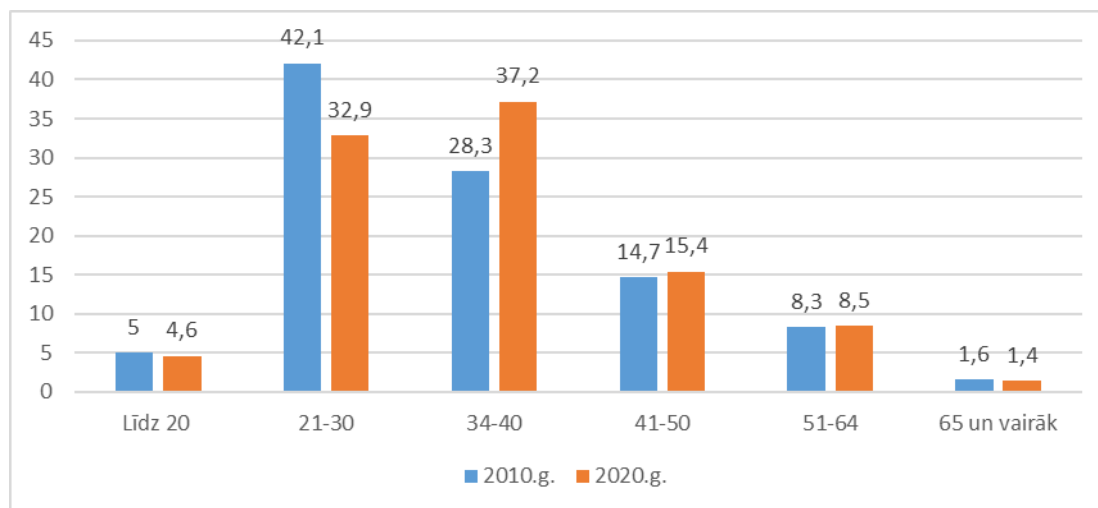
**Table 1.** Comparison of data from a sociological survey of students in Latvia and Georgia on the degree of their participation in entrepreneurship, (%)

Answer options	Latvia	Georgia
Have an idea that they would like to commercialize (build their business and make a profit)	59.8	72.9
Wish to start business	58.2	74.6
Consider themselves entrepreneurial people	19.7	28.9
Already have their own business	8.2	16.6

*Source:* elaborated by the authors (Menshikov, 2021)

59.8% of respondents in Latvia and 72.9% in Georgia have an idea that they would like to commercialize (start their own business and make a profit). As can be seen from the data in Table 1, there is a rather large gap between our students having an idea that they could commercialize and having their own business (especially for Latvian students studying in programmes that are not directly related to business, management, economics).

In 2021, a study was conducted by the Latvian Register of Enterprises “Lursoft”, which analysed the age of people who decided to register their first company last year, as well as how the average age of entrepreneurs who founded their first company has changed compared to ten years ago.



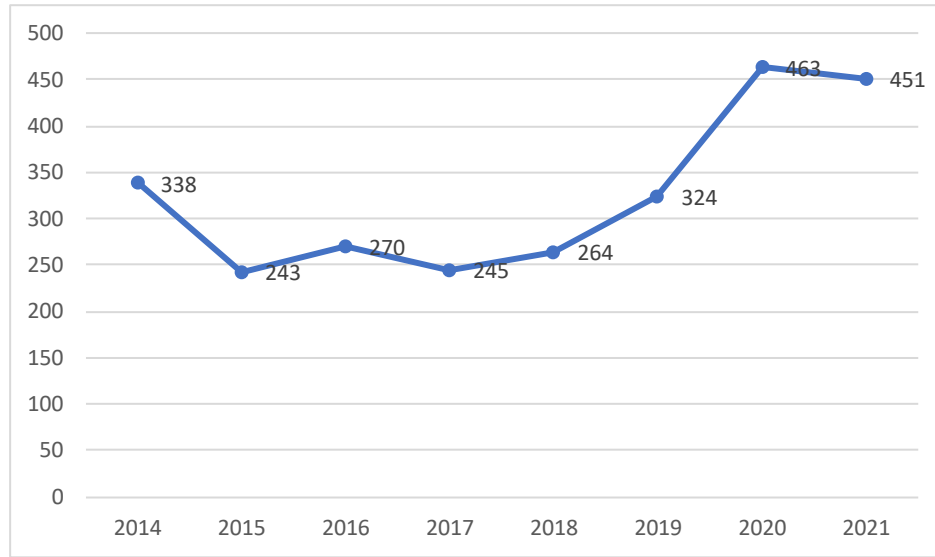
**Fig. 1.** Share of entrepreneurs who registered their first business, by age group, %

*Source:* elaborated by the authors based on (Delfi, 2021).

The analysis of the data of the Latvian Register of Enterprises “Lursoft” on all owners of enterprises registered in Latvia shows that their average age has increased over the past 10 years. In 2010, it comprised 46.1 years, and at the end of 2020 it reached 49.2 years. Figure 1 illustrates that over the past 10 years, the proportion of young people under the age of 30 (which includes the vast majority of students) among those who founded their own enterprise has significantly decreased - from 47.1% to 37.5%. However, “Lursoft” researchers do not analyse the reasons that hinder the disclosure of the entrepreneurial potential of young people.

The main reason, according to the authors, is the lack of a system of training students in universities for entrepreneurial competences, which in fact requires from a modern university a significant and profound change in its mission. In fact, the problem is solved only when an entrepreneurial component is added to the implemented educational and research tasks. In the scientific literature, this expansion of the university mission has been called the transition to “University 3.0”.

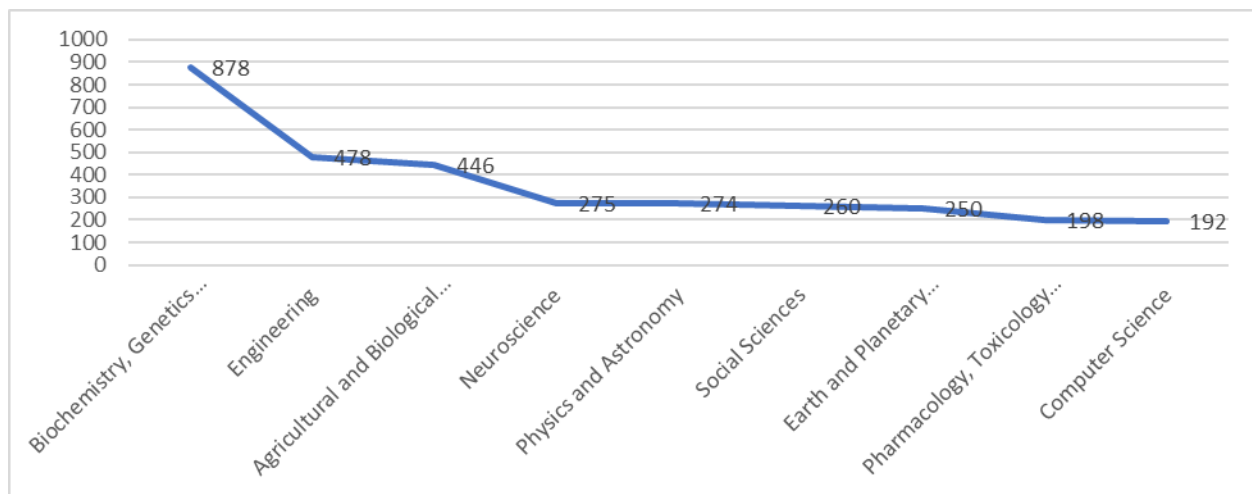
The interest of researchers in general in the problems of University 3.0 has increased significantly in recent years (Carayannis & Campbell, 2009, 2010, 2011). Let us analyse, for example, the reflection of the issues of University 3.0 in the authoritative Scopus database.



**Fig. 2.** Number of Scopus database papers containing the words “University 3.0” in the title, abstract or keywords by year, from 2014 to 2021

*Source:* elaborated by the authors based on SCOPUS database

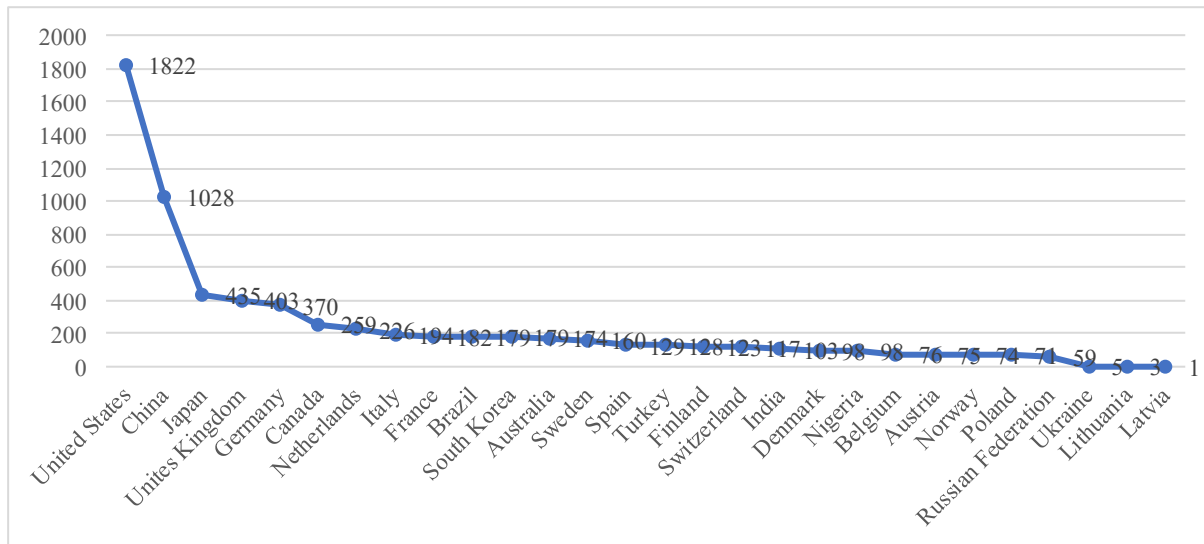
The results displayed in Figure 2 confirm the high interest of scientists from various fields of science in the topic “University 3.0”. Publications were indexed particularly rapidly in the Scopus database in 2020 and 2021, when the number of such publications increased compared to 2015 and reached 463. The majority of the publications are related to the natural sciences and technical disciplines, however, 7.9% of the total number of publications are elaborated in the field of social sciences.



**Fig 3.** Number of Scopus database papers containing the words “University 3.0” in the title, abstract or keywords .by field of science, from 2015 to 2021

*Source:* elaborated by the authors based on SCOPUS database





**Fig. 4.** Number of Scopus database papers containing the words “University 3.0” in the title, abstract or keywords by country, from 2015 to 2021

*Source:* elaborated by the authors based on SCOPUS database

The most cited article is The Chinese University 3.0 from The University of Hong Kong (China) Li, J., published in 2016. (Li, 2016). The authors of this article build the concept of Chinese University 3.0, explore its key values and features, as well as its possible contribution to the global era. Three different stages in the history of Chinese universities are differentiated and their institutional development and characteristics are considered. The paper then focuses on China University 3.0 moving towards world-class status and mass higher education, reflecting core values and traits such as self-mastery and intellectual freedom, humanist (Zhi-Xing) mission and institutional diversity (He'er Butong), to demonstrate how they are culturally distinct from the dominant Anglo-Saxon and American models, but share some commonalities with the Continental European and Japanese university models (Li, 2016)

In the systems of higher education of economically developed countries, dramatic changes are being observed, due to the decisive importance of universities for innovative development and economic growth. New areas of activity of the University include the development and transfer of technologies, the commercialization of academy products and their promotion to the market, the creation of new enterprises, the management of intellectual property for profit. This is the basis of University 3.0 model with three key social objectives: education, research activities, economic and social development (including the commercialization of knowledge). The development of modern higher education takes place in the context of conflicting social trends that emerged in the late 1970s. On the one hand, there is a stronger management of the public sector, and on the other hand, it is being eroded and democratized. The strategic systems of conceptualization of social development – “New State Management”, “Networks of Management”, “Neo-Weberian State” - demonstrate the key transformations that the modern university is going through. The University 3.0 model originates from these systems and expands its social mission as the corporate unit of the knowledge economy and the main driver of economic growth. The Network University is a model of interdepartmental cooperation that provides excellence in strategic research and education, as well as efficient ways of producing knowledge. The Creative University is a model of an anthroposocial system that creates a person of the future both in socio-economic and existential terms. The innovation-entrepreneurial university can be described as a model of the Knowledge Corporation, which ensures

the rapid technological and economic growth of society. The most important function of this university is the penetration of students' competences into the socio-economic sphere and their direct participation in economic activities. The social role of University 3.0 is to create the basic structures of the knowledge society. University 3.0 is becoming the basis for the global competitiveness of national economies and geopolitical alliances, while its entrepreneurial ecosystem gives rise to new, fast-growing industries, advanced technology markets, and administrative-territorial spaces with a highly developed economy (Karpov, 2017).

There are two trends observed in the university community: on the one hand, the advanced part of the university community is actively promoting new formats of education, including online courses, is creating an innovative infrastructure to stimulate student entrepreneurial education and inspire their professors and teachers to create high-tech start-ups, is getting involved in the process of exporting educational services and international collaborations. On the other hand, the accumulated "luggage" is pulling back: a very elderly teaching staff who oppose any innovations just because "it did not use to be like this before"; outdated physical infrastructure, including laboratory equipment and technology park; low quality of applicants who do not want and often simply are not able to study at a university (with an average mark slightly above the "three"); slum-like hostels; and finally, the lack of modern university management skills combined with the opportunistic behaviour of part of the administration. A modern university should train not specialists for non-existing larger state enterprises, but specialists who, along with skills in the profession, also have the ability to manage projects, take risks, i.e. demonstrate entrepreneurial skills. Accordingly, a modern university should pay much attention to improving the content of education working together with regional employers, creating joint platforms for student project activities and stimulating entrepreneurs and venture capitalists to come to the university in the role business coaches and mentors of university start-ups. The university should be able to act proactively - i.e. analyse trends in science and higher education and form those elements of their own internal structure that will become triggers for changes.

It is necessary to pay attention to those types and forms of education that are still on the periphery of their attention – supplementary education for adults, and also learn how to offer part of the educational content to their students as an elective, on a fee-paying basis, because neither format of education - a 2-year Master's programme, a 3 or 4-year undergraduate programme, can include everything that can be useful to students on their career path. In addition, universities should abandon the concept of eternity and immutability of directions of study, if only because current graduates will have to live in a society where the life cycle of professions is significantly reduced, and modern information technologies (in particular, blockchain) will make redundant until recently quite respectable professions of a notary or corporate lawyer in the very near future. Hence the need for a gradual transition to the "educational supermarket" model, in which the "client" chooses those products that he himself considers necessary, and not (only) those that the state has imputed to him in the form of an "educational subsistence minimum". Further, universities will have to abandon the axiom that the core of the educational course is classroom lectures, and that the fundamentals of students' self-study is reading and taking notes from textbooks. Even now, the most motivated students can, instead of courses (or in addition to courses) of their professors, get access to the world stars of the academy on various platforms of open interactive education; the textbook is dying out right beneath our eyes, and is being successfully replaced by Wikipedia and similar Internet resources. Accordingly, in order to keep students, universities will need to do a lot - in particular, significantly change the format of the educational process, revise the existing structure of the academic staff, and conduct mass retraining of some lecturers in order to teach them how to use new methods and technologies in education. Finally, they will have to see students as important participants in the educational process - in order to rely on the energy of young people, their high mobility, and the accumulated entrepreneurial potential so far. How to do all this, being within the very strict resource constraints? There is only one way - by rebuilding the management model of the university on the basis of entrepreneurship, i.e. search for resources (human, financial), which are never enough, in the external market, offering the participants of this market cooperation, including

intrapreneurship, i.e. rewarding their own employees for showing initiative in the implementation of new educational, research, social and other projects that strengthen the reputation and increase the negotiating power of the university in communication with regional leaders and business structures.

In his articles A.O. Karpov (2017) considers the issues related to the prerequisites and ways of development of University 3.0 in the socio-cultural context. Universities are compared in terms of fulfilling the tasks of teaching, research and socio-economic development. To analyse the third mission, comparisons are made with foreign universities in terms of innovation and entrepreneurial activity. To study the potential of the country for the development of University 3.0, an index of prerequisites for its development (University Development Index or UDI) has been developed. The complex and elementary components of the Global Competitiveness Index (GCI) are used as UDI parameters that characterise the possibilities for the effective implementation of the three missions of the University. Based on the calculated UDI values, it is possible to identify the potential of countries to create a University 3.0 compared to a sample of culturally differentiated countries (Karpov, 2017)

Using the most sensitive GCI data 2017–2018, an index of prerequisites for the development of University 3.0 has been built - a UDI (University Development Index), which for some countries characterises the possibility of its creation, while for others - a resource for improvement (it is in these senses that the term “development” is used here). UDI is a predictive construct linking social, economic, cultural and institutional factors. The structure is presented in Table 2. The table shows the sub-indices that have the greatest impact on the stages of the country’s development focused on efficiency and innovation.

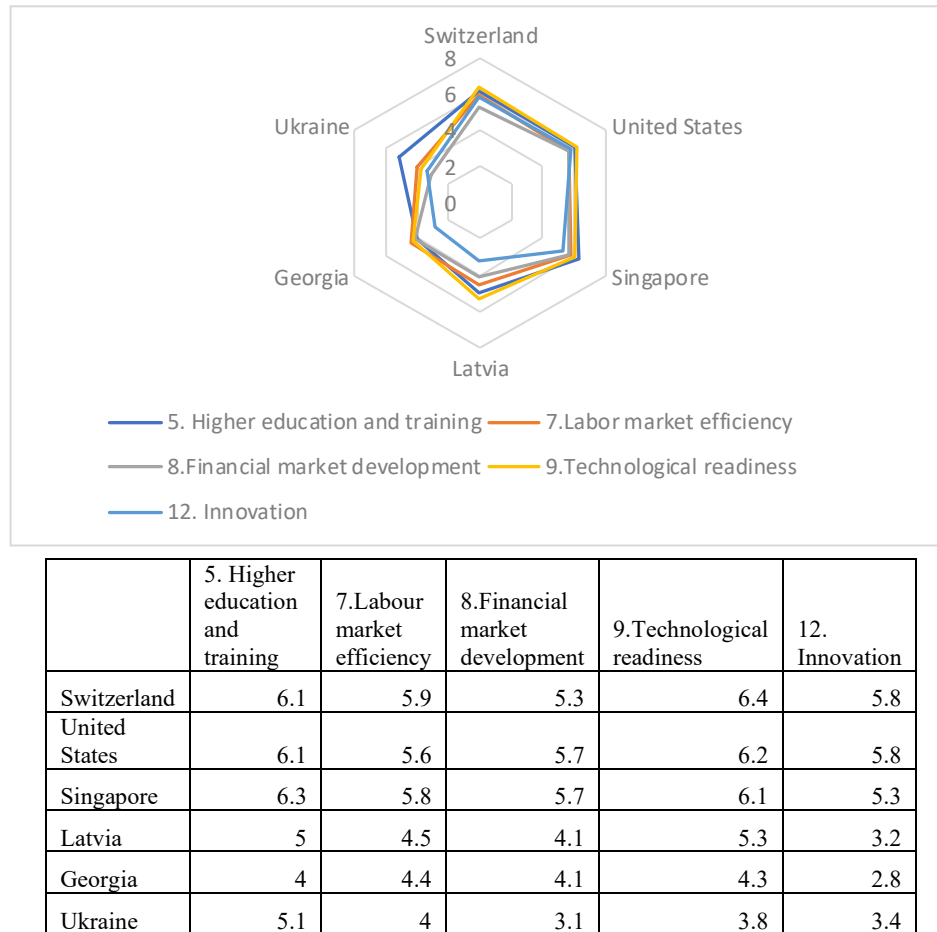
**Table 2.** The structure of the complex (UDI/c) and parametric (UDI/p) indices of prerequisites for the development of University 3.0

<b>Efficiency enhancers sub-index. Key for efficiency-driven economies</b>	<b>Components of indicators of GCI sub-indices</b>
5. Higher education and training	5.03. Quality of the education system 5.04. Quality of math and science education
7. Labour market efficiency	7.08. Country capacity to retain talent 7.09. Country capacity to attract talent
8. Financial market development	8.01. Availability of financial services 8.02. Affordability of financial services 8.03. Financing through local equity market 8.04. Ease of access to loans 8.5. Venture capital availability
9. Technological readiness	9.1. Availability of latest technologies 9.02. Firm-level technology absorption 9.03. FDI and technology transfer
12. Innovation	12.01. Capacity for innovation 12.03. Company spending on R&D 12.04. University-industry collaboration in R&D

*Source:* elaborated by the authors based on (The Global...,2017)

The situation of weaknesses in the prerequisites for the development of University 3.0 in Latvia, Georgia and Ukraine is shown in the charts in Figure 5. For comparison, the countries with the best positions in GCI in the first four regional groups have been taken - Switzerland, Singapore, and the United States. In the complex index (UDI/c), Latvia, Georgia and Ukraine lag behind these countries in five out of five indicators – in higher education and vocational training, labour market efficiency, technological readiness, financial market development, innovation and R&D (Fig. 6). In Georgia, the indicators are lower than in Latvia - in higher

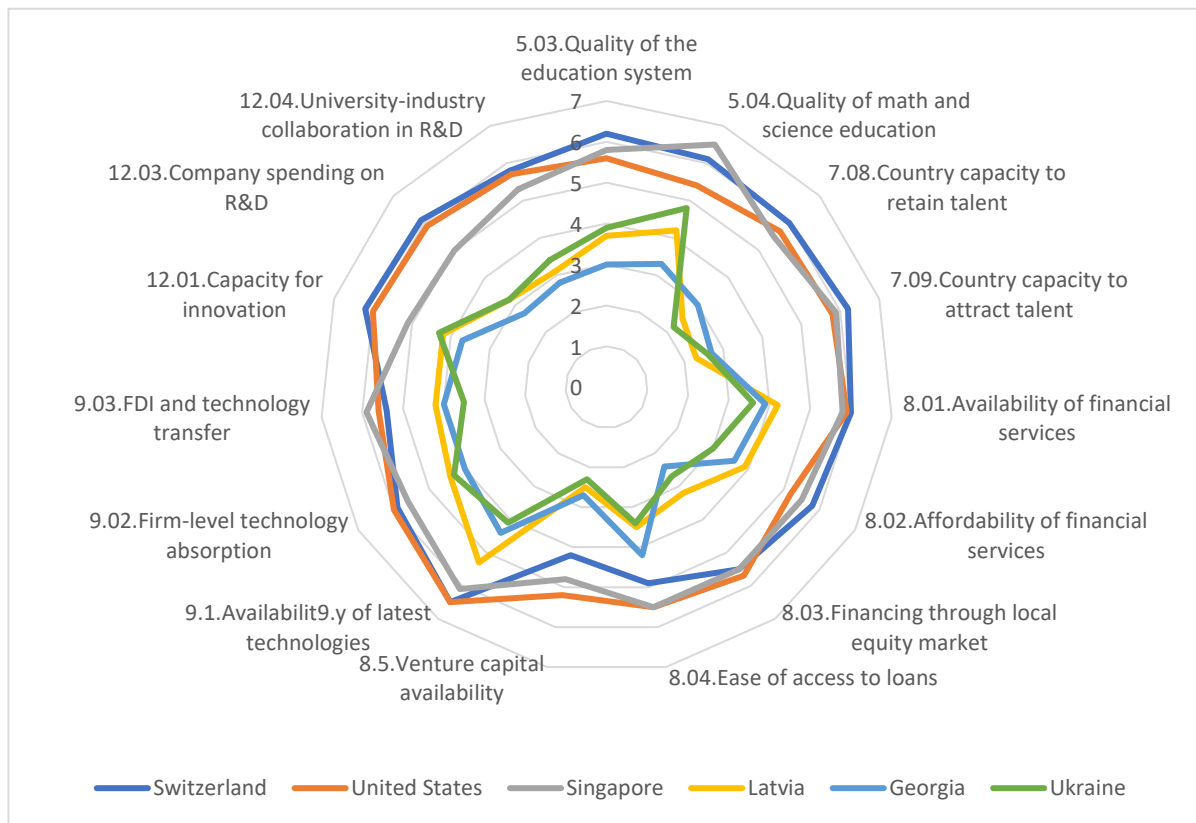
education and vocational training, financial market development, innovation and R&D. In Ukraine, the indicators are even lower than those of Latvia and Georgia, except for higher education, vocational training and innovation.



**Fig. 5.** Charts of indicators of key GCI sub-indices 2017-2018 included in UDI/p for the countries that are the first regional leaders in terms of competitiveness, as well as Latvia, Georgia and Ukraine

*Source:* elaborated by the authors

In the parametric index (UDI/p), Latvia, Georgia, Ukraine, in five out of ten indicators, are significantly inferior to all the leading countries in the regions (Fig. 6). Among them are sensitive ones such as opportunities to attract and retain talent; accessibility, absorption and technology transfer. Only in two indicators does Latvia surpass Georgia - in terms of Country capacity to attract talent, Ease of access to loans. In three indicators - FDI and technology transfer, Venture capital availability, Availability of financial services, Georgia's indicators are almost the same as Latvia's.



**Fig. 6.** Charts of the components of indicators of the key GCI 2017–2018 sub-indices included in UPI/p for the countries that are the first regional leaders in terms of competitiveness, Latvia, Georgia and Ukraine.

*Source:* elaborated by the authors

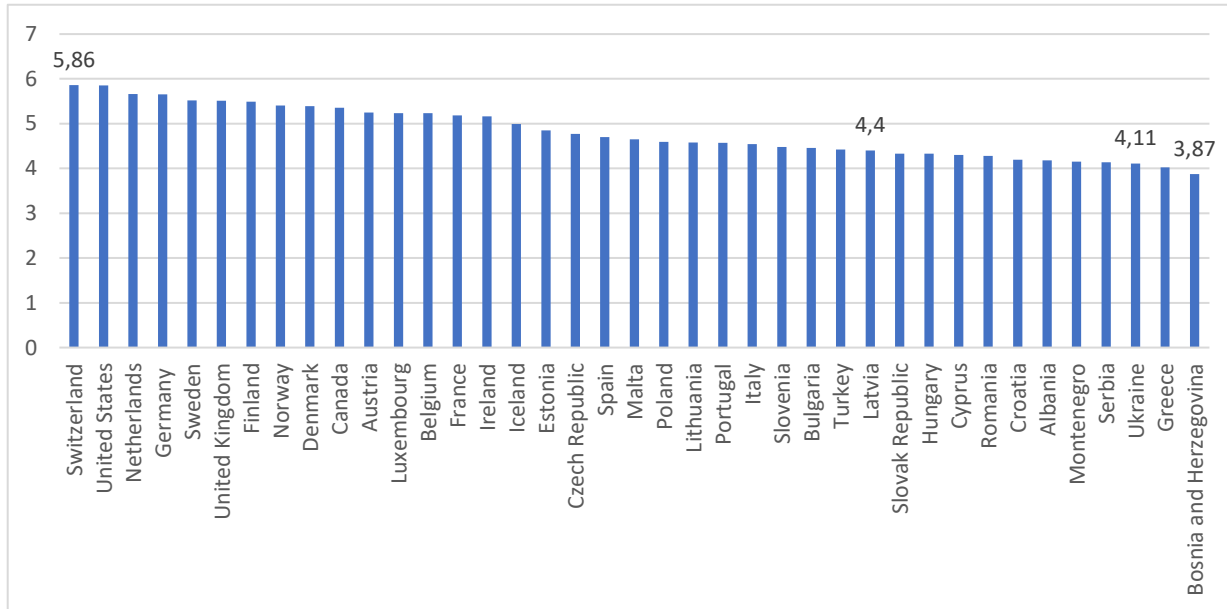
Table 3 shows the calculated index values of the prerequisites for the development of University 3.0 for 21 countries (the first three countries with the best GCI positions in each of the seven regional groups are taken). Latvia and Georgia are inferior in GCI to all countries from the sample. Latvia is ahead of such countries as Slovak Republic, Hungary, Cyprus, Romania, Croatia, Albania, Montenegro, Serbia, Ukraine, Greece, Bosnia and Herzegovina. Latvia in the region of Europe and North America ranks 28<sup>th</sup> out of 39 countries in this region and makes up 4.4 GCI, 27 countries from the sample remain out of reach (Fig. 6). Switzerland, United States, Netherlands have the best GCI scores and are 5.86, 5.85, 5.66 respectively. This confirms the low level of the index of prerequisites for University 3.0 development in Latvia and calls into question the very possibility of a full-fledged University 3.0 appearing in our country today.

**Table 3.** Index of prerequisites for the development of University 3.0 for the sample of countries – regional leaders according to GCI 2017-2018

Region	Country	GCI 2017-2018	Rank of 138 countries
East Asia and Pacific	Singapore	5.71	2
	Hong Kong SAR	5.53	9
	Japan	5.49	8
Eurasia	Azerbaijan	4.69	35
	Russian Federation	4.64	38
	Kazakhstan	4.35	57
	Georgia	4.28	67
Europe and North America	Switzerland	5.86	1
	United States	5.85	3
	Netherlands	5.66	4
	Latvia	4.4	54
Latin America and the Caribbean	Chile	4.71	33
	Costa Rica	4.5	47
	Panama	4.44	50
Middle East and North Africa	Israel	5.31	16
	United Arab Emirates	5.3	17
	Qatar	5.11	18
South Asia	India	4.59	40
	Bhutan	4.1	82
	Sri Lanka	4.06	88
Sub-Saharan Africa	Mauritius	4.52	45
	Rwanda	4.35	58
	South Africa	4.32	61

*Source:* elaborated by the authors





**Fig. 6.** Index of prerequisites for the development of University 3.0 for a sample of countries in Europe and North America region according to GCI 2017–2018

Source: elaborated by the authors

Ukraine in the region Europe and North America ranks 37<sup>th</sup>, leaving only Greece and Bosnia and Herzegovina behind. Georgia in its Eurasia region takes 4<sup>th</sup> place, behind Azerbaijan, Russia Federation, Kazakhstan and is 4.28 GCI. In the ranking of 138 countries, Latvia ranks 54<sup>th</sup>, Georgia 67<sup>th</sup> and Ukraine 81<sup>st</sup>.

### 3. International experience in forming the prerequisites for creating an entrepreneurial university

Despite the popularity of the concept of the third mission of universities in many countries and the unanimity of researchers and representatives of the scientific and innovative sector at different levels that universities need to develop as centres of innovative entrepreneurship, at this stage there is a lack of scientific and methodological developments on the effective transition of higher education institutions to model 3.0. Therefore, when starting to develop a serious and viable programme for creating entrepreneurial universities in our country, it is necessary to carefully study foreign experience and the work of researchers in this area.

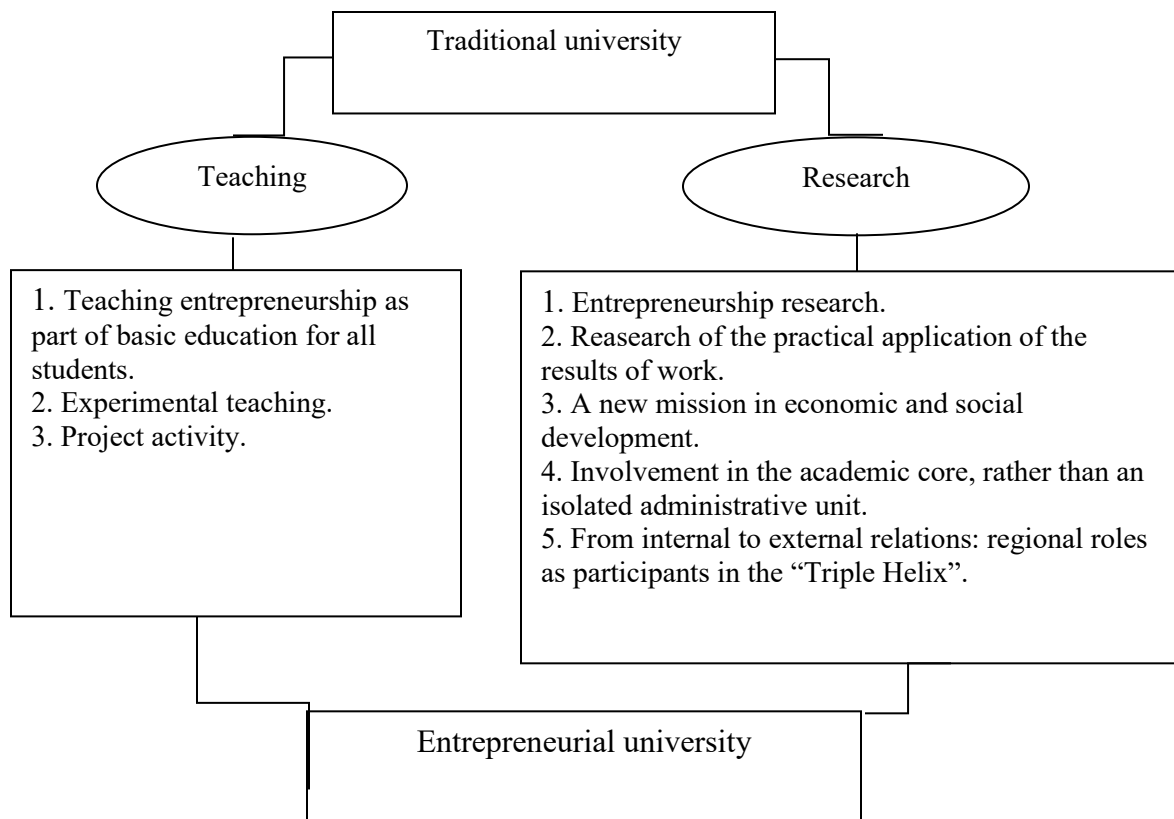
The idea of “University 3.0” is understood by scientists from Kazakhstan Shukhrat, A., Nizamov A. (2020), as an institution of higher education that has: 1. *Certain clear goals of innovation and entrepreneurship, the availability of an appropriate material and technical base.* Defining a clear grounded plan based on innovation and entrepreneurship by developing strategies and programmes. Managers must not only have clear goals for innovation and entrepreneurship, but also understand clear strategies and programmes to achieve them; creation of an appropriate material and technical base, a scientific laboratory, a small innovative enterprise, technology parks. 2. *Improved organisational structure of higher education, development of infrastructure for innovative entrepreneurship in accordance with the goals.* Formation of an appropriate structure for the successful implementation of the goals. In the process of transformation, it is important to create units that ensure the implementation of strategies and programmes for the development of innovation and entrepreneurship and the development of infrastructure; determine their tactics in accordance with the strategy of developing mechanisms for their implementation, determine the rights and responsibilities of each department and introduce management

procedures and coordination of transformations, determining their place and role in the development of innovative entrepreneurship in higher education; improvement of the system of promotion and development of managerial personnel. Development of a culture that increases innovation and entrepreneurial motivation, supports types of activities. Formation of a culture that supports the development of an innovative and entrepreneurial environment, the development of a sense of collective responsibility, the development of teamwork; confidence in the need for innovation and entrepreneurship in the field of higher education, support for the innovative initiative of the management, the introduction of an effective system of motivation for the scientific and creative activities of employees; to develop confidence in one's own success, promote the activities of managers in the field of innovation and entrepreneurship, strengthen confidence in the ability of each employee to influence the transformation process. 3. *Development of innovative entrepreneurial knowledge and skills of university staff*, broad participation of students in this activity. Creating conditions for the professional development of employees, increasing opportunities for the use of creative potential, reducing the workload, implementing measures to strengthen labour discipline; development of mechanisms for the exchange of experience in innovative and entrepreneurial activities, cooperation with foreign universities in this area, improvement of systems for searching and exchanging information; promotion of scientific schools, encouragement of young workers, scientific personnel who support innovative and entrepreneurial activities in society, the introduction of mechanisms to support their innovative and entrepreneurial activities even after receiving a degree and title; organisation of trainings to improve the knowledge and skills of the teaching staff in the field of scientific entrepreneurship, the broad involvement of students in scientific and entrepreneurial activities, improving the mechanism for ensuring the succession of scientific and entrepreneurial activities. 4. *Autonomy of higher educational institutions*, which implies timely adaptation of internal environment factors to changes in external environment factors. The lack of independence in the introduction of new types of activities in higher education, in particular innovative and entrepreneurial ones, strict state control over educational, scientific and entrepreneurial activities, financial dependence, create certain difficulties. Granting independence in the joint implementation of educational, research, innovation and entrepreneurial activities, the development of regulatory documents of the educational process; optimization of the organisational structure in accordance with the areas of activity, the creation of new departments, the formation of staff, the choice of study directions and, delegation of powers to universities based on their capabilities; awarding academic degrees and academic titles, development of cooperation with business, expansion of independence in the provision of additional services; introduction of a contractual procedure between the state and higher education institutions, regulating financial relations in terms of the provision of educational and scientific services; cooperation with manufacturers, regional issues (Shukhrat & Nizamov, 2020).

Burton Clark provides a more exhaustive and structured description of the entrepreneurial university. His work is based on the analysis of the transformation of 5 universities, though it does not give a clear understanding of how the structures that accompany the entrepreneurial university should be implemented and work. J. Ropke (2019) and J. Wissema (2016) (the author of the "third generation university" concept) write about the characteristic features and functions of an entrepreneurial university.

Henry Etzkowitz (Etzkowitz 2008) in his work "The Triple Helix Model" presents the university as the most important and leading part of the implementation of this model. The reason for bringing the role of the university to the fore in this theory is the new knowledge economy, which sets new trends in the work of all three components of the model developed by Etzkowitz. According to the author, "acting as an equal institutional partner together with business and the state, universities are one of the elements in the triple helix model and occupy a leading position in a knowledge-based society." This is due not only to one of the most important activities of the university - education and research, but also to the fact that universities make a huge contribution to the development of the economy through the creation of new companies in university incubators. Thus, according to H. Etzkowitz, the entrepreneurial university is a centre that creates new technologies, which carries

out work in research and innovation, actively uses the academic and practical skills of students and creates conditions for the implementation of new ideas. In this case, government and business provide the university with additional resources for production, and also allow the creation of a new innovative space (due to the intersection of ideas and interests of all three components of this model). In particular, the state sets a certain set of norms and rules for the activities of society, business, provides educational services along with the university. Accordingly, all three structures - the state, universities and business, interacting with each other and partially adopting each other's functions create an optimal environment for generating innovations. It should be noted that H. Etzkowitz, like J. Ropke, (Ropke, 2021) emphasizes the regional aspect in the development of an entrepreneurial university. Thus, the researcher points out that entrepreneurial universities are those “potential engines of regional economic development”. Moreover, Etzkowitz offers his own vision of transforming a traditional university into an entrepreneurial one (Fig. 7).



**Fig. 7.** Transformation of a traditional university into an entrepreneurial one

*Source:* elaborated by the authors

Thus, the researcher highlights the specific characteristics of an entrepreneurial university that it should have in the field of teaching and research. Burton Clark (1998), studying the issue of the reaction of universities to changes in the economy, approaches the definition of the concept of “entrepreneurial university” in the most comprehensive way. In his opinion, the entrepreneurial university actively strives for innovation in its operation. Moreover, the entrepreneurial university organises its activities in such a way as to constantly change in order to always remain in a favourable position. Clark identifies five common features that were characteristic of the structure of all five universities studied by the author, which allowed them to become entrepreneurial universities. These features include: 1. a strengthened guiding core - for a quick and flexible response to the ever-changing

demands of science, government and society, a structure is needed that would include the work of not only the central management group of the university, but also its departments; 2. integrated entrepreneurial culture - the idea of change; 3. extended periphery of development - active interaction of the university with the external environment, which requires the infrastructure of the university that meets the needs of society; 4. stimulation of the academic structure - the formation of faculties as independent business units; 5. diversified funding base - search for non-state sources of funding. The main features of an entrepreneurial university, according to the work of B. Clark, include, first of all, the reorientation of the university to innovative activities, through the reorganisation of all its structural divisions, increasing the level of economic attractiveness in the market, and, accordingly, increasing its income. Burton Clark writes about the features of an entrepreneurial university, but in no case does he indicate how to implement the structures that are indicated in his work and how they should work properly. Wissema considers the transformation of the university not from the point of view of external challenges (like Burton Clark), but from the point of view of internal challenges. The researcher emphasizes that in the near future the work of a uniform model of the university will end, i.e. universities will become very different in terms of the set of implemented programmes. Wissema (2016) calls such universities “the third generation universities”. Thus, “the third generation university perceives the commercialization of its know-how as its third goal in addition to the goals of the development of scientific research and education”.

H. Thorp and B. Goldstein (2013) consider it necessary to emphasize that an entrepreneurial university is not a business school as such, it does not adopt the methods and values of the world of commerce, it does not serve as a direct path to the creation of new companies and an absolute expert in economic development (Thorp, Goldstein, 2013). University 3.0. has the significance of the social sciences and humanities for innovations that are aimed at finding solutions to the problems the humanity faces; the focus is on solving major problems; direction to innovative activity and implementation of innovations in practice; culture takes precedence over structure - more attention is paid to the academic culture aimed at innovation. (Thorp & Goldstein, 2013).

The model of Paul Hannon in assessing the internal environment is determined by: 1. how organisational leadership is manifested, ensuring the development of entrepreneurship throughout the university. The key to the success of the University of Hertfordshire, for example, was the rector's strategic vision, thanks to which the university grew from the smallest polytechnic institute into a major university of international importance. Leadership is provided by the rector, who is committed to creating an entrepreneurial university, and the vice-rector for entrepreneurship, who is dedicated to student employment and commercial revenue generation. The university bills itself as a commercial enterprise and is a founder of a wide variety of companies, the income of which is reinvested in the university, providing students with additional opportunities. A highly specialized biochemical laboratory has been created within the walls of the university; the university has invested over £10m in the biopark, one of the UK's largest technology parks dedicated to incubating businesses working in the field of biology. 2. how the entrepreneurial vision is reflected in the university's strategy, 3. what infrastructure is created and how it supports interdisciplinary research and entrepreneurial activity of students, postgraduates and staff, and finally 4. how it supports and stimulates entrepreneurship at all organisational levels. The internal environment shapes the entrepreneurial thinking and behaviour of students, influences their perception of entrepreneurship as a future life choice, student involvement (Hannon, 2018; Hannon, 2013).

**Encouragement of entrepreneurial activity of employees.** An entrepreneurial university is ultimately defined by how the university contributes to achieving regional and national entrepreneurial goals, how the university disseminates its entrepreneurial practices and exerts political influence. For example, Imperial College London, where entrepreneurship became one of the main directions of its development strategy only in 2010. Within one year, the college managed to earn 30 million pounds from research funded by private enterprises. The business school has an entrepreneurial centre that allows students, researchers and business people to meet, share new ideas and help each other to bring new technological ideas to the market. Coventry University ranked first in the

number of consulting services provided to small and medium-sized businesses, and entered the top five in the number of consulting contracts concluded with large commercial organisations (Williams, 2012; McFarlane, 2012)

#### **4. Entrepreneurial University in Latvia – the first experience in the formation of prerequisites**

The low level of prerequisites for the development of University 3.0 in Latvia, as can be seen from our analysis of the parameters of the Global Competitiveness Index, does not inspire optimism for its imminent appearance in our country. As the study "Latvia's Progress in the Development of Entrepreneurship Education after Accession to the European Union" shows, there are great opportunities to improve entrepreneurship education at all 3 levels from basic to higher education. The Ministry of Education and Science has taken the following measures to implement the introduction of entrepreneurship education in higher education: on 29 May 2007, the Cabinet of Ministers of the Republic of Latvia amended the Regulations on the first and second level professional higher education state standards. They stipulate that when acquiring professional study programmes, the content of study courses should include a module for the development of professional entrepreneurship competences (organisation and establishment of enterprises, management methods, fundamentals of project development and management, record keeping and financial accounting system, knowledge about the formation of social dialogue in society and laws and regulations on labour relations). The module in the amount of at least six credit points must be included in all study programmes (bachelor in HEIs, if not previously acquired).

Having evaluated the guidelines for the implementation of entrepreneurship education at all levels of education included in the Latvian state policy planning documents, it must be concluded that development progress in this area is minimal, except for the improvements made in recent years in the content of social and economic education subjects.

- At all levels of the education system, the development of entrepreneurial competence is based mainly on the formation of knowledge and understanding what contribution learning the economics may give.
- The educational programmes developed and offered at the national level do not provide for the involvement of young people in a specific practical activity simultaneously with the acquisition of knowledge, following the principle of "learning by doing". It is a one-sided approach to the development of entrepreneurial competence.
- There is also no developed methodology for integrating the elements of entrepreneurship competence into other subjects and developing the personal qualities required for entrepreneurship in relation to the development of other key competences. In order to promote the progress of entrepreneurship education, it would be useful to use not only the materials developed by the European Commission's expert group, but also the knowledge and experience of national experts involved in European Commission projects. When planning policies, this would enable governments to learn more quickly from the best practices of other countries and achieve significant results in a much shorter period of time. (Bilkse, 2009).

At the same time, a favourable environment for the development of entrepreneurship among young people, including students, is currently preserved in Latvia. For example, during the World Entrepreneurship Week from 16 to 20 November 2020, the Entrepreneur Experience Days were held in Latvia for the third time. This initiative contributed to the sharing of experience among entrepreneurs and organisations for a more successful development of entrepreneurial activity in Latvia. Swedbank, together with business partners of the Latvian Chamber of Commerce and Industry and ALTUM, provided participants with an exchange of experience by visiting each other virtually and using digital tool platforms. In addition, during this week, a series of discussions were organised online with experts and entrepreneurs on how to better adapt to new circumstances, how to cooperate and talk remotely, how, despite the situation in the world, to grow and develop, conquering international markets. Most recently, the Latvian Chamber of Commerce and Industry (LCCI) created and launched the "Entrepreneurs of Tomorrow" project for university students, in which LCCI members -



entrepreneurs and professionals from various industries began to deliver lectures to students of Latvian universities, providing practical knowledge about entrepreneurship, thereby promoting young people's interest in entrepreneurship and preparing them to doing business in both the Latvian and international markets (LV 2021).

Latvia also implements entrepreneurship support programmes. The most popular support programmes mentioned by students in our sociological survey were the programmes of Investment and Development Agency of Latvia, primarily business incubators and investment motivation programmes, as well as assistance programmes for start-up entrepreneurs implemented by the financial institution Altum. Some students also mentioned local (municipal) support programmes. Among the types of support that can be received within the programmes, students noted the following: assistance in starting a business (both tangible and intangible), possible financing - in part or in full, risk assessment and management, office or production premises, and equipment required for business, meetings with existing experienced entrepreneurs - assistance in the export of competitive products or services, preparation of required documents, filling in declarations and assistance of accountants. (Altum, 2021; Vidzemes EC, 2021; NaudaBiznesam, 2021; BA School, 2021; Connect., 2021; Turiba., 2021; Entrepreneurship, 2019; Ideju., 2021; ALTUM, 2020; Rigas., 2021; LR., 2021; University., 2021; LIAA, 2021; RTU., 2021; Swedbank, 2020; The role., 2019; The effect., 2018; Voronov et al., 2020). At the same time, we need a state programme of at least a pilot project to create two or three entrepreneurial universities so far, which will allow us to have our own experience in removing economic, social and cultural barriers to the modernisation of our higher education, and the emergence of our own strong entrepreneurial leaders here.

### **Conclusions, proposals, and discussion points**

Over the past 10 years, the proportion of young people under the age of 30 (which includes the vast majority of students) among those who started their own business has significantly decreased - from 47.1% to 37.5%. Although, according to the data of the sociological survey, 52% in Latvia and 74% in Georgia of the students surveyed want to engage in entrepreneurship. The main reason, according to the authors, is the lack of a system of training students for entrepreneurial competencies in universities, which requires a significant and profound change in the mission of a modern university.

The analysis carried out reveals the key factors, and prerequisites that have the most significant impact on the development of an entrepreneurial university in Latvia. First of all, this is a strategic vision and strong leadership, certain clear goals for innovation and entrepreneurship, the availability of an appropriate material and technical base, an improved organisational structure of higher education, the development of an infrastructure for innovative entrepreneurship in accordance with the goals, the development of innovative entrepreneurial knowledge and skills of the university staff.

The development of University 3.0 depends on a diverse system of interaction between social, economic, and cultural factors. The entrepreneurial impact of universities is not limited to patent commercialization rates, it is considered much more broadly and includes the development of student employment skills, the impact on the economic development of the region, and the improvement of the quality of the population.

The key to success lies in the active interaction of universities with bodies of authority at the regional and national levels, as well as with representatives of the private and non-profit sectors. In the article, the considered index of prerequisites makes it possible to determine the factors hindering the creation of an entrepreneurial university, for which special sociocultural solutions can be developed.

In the complex index (UDI/c), Latvia, Georgia, and Ukraine lag behind in five out of five indicators - in higher education and vocational training, labour market efficiency, technological readiness, financial market



development, innovation and R&D. The results of the research presented in the article point at the need to modernise the Latvian higher education, at the same time showing the possibility of building University 3.0 in Latvia. This task, due to its extreme complexity, must be solved by scientific methods through the creation of social structures that make up its fundamental basis and ensure its functioning.

The Covid 19 pandemic, with all its grave consequences, has become a catalyst for innovative solutions in the field of online education, telecommunication solutions, IT solutions, it forces us to look differently at the problems that arise in the event of loss of a job or other opportunities. It is necessary to work hard to form a single ecosystem of student technological and social entrepreneurship.

**The novelty of the research findings** is to substantiate the conclusion about the need for entrepreneurial universities in Latvia, as well as to identify the main components of the transformation “University 3.0” in higher education of Latvia.

**The materials, findings and conclusions of the research** can be used by research organisations, government bodies, institutions of higher education, student organisations. Our research may make scientists - entrepreneurs and strategists realise how important it is to modernise Latvian higher education, thereby making a huge contribution to the development of the economy.

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**Vladimir MENSHIKOV** is Dr.sc.soc., Professor at Daugavpils University. His research interests include sociology of security; regional development; capital theory. He is an Expert of the Latvian Council of Science in the fields of economics and sociology. He is a head of the Centre of Social Research of Daugavpils University, Latvia.

**ORCID ID:** <https://orcid.org/0000-0001-9988-8588>

**Oksana RUZA** is Dr.oec., Docent, Researcher at the Institute of Humanities and Social Sciences of Daugavpils University (Latvia). She is an Expert of the Latvian Council of Science in the fields of economics. Her research interests include regional economics, industrial economics, finances.

**ORCID ID:** <https://orcid.org/0000-0002-6194-3841>

**Irēna KOKINA**, Prof. Dr. psych., rector of Daugavpils University, Latvia. She is an Expert of the Latvian Council of Science in the fields of Psychology and of Economics and Entrepreneurship. Her research interests include sustainable development, issues of psychology and management.

**ORCID ID:** <https://orcid.org/0000-0001-6778-0783>

**Iluta ARBIDANE** is Dr.oec., Dean of the Faculty of Economics and Management of Rezekne Academy of Technologies, Latvia. Her research interests: transport, new technologies, territory development.

**ORCID ID:** <https://orcid.org/0000-0002-9762-3874>

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## WHAT IS THE COST OF MAXIMIZING ESG PERFORMANCE IN THE PORTFOLIO SELECTION STRATEGY? THE CASE OF THE DOW JONES INDEX AVERAGE STOCKS

**Fernando Garcia <sup>1</sup>, Tsvetelina Gankova-Ivanova <sup>2</sup>, Jairo González-Bueno <sup>3</sup>, Javier Oliver <sup>4</sup>,  
Rima Tamošiūnienė <sup>5</sup>**

<sup>1,4</sup> *Universitat Politècnica de Valencia, Faculty of Business Administration, Cn de Vera s/n 46022 Valencia, Spain*

<sup>2</sup> *Technical University of Gabrovo, Faculty of Economics, ul. "Hadji Dimitar" 4, 5300 Gabrovo Center, Gabrovo, Bulgaria*

<sup>3</sup> *Universidad Autónoma de Bucaramanga, Faculty of Public Accounting, 680003 Bucaramanga, Colombia*

<sup>5</sup> *Vilnius Gediminas Technical University, Faculty of Business Management, Sauletekio 11, LT-10223, Vilnius, Lithuania*

*E-mails:* <sup>1</sup> [fergarga@esp.upv.es](mailto:fergarga@esp.upv.es); <sup>2</sup> [zvetelina\\_gankova\\_7@yahoo.de](mailto:zvetelina_gankova_7@yahoo.de); <sup>3</sup> [jgonzalez13@unab.edu.co](mailto:jgonzalez13@unab.edu.co); <sup>4</sup> [jaolmun@ade.upv.es](mailto:jaolmun@ade.upv.es);  
<sup>5</sup> [rima.tamosiuniene@vilniustech.lt](mailto:rima.tamosiuniene@vilniustech.lt)

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**Abstract.** Portfolio selection is one of the main financial topics. The original portfolio selection problem dealt with the trade-off between return and risk, measured as the mean returns and the variance, respectively. For investors more variables other than return and risk are considered to select the stocks to be included in the portfolio. Nowadays, many investors include corporate social responsibility as one eligibility criterion. Additionally, other return and risk measures are being employed. All of this, together with further constraints such as portfolio cardinality, which mirror real-world demands by investors, have made the multicriteria portfolio selection problem to be NP-hard. To solve this problem, heuristics such as the non-dominated sorting genetic algorithm II have been developed. The aim of this paper is to analyse the trade-off between return, risk and corporate social responsibility. To this end, we construct pareto efficient portfolios using a fuzzy multicriteria portfolio selection model with real-world constraints. The model is applied on a set of 28 stocks which are constituents of the Dow Jones Industrial Average stock index. The analysis shows that portfolios scoring higher in corporate social responsibility obtain lower returns. As of the risk, the riskier portfolios are those with extreme (high or low) corporate social responsibility scores. Finally, applying the proposed portfolio selection methodology, it is possible to build investment portfolios that dominate the benchmark. That is, socially responsible portfolios, measured by ESG scores, must not necessarily be penalized in terms of return or risk.

**Keywords:** sustainable investment; corporate social responsibility; multi-objective portfolio optimization; LR power fuzzy numbers; NSGA-II

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**JEL Classifications:** G11



## 1. Introduction

Investors can implement different strategies to invest their capital in the equity markets. On the one hand, if their investment horizon is intraday or short-term, they will choose among different trading strategies (Oliver-Muncharaz & García, 2020; Oliver-Muncharaz, 2020; Ogiugo et al., 2020; Rutkauskas et al., 2021).

On the other hand, for medium and long-term investments, portfolio management strategies are the most common. In this area, investors will opt for passive management if they consider that it is not possible to beat the market and will limit themselves to replicating a benchmark stock market index (García, Guijarro, & Moya, 2013). Conversely, they will engage in active management if they think they can outperform the benchmark.

Today's active portfolio management strategies are based on the seminal work by Markowitz (1952). The objective of the methodology is to obtain investment portfolios that simultaneously maximize return and minimize risk. The original methodology has been improved over the years and, among other modifications, additional criteria have been included to be considered in the selection of the stocks that make up the portfolio and that are important for investors, such as liquidity (García, González-Bueno, Guijarro, Oliver, & Tamošiūnienė, 2020). Another important criterion is the socially responsible behaviour of the companies selected in the investment portfolio (Cesarone, Martino, & Carleo, 2022).

Socially responsible investment (SRI), also called sustainable, responsible, green or ethical investment, is defined as a decision-making process that integrates in the investment strategy environmental, social and governance (ESG) criteria together with financial criteria (Miralles-Quirós & Miralles-Quirós, 2017; Silvestre, Antunes, & Filho, 2018). That means, socially responsible investors consider companies' ESG performance in addition to the conventional variables that measure financial performance, such as return and risk.

Over the last decades, SRI has experienced remarkable growth (Oliver-Muncharaz & García, 2020). At present there is no doubt that sustainable investment is a major force shaping global capital markets. According to the Global Sustainable Investment Review, sustainable investment in major capital markets has reached 35.3 trillion in assets under management, having experienced a 15% growth in two years (GSIA Global Sustainable Investment Alliance, 2020).

The motivation for investing in socially responsible companies is twofold. First, the desire of investors to promote a more ethical and sustainable corporate culture that respects human rights and avoids climate change, among other things (Arribas, Espinós-Vañó, García, & Oliver, 2019). Second, it is assumed that socially responsible companies, at least in the medium and long term, will have a higher financial performance than conventional companies (García, González-Bueno, Guijarro, & Oliver, 2020b).

As for the performance of socially responsible companies, it has not been empirically demonstrated that it is superior to the performance of conventional companies. In the scientific literature, studies can be found that conclude that the financial performance of socially responsible investment funds and stock market indexes is superior to that of their conventional peers (Gómez-Bezares, Przychodzen, & Przychodzen, 2016; Wu, Lodorfos, Dean, & Gioulmpaxiotis, 2017). At the same time, however, other studies identify exactly the opposite (Lesser, Röble, & Walkshäusl, 2016; Revelli & Viviani, 2015; Trinks & Scholtens, 2017). Finally, numerous studies have found no significant differences between the financial performance of the two groups of companies (Espinós-Vañó, García, & Oliver, 2018; Revelli & Viviani, 2015).

One of the reasons for this disparity in results is how socially responsible behaviour is defined (Espinós Vañó & García, 2018). It has been shown that committing socially irresponsible actions does not prevent companies from

being included in socially responsible stock market indexes (Arribas, Espinós-Vañó, García, & Morales-bañuelos, 2019; Arribas, Espinós-Vañó, García, & Riley, 2021). In fact, the variable that most influences eligibility for the main sustainable stock market indexes is the size of the companies (Drempetic, Klein, & Zwergel, 2019).

The aim of this research is to determine whether it is possible to create investment portfolios that simultaneously maximize profitability and socially responsible behaviour while minimizing risk. For this purpose, the multicriteria decision making methodology will be used, which allows to reach compromise solutions between different conflicting objectives. This methodology has been widely applied in the field of financial investments (Masood, Tvaronavičienė, & Javaria, 2019) and the creation of investment portfolios (Basilio, de Freitas, Kämpffe, & Bordeaux Rego, 2018; García, González-Bueno, Guijarro, & Oliver, 2020a; Martinkutė-Kaulienė, Skobaitė, Stasytė, & Maknickienė, 2021; Pahade & Jha, 2021). Generally, investment funds and socially responsible stock market indexes use positive or negative screening to select the companies in their portfolios. As mentioned above, this approach is subjective and not without criticism. Evaluation of the degree of corporate social performance is one of the most discussed questions among academic researchers and practitioners (Lamata, Liern, & Pérez-Gladish, 2018). In contrast to this option, the multi-criteria methodology applied in this paper does not require a prior selection of eligible companies, but rather selects those companies that maximize the ESG score of the portfolio, while maximizing the expected return and minimizing the risk. It is an objective and transparent methodology that allows socially responsible investors to simultaneously incorporate three fundamental criteria in their investment strategy.

The proposed methodology was applied to companies included in one of the most important stock market indexes, the Dow Jones Index Average (DJIA). The results obtained are in line with previous studies. On the one hand, there is a trade-off between profitability and risk: portfolios with higher profitability must assume a higher level of risk, and vice versa. On the other hand, the relationship of these variables with the ESG score of the portfolio is not linear. Investment portfolios with a high ESG-score are dominated in terms of return and risk by portfolios with a lower ESG-score. But portfolios with lower ESG-scores do not dominate other portfolios with relatively high ESG-scores. When comparing the performance of the portfolios obtained with that of the index to which they belong (DJIA), it is found that they all beat the DJIA in terms of return. Furthermore, by applying the proposed methodology it is possible to beat the DJIA in the three criteria used: sustainability, profitability and risk. Therefore, we can conclude that the proposed methodology allows investors to build investment portfolios that maximize socially responsible behaviour without having to sacrifice other fundamental objectives, such as maximizing profitability and minimizing risk.

The rest of the paper is structured as follows. Section 2 introduces the theoretical background. This is followed by a description of the multi-criteria methodology that will be used to create the investment portfolios. Section 4 shows and comments on the results obtained. Finally, the main conclusions are presented.

## **2. Theoretical background**

The problem posed by financial investment decisions consists of determining in which assets to invest and in what proportion, so as to maximize the profitability and minimize the risk of the investment. This is called the portfolio selection problem and was first proposed by Markowitz (1952). In the original model, the mean return and the variance were used to quantify the expected return and risk of the assets, respectively. Since then, numerous academics have proposed changes to adapt various aspects of the original model to the reality of financial markets. The new proposals have modified the way in which risk and return are quantified and have introduced new realistic criteria and restrictions.

In terms of risk quantification, the mean-variance model assumes that the return on financial assets follows a normal distribution, when in fact it is not (Narayan & Ahmed, 2014). To measure the risk of financial assets,

alternative measures have been used, such as, for example, semivariance (Markowitz, 1959), semi-absolute deviation (Speranza, 1993) or the CVar (Rockafellar & Uryasev, 2002), which are downside risk measures.

The Markowitz model assumes that the return of the financial assets is a random variable, so that their future performance can be reasonably well estimated from past data. However, financial markets are subject to different forms of uncertainty beyond randomness. To address this problem, fuzzy set theory can be applied (Zadeh, 1978). When analysing fuzzy phenomena, the shape of the membership function that best represents its historical evolution must be selected. In the case of the profitability of listed companies, triangular, trapezoidal and L-R power fuzzy numbers have been mainly used. The fuzzy theory has been welcomed by many authors, who use possibility measures to select the companies to be included in their investment portfolios (Liu & Zhang, 2018; Mansour, Cherif, & Abdelfattah, 2019; Pahade & Jha, 2022). But possibility measures lack the self-dual property, so they provide little information to investors and may confuse them. This problem was solved by Liu and Liu (2002), who proposed a self-dual credibility measure to study fuzzy phenomena. Since then, the credibility framework has been applied by many researchers to deal with the portfolio selection problem (Chen, Liu, & Wu, 2012; Jalota, Thakur, & Mittal, 2017a; Mohebbi & Najafi, 2018; Pahade & Jha, 2021; Vercher & Bermúdez, 2015).

Another improvement to the original mean-variance model has been the inclusion of additional criteria, such as liquidity (Gupta, Inuiguchi, Mehlawat, & Mittal, 2013; Yue & Wang, 2017; Yue, Wang, & Dai, 2015), skewness (Bhattacharyya, Kar, & Majumder, 2011) or kurtosis (Ma, Chen, Sun, & Zhu, 2021). An additional criterion used in some recent studies is the socially responsible behaviour of companies (Bilbao-Terol, Arenas-Parra, Cañal-Fernández, & Obam-Eyang, 2018; Fernando García, González-Bueno, Oliver, & Riley, 2019; Gasser, Rammerstorfer, & Weinmayer, 2017; Oliver, 2021). The use of criteria in addition to return and risk reflects investors' demand to satisfy other needs. Indeed, investors may be willing to sacrifice part of their expected return on their investment or increase their risk exposure if this negative situation is offset by improvements in other criteria, such as greater portfolio sustainability. In today's world, return and risk are not the only variables that guide the decision-making process of investors.

Along with the introduction of additional criteria, the original Markowitz mean-variance model has become more complex by introducing realistic constraints, such as cardinality, bound and budget constraints. As a consequence of the increased complexity of the model, the portfolio optimization model turns into a constrained NP-hard multi-objective problem. In this case, traditional optimization methods cannot be employed. Heuristic methods as multi-objective evolutionary algorithms must be used to solve the portfolio selection problem. One of the most widely used in the financial field is the Non-dominated Sorting Genetic Algorithm II (NSGA-II).

In this research paper, investment portfolios are created considering three criteria: profitability, risk and ESG-score, which is used as a measure of the ESG-engagement of the companies. Return and ESG-scores are assumed to be L-R power fuzzy variables in a credibility framework. The risk measure is the variance. Two constraints are included in the portfolio selection model: upper bound and cardinality. To solve the model, the NSGA-II is employed.

### **3. Methodology**

The methodology used in the process of creating socially responsible investment portfolios is described below. First, it is explained how the L-R fuzzy numbers are calculated in the credibilistic framework to quantify return and ESG behaviour. Second, the multi-objective portfolio selection model and the use of the NSGAII algorithm to solve the model are presented.

### 3.1. Calculation of L-R fuzzy numbers and credibility values

The functions  $L, R: [0,1] \rightarrow [0,1]$  are reference functions of a fuzzy number they satisfy the following conditions  $A = (x, \mu_A(x))$ , they satisfy the following conditions (Dubois & Prade, 1980):

- i)  $L(1) = R(1) = 0, L(0) = R(0) = 1$ ;
- ii)  $L(x)$  and  $R(x)$  are strictly decreasing and upper semicontinuous functions.

A fuzzy number  $M = (a, b, c, d)_{L\pi R\rho}$  is said to be an LR-type fuzzy number if its membership function has the following form (Dubois & Prade, 1980):

$$\mu_M(x) = \begin{cases} L_\pi\left(\frac{b-x}{b-a}\right), & \text{if } a \leq x < b \\ 1, & \text{if } b \leq x \leq c \\ R_\rho\left(\frac{x-c}{d-c}\right), & \text{if } c < x \leq d \\ 0, & \text{Otherwise} \end{cases} \quad (1)$$

where  $(b - a)$  and  $(d - c)$  show the left and right spreads of  $M$ , respectively.  $L_\pi$  and  $R_\rho$  are the reference functions that define the left and right shapes of  $M$ , respectively. Throughout this research, the left and right shapes of L-R fuzzy numbers are defined by  $L_\pi(k) = 1 - x^\pi$ , and  $R_\rho(k) = 1 - x^\rho$ , respectively. L-R power fuzzy numbers will be referred as  $M = (a, b, c, d)_{\pi\rho}$  and the LR-fuzzy numbers used have the same reference functions  $L$  and  $R$ .

The crisp equivalent expression for the credibilistic expected value of a L-R power fuzzy variable  $\xi = (a, b, c, d)_{\pi\rho}$ , is obtained by deriving the expected value of a fuzzy variable (Jalota, Thakur, & Mittal, 2017b):

$$E(\xi) = \frac{1}{2} \left[ b + c + \frac{(d-c)\rho}{\rho+1} - \frac{(b-a)\pi}{\pi+1} \right] \quad (2)$$

Therefore, the maximization of the expected return of the portfolio is expressed as:

$$\text{Max } F_1(\omega_i) = \sum_{i=1}^n \left[ \frac{1}{2} \left[ b_{r_i} + c_{r_i} + \frac{(d_{r_i} - c_{r_i})\rho_{r_i}}{\rho_{r_i} + 1} - \frac{(b_{r_i} - a_{r_i})\pi_{r_i}}{\pi_{r_i} + 1} \right] \omega_i \right] \quad (3)$$

The expression for the maximization of the expected ESG performance of the portfolio is following crisp objective:

$$\text{Max } F_2(\omega_i) = \sum_{i=1}^n \left[ \frac{1}{2} \left[ b_{\text{ESG}_i} + c_{\text{ESG}_i} + \frac{(d_{\text{ESG}_i} - c_{\text{ESG}_i})\rho_{\text{rESG}_i}}{\rho_{\text{rESG}_i} + 1} - \frac{(b_{\text{ESG}_i} - a_{\text{rESG}_i})\pi_{\text{ESG}_i}}{\pi_{\text{ESG}_i} + 1} \right] \omega_i \right] \quad (4)$$

The multiobjective credibilistic mean-semivariance-PER portfolio selection model seeks the maximization of portfolio's return ( $\text{Max } F_1(\omega_i)$ ), the maximization of portfolio's ESG score ( $\text{Max } F_2(\omega_i)$ ), being this score a proxy for companies' socially responsible behaviour, and the minimization of risk ( $\text{Max } F_3(\omega_i)$ ), being the risk

calculated as portfolio's return variance. As mentioned above, both return and ESG score are L-R power fuzzy numbers. Moreover, the model includes some real-world constraints such as allocation of all the budget, upper bound, number of assets to be included in the portfolio and no short selling:

a) Capital budget constraint on the assets is denoted by

$$\sum_{i=1}^n \omega_i = 1 \quad (5)$$

b) Upper bound

$$\omega_i \leq u_i y_i, \quad i=1,2,\dots,n \quad (6)$$

c) Cardinality constraint

$$\sum_{i=1}^n y_i = k, \quad y_i \in \{0,1\}, \quad i=1,2,\dots,n \quad (7)$$

d) No short selling of assets

$$\omega_i \geq 0, \quad i = 1,2,\dots,n \quad (8)$$

For this study, a feasible portfolio  $P$  is efficient if there does not exist another feasible portfolio  $P'$  such that,  $P_{F1(\omega_i)} \geq P'_{F1(\omega_i)}$  and  $P_{F2(\omega_i)} \leq P'_{F2(\omega_i)}$  and  $P_{F3(\omega_i)} \leq P'_{F3(\omega_i)}$  with strict inequality for at least one of them. The set of efficient solutions is the so-called Pareto optimal set in the decision space and constitute the Pareto optimal frontier. Portfolios on this frontier are said to be non-dominated. There is no portfolio that simultaneously beats any portfolio on the frontier regarding the three criteria employed (return, risk and ESG-score).

The multi-objective portfolio selection model is not a classical quadratic optimization problem, but a quadratic mixed-integer problem that is NP-hard. To deal with this problem, a multiobjective evolutionary algorithms (MOEAs) is applied. Concretely, we use the Non-dominated Sorting Genetic Algorithm II (NSGA-II) (Liagkouras & Metaxiotis, 2015), which was introduced by Deb *et al.*, (2002). The structure of this algorithm is detailed in Palanikumar *et al.* (2009) and Deb *et al.* (2002). The experimental parameter configuration employed in this research is the following: Population size (400), distribution index for crossover (10), probability of crossover (0.9), distribution index for mutation (50); probability of mutation (0.01) and maximum number of generations 2000.

#### 4. Results and discussion

The aim of this research is to analyse the trade-off between return, risk and corporate social responsibility in investment portfolios. The question is, whether investing in socially responsible companies is penalized in terms of return and risk or if it pays to be a socially responsible investor.

In order to carry out the study, the methodology described in the previous section was applied to a database covering 28 of the 30 stocks that make up the prestigious DJIA stock index in January 2022. The tickers of the companies included in our study are: MMM, AXP, AAPL, T, BA, CAT, CVX, CSCO, KO, XOM, GS, HD, IBM, INTC, JNJ, JPM, MCD, MRK, MSFT, NKE, PFE, PG, UNH, VZ, V, WBA, WMT, DIS. For each of these companies, daily information is available on the share price ( $P_i$ ) for the period from 2<sup>nd</sup> January 2008 to 31<sup>st</sup> December 2019. From this information, the daily profitability has been calculated as  $r_{it} = \ln(P_{it+1}/P_{it})$ . Information on the corporate social responsibility performance of the 28 companies for this period is also available. These data have been obtained from the Bloomberg ESG disclosure Score. The ESG scoring quantifies the performance in the fields of environmental, social and governance activities using a scale from 0 to 100, being 100 the best possible score. The data relating to profitability and ESG performance have been treated as described in section 3. The variance has been obtained directly from the daily returns.

Table 1 shows, for each year from 2008 to 2019, how the companies in the sample have performed in terms of ESG, profitability and risk. For profitability and risk, the average values are shown, while for ESG performance, the information is broken down by quantiles.

**Table 1.** Descriptive analysis of the sample

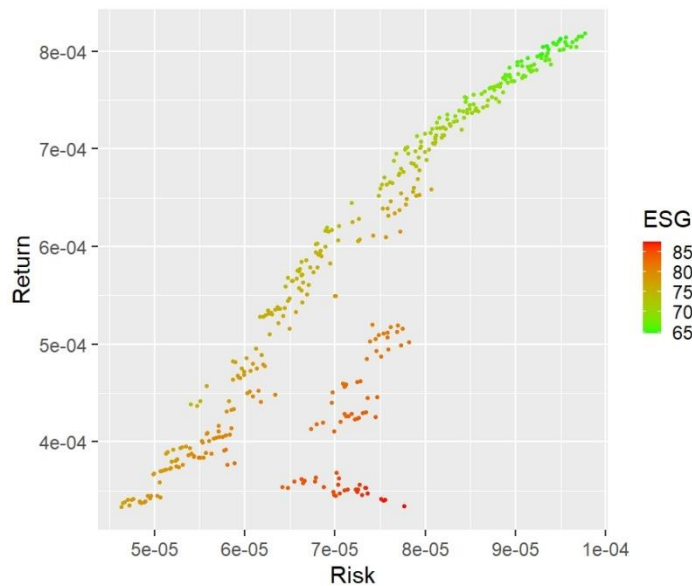
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ESG Min.	20,2	17,1	29,2	25,3	23,5	21,0	50,8	50,9	55,4	61,7	63,4	54,5
ESG 1st Qu.	56,3	64,4	61,7	64,0	63,1	62,4	63,1	66,6	67,1	68,1	68,0	70,2
ESG Median	69,6	71,4	68,8	71,6	72,5	69,8	68,8	73,3	74,1	71,8	72,9	74,4
ESG Mean	65,6	69,1	69,4	69,9	69,1	69,1	70,9	72,7	74,2	74,7	74,9	75,7
ESG 3rd Qu.	78,2	78,6	81,2	78,3	76,9	78,4	78,3	79,1	81,4	82,2	80,2	81,2
ESG Max.	91,6	95,1	94,8	92,8	91,2	92,3	92,5	93,1	91,2	90,3	93,2	93,2
Return	-0,0013	0,0010	0,0004	0,0002	0,0005	0,0010	0,0004	0,0000	0,0004	0,0007	-0,0001	0,0007
Risk	0,0011	0,0010	0,0006	0,0008	0,0005	0,0006	0,0005	0,0006	0,0005	0,0008	0,0007	0,0007

Source: The authors

As for the ESG score, the wide range between the highest and lowest scores is striking. This implies that the ESG performance of the companies in the sample is very uneven. It is not possible to obtain investment portfolios with ESG values well above 90. Nor is it to be expected that the portfolios with the worst ESG performance do not reach 40 points. The average for the period analysed is between 65 and 75 points. Another fact worth noting is that the minimum ESG values show an upward trend, which may be indicative of increased awareness of the companies in the sample of the importance of socially responsible behaviour. Return rates fluctuate between a minimum of -0.0013 in 2008 (the year of the financial crisis) and the maximum in 2009 and 2010 (0.0010). In terms of risk, the mean variance fluctuates between 0.0011 (year 2008) y 0.0005 (years 2012, 2014 and 2016).

Figure 1 shows the distribution of 400 pareto-efficient portfolios in the return, risk and ESG-score space. These portfolios have been chosen applying the methodology described in section 3. In this case, no cardinality or upper bound restrictions have been imposed. There is no portfolio that simultaneously achieves higher returns, lower risk and higher ESG-score. Portfolios that are not on the Pareto efficient frontier are beaten by those that are on the frontier in all these criteria. That is, they have lower returns, higher risk and lower ESG-score.





**Figure 1.** Pareto optimal frontier of the credibilistic multiobjective mean-variance-ESG portfolio model

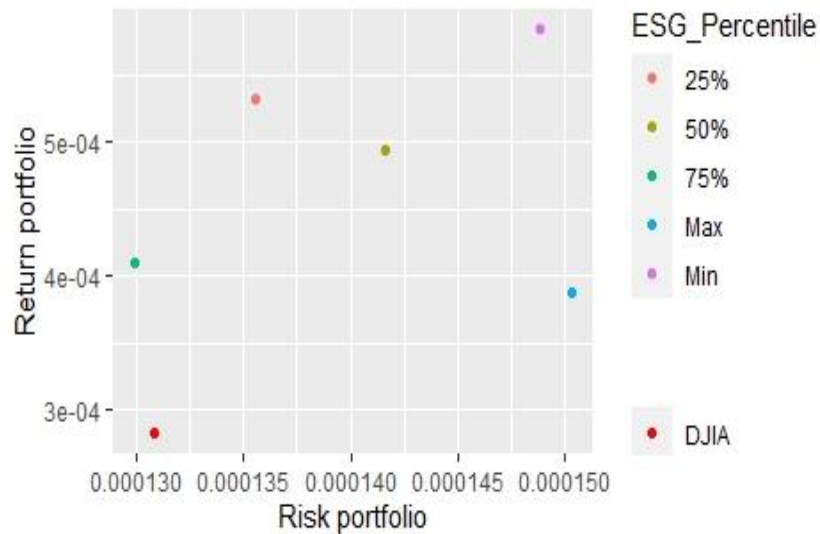
*Source:* The authors

The multi-criteria methodology used yields non-dominated portfolios with very high ESG values. In these cases, investments are made in the companies with the highest ESG-score. These portfolios are dominated by many others in terms of profitability and risk. In other words, concentrating investments in the most socially responsible companies has negative consequences on the profitability of the portfolio and the risk borne. This is a curious fact, since in theory the higher the return, the higher the risk and vice versa.

It is also observed that portfolios can be created with relatively low ESG values by investing in companies with lower ESG-score. By sacrificing ESG performance, we obtain portfolios with high returns and high risk. These portfolios are dominated by many other portfolios in terms of risk and ESG-score.

In short, figure 1 shows the trade-off between the different criteria. It is interesting to note how, in the sample and period analysed, higher ESG implies lower profitability, contrary to what other papers in the literature suggest. The most profitable companies are the relatively less socially responsible ones. And for these companies, as economic theory suggests, higher profitability is associated with higher risk.

Following these results, we proceeded to create 400 more realistic investment portfolios by introducing all the restrictions according to the specifications in section 3. The number of companies in the portfolio was set at  $k=10$  and the upper bound at 30%. From the totality of portfolios obtained, Figure 2 shows a selection. The portfolios have been selected by their quantile in relation to their ESG-score.



**Figure 2.** Pareto optimal selected portfolios of the credibilistic multiobjective mean-variance-ESG portfolio model

*Source:* The authors

The ESG-score of the portfolios shown in Figure 2 is as follows. The portfolio with the lowest ESG-score, the one corresponding to the minimum ESG performance, has an ESG-score of 66.32. The portfolio located in the percentile 25 has an ESG-score of 68.55. The one located in the median has an ESG-score of 70.82. The one located in the percentile 75 reaches 73.26 ESG-scores. Finally, the portfolio with the highest ESG-score has 76.25 points. On figure 2 is also drawn the portfolio that corresponds to the DJIA (red color), which has the one with the lowest return. Its ESG-score is 70.97.

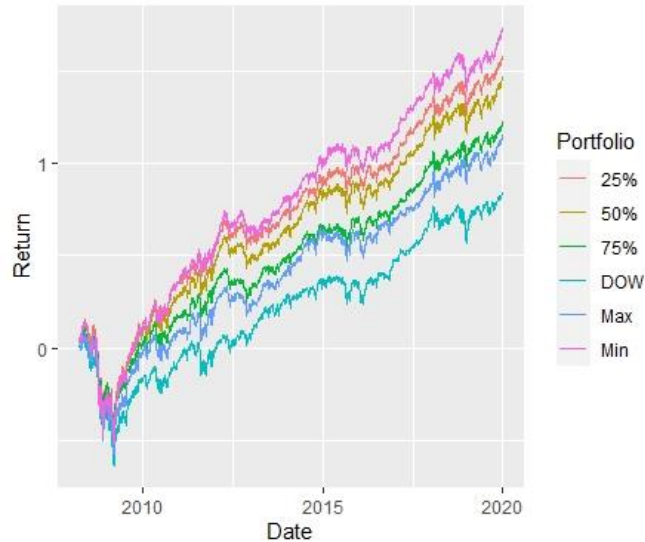
The ESG-score range of the created investment portfolios is between 66.32 and 76.25. Considering the information in Table 1, it can be stated that they have a medium-high ESG level. The return (between 0.00035 and 0.006) is also relatively high, given the sample of companies available. It is striking how low the level of risk assumed by the selected portfolios is (0.00013 to 0.00015). The investment portfolio corresponding to the DJIA has a slightly higher ESG-Score than the sample average, and a relatively low level of return and risk.

As occurs when the model has no cardinality or upper bound restrictions, the profitability of the portfolios gradually decreases as the ESG-score increases. It can be concluded that the higher the ESG-score, the lower the portfolio return. The same is not true for risk. The riskiest portfolios are those with extreme ESG-score values (low or high). Therefore, the relationship between risk and socially responsible corporate behaviour is neither positive nor linear.

An important result is that, with the applied methodology, it is possible to beat the DJIA in terms of return, risk and ESG-score. As can be observed in Figure 2, the portfolio in percentile 75 dominates the portfolio representing the DJIA. Therefore, an investor seeking to maximize the ESG level of her portfolio needs not be penalized in terms of return or risk. In other words, with the proposed methodology, it is possible to construct socially responsible investment portfolios in terms of ESG without giving up returns or assuming more risk than the benchmark stock index. This is at least the case with the DJSI companies in the period analysed.

Finally, since many investors are particularly concerned about the performance of their portfolios, figure 3 shows the performance of the portfolios obtained and the DJSI from the beginning of 2008 to the end of 2019. As figure

3 shows, all the portfolios created with the multi-criteria model beat the DJIA index in terms of performance over the entire period.



**Figure 3.** Evolution of the return of selected portfolios and DJIA

*Source:* The authors

It is clear that the most profitable portfolios are those with lower ESG scores. As for the time evolution, it is similar in all cases. Profitability fell sharply in 2008 and early 2009. From then on, it followed a strong upward trend.

## Conclusions

In recent decades, investors' concern for the socially responsible behaviour of companies has increased considerably. This evolution is probably due to the increase in society's awareness of problems such as pollution and climate change, respect for human rights or labour conflicts. In response to this demand from investors, companies have emerged that specialize in quantifying the socially responsible behaviour of companies in terms of the environment, society and corporate governance (ESG). As a result, investors can include ESG performance of companies as a criterion for inclusion in their investment portfolios.

One of the questions that has attracted the attention of researchers in recent years is whether it is worth investing in socially responsible companies. On the one hand, it is assumed that sustainable companies will perform better in the medium and long term, which, in turn, will positively affect their stock price. But on the other hand, they face higher costs in the short term. Another fundamental question is how ESG performance is defined and measured.

In this paper we have applied a fuzzy multi-criteria portfolio selection model that includes in the decision process not only the usual criteria of profitability and risk, but also the ESG behaviour of the companies. In addition, real-world constraints such as cardinality or upper bound are included. To solve the model, which is NP-hard, the NSGA-II heuristic has been used. The model was applied to create investment portfolios with 28 companies included in the DJIA index over the period 2008-2019.

The results obtained show that higher ESG engagement of portfolio companies implies lower investment returns. This result is contrary to that of some previous studies. However, this is a very controversial issue, on which there is no unanimity among researchers. As for the relationship between ESG-score and risk, portfolios with extreme ESG-score values (i.e. both portfolios with higher ESG-score and portfolios with lower ESG-score) bear the greatest risk. There is therefore no simple relationship between ESG performance and risk. Finally, the application of the proposed multi-criteria portfolio selection methodology makes it possible to build portfolios that dominate the benchmark (DJIA) in all three criteria: performance, risk and ESG-score. Therefore, investors who wish to invest in socially responsible companies do not necessarily have to assume greater risk or renounce to the profitability levels achieved by the benchmark.

Obviously, the results obtained are largely due to the sample of companies selected and the period analysed. To make the results more robust, it is necessary to apply the methodology to other markets and to a larger number of companies. In addition, it would be interesting to use other measures to quantify the socially responsible behaviour of companies. It is also advisable to use other stock market indexes as benchmarks. Finally, changes can also be made to the methodology, such as using other measures to measure risk, such as CVar, and incorporating other real-world constraints, such as transaction costs.

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**Author Contributions:** Conceptualization: *Fernando García, Jairo Gonzalez-Bueno, Tsvetelina Gankova-Ivanova*; methodology: *Javier Oliver, Jairo Gonzalez-Bueno*; data analysis: *Javier Oliver, Rima Tamosiuniene*, writing—original draft preparation: *Fernando García, Rima Tamosiuniene, Tsvetelina Gankova-Ivanova*, writing; review and editing: *Javier Oliver, Jairo Gonzalez-Bueno*; visualization: *Javier Oliver*. All authors have read and agreed to the published version of the manuscript.

**Fernando GARCÍA** received the B.S. degree from the Hochschule Bremen, in Germany in 1998, the M.S. degree in Business Administration from the Universitat de València, Valencia, Spain, in 1999, and the Ph.D. degree from the Universitat Politècnica de Valencia in 2005. He is associate professor of finance in the Business School of Universitat Politècnica de València. His research interests include investment strategies, multicriteria decision making, corporate responsibility and asset valuation. He has published more than 30 papers in indexed Journals such as *Technological and Economic Development of Economy*, *Mathematical and Computer Modelling*, *Journal of the Operational Research Society*, *Journal of Business Economics and Management*, *Sustainability*, *Computers and Operations Research*, *Journal of Environmental Management*, *Neural Computing and Applications*, among others. He is an Associate Editor of the journals *Entrepreneurship and Sustainability Issues*; *Finance, Markets and Valuation*; and *Insights into Regional Development*.

**ORCID ID:** <https://orcid.org/0000-0001-6364-520X>

**Tsvetelina GANKOVA-IVANOVA** - received the B.S. and the M.S. degree in economics from the University of National and International Economy, Sofia, Bulgaria, in 1987, and the Ph.D. in economics also from the University of National and International Economy, Sofia, Bulgaria, in 1996. Since 2001 she is an associate professor of economics at the Faculty of Economics of the Technical University of Gabrovo, Bulgaria. Her current research interests include analyses and evaluation of investment projects, analysis and evaluation of effectiveness of digitalization. His research has been published in several articles.

**ORCID ID:** <https://orcid.org/0000-0001-7873-8062>

**Jairo GONZÁLEZ-BUENO** received the B.S. degree in financial engineering from the Universidad Autónoma de Bucaramanga, Colombia, in 2004, the M.S. degree in business administration from Universidad Industrial de Santander, Colombia, in 2012, and the Ph.D. in business management and administration from Universitat Politècnica de València, Spain, in 2018. He is professor of finance and accounting in the faculty of public accounting of the Universidad Autónoma de Bucaramanga, Colombia. His current research interests include portfolio management, finance ethics and valuation. His research has been published in Journal of Business Economics and Management, Sustainability, and Journal Finance, Markets and Valuation, among others.

**ORCID ID:** <https://orcid.org/0000-0002-5896-094X>

**Javier OLIVER** was born in Valencia, Spain in 1973. He received the Bachelor degree in Business Administration from the Universitat de València in 1996, Master degree in Finance from Universitat Politècnica de València in 2010 and the Ph.D. degree in Business Administration from the Universitat Politècnica de València in 2014. Since 2011 to the present, he is an Associate Lecturer on the Economics Analysis Department in the Universitat de València. As well, since 2013 to the present he serves as Associate Lecturer in the Economics and Social Sciences Department of the Universitat Politècnica de València. He has co-authored several articles in the financial area.

**ORCID ID:** <https://orcid.org/0000-0001-5317-6489>

**Rima TAMOŠIŪNIENĖ** received the B.S. and M.S. degree in Economics and Civil Engineering from Vilnius Civil Engineering Institute (Vilnius Gediminas Technical University), Vilnius, Lithuania, in 1987, and the Ph.D. degree from the Vilnius Gediminas Technical University in 1999. She is the Professor of Economics in the Department of Finance Engineering, Faculty of Business Management at Vilnius Gediminas Technical University. Her research interests are: Investment evaluation and management, investment strategies, corporate responsibility, business and investment projects preparation, evaluation management, risk management. She has published more than 15 papers in indexed Journals such as Journal of Business Economics and Management, Sustainability, Technological and Economic Development of Economy, Operational research, Transformations in business & economics and others.

**ORCID ID:** <https://orcid.org/0000-0001-8667-3713>

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## THE ROLE OF PRIVATE VENTURE CAPITAL INVESTORS IN ENHANCING VALUE-ADDING ACTIVITIES AND INNOVATION OF HIGH GROWTH FIRMS IN UGANDA \*

Ahmed I. Kato <sup>1\*</sup>, Germinah Evelyn Chiloane-Tsoka <sup>2</sup>

<sup>1,2</sup> Department of Applied Management, College of Economic Management Sciences, University of South Africa,  
Lynnwood Rd, Hatfield, Pretoria 0002, South Africa

E-mails: <sup>1\*</sup> [katoai@unisa.ac.za](mailto:katoai@unisa.ac.za) (Corresponding author); <sup>2</sup> [chiloge@unisa.ac.za](mailto:chiloge@unisa.ac.za)

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**Abstract.** For more than three decades, private venture capital (VC) firms have been recognised for their pivotal role in advancing value-creation and innovation in high-growth enterprises. Recent studies have found VC as a viable driver for the economic growth of developed nations. Research shows that many technological global companies today started as small venture capital (VC) funded companies. However, less evidence is available in emerging economies to support value creation and innovation capacity provided by the VC companies in Uganda. Consequently, how and when venture capitalists (VCs) can give significant oversight and add value to their ventures beyond VC funding has remained unresolved. Therefore, we use survey data from 77 VC firms expounded by interview data from key respondents from the VC industry. Our study finds that VCs' role is essential for nurturing value-added skills in VC-financed firms. Evidence was predictable in improved financial management, sales turnover, profitability, strategic planning, innovation capacity, recruitment, sound BOD, and a broad network for future funding opportunities. Our study contributes to the under-studied space of VC performance, especially in Uganda, where there is limited academic literature in this field. These results may support entrepreneurs/governments to engage in lucrative partnerships with experienced VC firms that can bridge the SMEs' equity financing gap early. Finally, this study offers a foundation for future research direction.

**Keywords:** Private venture capital firms; value-adding activities; venture capitalists; innovation; success of innovative firms; Uganda

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## 1. Introduction

For more than three decades, private venture capital (VC) firms have been recognised for their pivotal role in advancing value-creation and innovation for high-growth enterprises (Ernst & Young, 2008; Giacomo & Gigante, 2021; Lerner & Nanda, 2020; Jeong et al., 2020; Moirangthem & Nag, 2021). Recent studies have found VC as a viable driver for the economic growth of developed nations. VC investors provide capital to innovative enterprises to fill the equity financing gap that hampers their potential to grow (Ahlstrom & Bruton, 2006; NVCA, 2015, 2021; Kato & Tsoka, 2020). A review of the current literature reveals that there is a growing stream of many technology industries such as Google, YouTube, Facebook, Microsoft, and Apple in the US and other global industrialised markets in the UK, China, Canada, and Israel, ascending from VC and VCs' value-adding activities that facilitate new venture creations and sustainability of existing ones (Gompers et al., 2020; Jeong, et al., 2020). Convincingly, prior literature confirms that VC firms support value-creation in the portfolio companies and social-economic development of nations (Ernst & Young, 2016; Gompers et al., 2020; Deloitte & NVCA, 2021; Tereza, 2017). Although abundant literature exists in the advanced economies, less evidence is available in emerging economies to support the value creation and innovation capacity that VC companies deliver to their VC-financed enterprises. Consequently, how and when venture capitalists (VCs) can give significant oversight and add value to their ventures beyond capital has remained unresolved. As a result, this study delivers an empirical understanding of this field that has received insufficient attention from the academic literature.

Besides, VCs deliver a multifaceted compendium of value-added skills transferred from other mature technological markets to innovative firms. These involved far-reaching networks of strategic partnerships, capacity development, vast focused experience and hasten access to expert services essential for attracting future funding opportunities for innovative early-stage firms (Cheah & Ho, 2019; Colombo et al., 2005; Hellmann & Puri, 2002; Chua & Wu, 2012; Lin et al., 2020; Slimane, Chakir & Bouzahir, 2020). Similarly, the studies of Del Bosco et al. (2019), Liang et al. (2019), Owen and Mason (2019), and Wang et al. (2019) have reinforced VC as a catalyst for value-adding activities, innovation, and economic growth of start-ups, especially in more developed economies. Although prior studies have led to surprising empirical results and supported the subject of VC, there is a still-limited understanding of when and how VCs in Uganda conduct value-adding activities. This is accredited to the lack of empirical research and diminutive government support for the VC industry, especially in developing countries. We also discover that this disparity may persist since the US VC industry has remained superior globally compared to Africa, where the VC landscape is remarkably underdeveloped (Divakaran et al., 2014; Shanti, 2018; SAVCA, 2020; World Bank, 2020). Unless the entrepreneurs exhibit willingness and interest in the VCs' advice, no value-added can be achieved through VC involvement. (Fried & Hisrich, 1995; Sapienza et al., 1996). As a result, directing novel research focusing on value-adding activities was essential because these activities distinguish VC from other sources of funds such as bank loans (Gompers & Lerner, 2001; Gompers et al., 2020).

This study contributes to our understanding of how VCs in Uganda can create value-adding activities and successful investments, and it highlights pitfalls that may arise from VC fund managers' presence in the business processes of the start-up firms. Correspondingly, we would like to emphasize that although prior authors' command distinguished empirical conclusions, the matter of value-creation beyond the provision of VC to the portfolio companies has for long remained undecided. Primarily, the capacity of VC investors in Uganda and emerging economies in Africa is limited to embracing the new VC finance technology, owing to the mixed results engendered by varied methodologies and proxies engaged in estimating VC performance (Gompers et al., 2020; Harris et al., 2020; Tykvova, 2018).

Above and beyond, VC data are not easily accessible in Uganda, since many of the VC-backed enterprises are private firms, which rarely publish their results. VC's role in harnessing value-adding activities and promoting successful investments in innovative early-stage firms has not been well interpreted. As a result, this article builds on the understanding that VC firms are associated with enhancing value addition and growth of the portfolio companies, while potential entrepreneurs are interested in VC fund managers with focussed experience in nurturing SMEs with growth potential. To uphold our arguments, we show that countries such as Germany are still grappling with the application of the value addition concept to VC-backed companies (Moirangthem & Nag, 2021). As a result, it is not surprising that this philosophy is new to Uganda.

In a way to gain more insight into these theoretical thoughts, we collected data from 77 survey questionnaires and conducted 24 virtual interviews with key respondents with vast knowledge in VC investment, selected from Uganda's central business districts (CBD) comprising Kampala, Wakiso, Mukono, and Jinja. By so doing, we could shed light on how and when VCs spend their greatest effort to provide oversight and value-added assistance to their investment companies. Consistent with prior empirical work, we found that VCs' strategic involvement as their most important role helps provide financial and business advice and function as a board (Sapienza et al., 1996). For that reason, this article undertakes to advance existing literature by evaluating the study hypotheses to produce a holistic understanding of Uganda's VC market landscape.

This article delivers an in-depth insight into the categories of value-adding activities that VCs underwrite to the portfolio companies and how they positively influence the sustainability of their ventures. Second, massive literature works on VC and entrepreneurship have focused on understanding VC's impact on the performance and growth of SMEs and relatively ignored the latent role VCs play towards value-added to the VC-backed enterprises. We, therefore, offer new knowledge that supports these conclusions. Additionally, the study results have indispensable implications for VC fund managers and policymakers to design customised programmes focused on increasing awareness of value-adding activities that the VC companies can offer to the SMEs. Therefore, understanding the significance of these superior skills for promoting successful investments can help build teams that increase firm performance. Finally, we offer several important topics for future research.

The rest of the article is organised as follows: Section 2 provides a synopsis of Uganda's economics and SME development, while section 3 delivers a comprehensive literature review underpinning the VCs' role in young innovative firms. In Section 4, we illustrate the research design and methods adopted for data collection. Section 5 reports the results and discussion, and finally, Section 6 presents conclusions and recommendations for future research. In the current section, the present findings were confronted with the theoretical approaches to the influence of the VC industry on entrepreneurship development in emerging economies described in the literature. We point out significant conclusions and the directions for further research.

## **2. Synopsis of Uganda's economy and SME development**

SMEs are the drivers of Uganda's economy, comprising services (50%), commerce and trade (33%), manufacturing (10%), and others (7%). The SME sector contributes 20% of the national GDP and employs over 2.5 million Ugandans (UIA, 2018). However, heavy reliance on the informal entrepreneurship sector, characterised by a growing failure rate of SMEs from business, undermines the inclusive growth of Uganda's economy. Several studies have cited poverty and lack of access to funding for SMEs as one of the global challenges primarily for developing countries in Africa (United Nations, 2021; World Bank, 2016). The continent continues to host most world's poor communities and increasing levels of inequality (Schoch & Lakner, 2020). The gap between the rich and poor has continued to grow in most countries in Africa, including in Uganda. Approximately 40% of the total wealth in Africa is owned by a handful of the richest people, which is nearly 0.0001 percent of the continent's population (Seery et al., 2019). We observe that the rapid and sustained



poverty reduction requires inclusive growth that allows people from different groups and sectors to contribute to and benefit from economic growth. (United Nations, 2021). As a result, SME development in Uganda is one of the policy agendas of the government to boost economic growth and development.

Considering entrepreneurship development, one of the government's key interventions is increasing foreign investment. This funding mechanism offers the young innovative firms an opportunity to access affordable capital and superior skills with competency to boost economic growth. Recent authors argue that fostering VC investment, coupled with sustainable entrepreneurship, has a direct positive result on employment creation, national GDP growth, and the creation of new firms. As an example, the fabulous YOZMA VC Fund in Israel is one of the global successful VC-funding models (Lerner, 1995), the Uganda government can emulate to avert the alarming failure of start-up firms (Muriithi, 2017; Uganda Investment Authority, 2016; UMTIC, 2015; World Bank, 2016, 2020). Unfortunately, the government programmes have been futile in confirming effective recognition of the full growth potential and financial development of SMEs. This study was motivated by the growing importance of upholding sustainable entrepreneurship and SME development in Uganda. This is because the role of entrepreneurship and SMEs in gross domestic product (GDP) and overall economic development in Uganda has been a subject of discussion by many scholars (Eton et al., 2021). However, no research has been conducted to understand how VC investment can encourage entrepreneurship development. Some studies carried out largely revolve around the advanced economies, thus widening the literature gaps in emerging countries such as Uganda.

### **3. Theoretical background and empirical review**

Several entrepreneurship theories have been advanced to support the surroundings under which VCs can deliver value-added skills to the portfolio companies. Nearly all scholars give the impression that the human capital theory offers a firm foundation for this subject. (Barney et al., 1994; Cumming et al., 2005). Human capital theory posits that a management team with superior skills has been confirmed to realise advanced performance in the VC market (Deloitte & NVCA, 2022). VC firms normally offer various value-adding activities, such as networking and support in setting up strategic partnerships, besides financial capital. Research has observed that more skilled VCs expressively enhance value-adding activities in the portfolio companies than those with less business-explicit experience (Lerner, 1995; Proksch, et al. (2017; Gompers et al., 2021). To support this concept, Sapienza et al. (1996) contended that VCs would most add value to ventures when the venture lacked resources or when uncertainty was high, such as ventures in the earliest stages and for ventures pursuing innovation strategies.

Considering this discourse, we are compelled to conclude that human capital theory ostensibly resonates well with the concept of value-added by VCs to early-stage firms. It is further stated that the VC-backed enterprises have a competitive advantage over their counterparts, owing to the superior skills of the VC investors (Gorman & Sahlman, 1989; Sapienza, 1992; Maula et al., 2005; Chua & Wu, 2012). VCs who allocate adequate time to assess and focus on value-added to POs beyond VC funding have reported more successful exits and negligible failed VC-funded firms with no return. These findings seem to show VCs are more engaged in their portfolio firms, while entrepreneurs have a robust partiality for VCs with parallel experiences as their own (Lerner, 1995).

Even though the human capital theory has been accredited by several authors as it offers a greater insight into VC activity in emerging markets (De-Clercq & Dimov, 2012; Harris et al., 2014), some scholars have contested that it is short of tenets, which encourage the role of networks in the VC model. In this article, we advance the concept of value-adding activities, in which VC fund managers add value to the projects they finance and uphold their sustainability in business as well. Therefore, this paper is guided by our attempt to address three research hypotheses, in the next chapter, we debate the first research hypothesis stated as the following:



### **3.1. H1: VC firms' role in the early-stage firms positively contributes to value-adding activities and success of early-stage firms**

Recent literature present conflicting conclusions, such as Bottazzi, Da, Rin, and Hellmann, 2008; Luukkonen, Deschryvere & Bertoni, 2013) debate that VCs-focused experience is a foundation for value-creation for young innovative firms. Whereas the empirical research of Large and Muegge, (2008) submits that working, outreach, consulting, mentoring, and recruiting are dominant value-added activities, nevertheless, these results are inconclusive. Alternatively, others (Gompers & Lerner, 2001; Busenitz, Fiet & Moesel, 2004; Chemmanur et al., 2014; Kaplan & Sensoy, 2015) propose that VC investors hold a dedicated familiarity with various industries and strategic network of contacts that they share with their funded companies. Mason and Harrison (2004) write that venture capital firms typically also adopt a "hands-on" investment style to limit risk and add value to their investments, and certainly, it requires close contact with investee companies. In contrast, studies by Lee and Wahal (2004) find no difference between the VC-financed companies and the non-VC-finance enterprises in terms of growth to IPOs and post-IPO performances. A future research direction to shed more light on these discrepancies would be beneficial to enriching existing literature in the current domain.

We observed that the reputation of young innovative firms with growth potential has been at the frontier of insightful research undertaking expressly on the benefits derived from this nature of investment (Ingstad et al., 2014; Jeong, et al., 2020). Although prior scholars have explored this subject, academic struggles are essentially engrossed in United States technological companies, thus leaving a relatively young VC market in Uganda under-explored. This in part contributes to the paucity of familiarity with how the VC companies in Uganda can enhance value-adding activities in their projects. Besides, even the few studies that have attempted to diagnose the importance of value-added assistance and innovation to the portfolio companies are theoretical reviews (Slimanne et al., 2016), while empirical evidence is questionable.

Previous studies have investigated the nexus between human capital theory and the VC value-creation, largely on investment selection and performance (Bottazzi et al., 2008; Gompers et al., 2005; Eldridge, 2007). Academic literature for Gorman and Sahlman, (1989) found that more skilled VCs spend more than 60% of their time in post-investment undertakings. Their role is evident in strategic planning, management recruitment, and providing a network of contacts. VCs enter the profession once they obtain focused experience as an entrepreneur, while others join after the experience they gained in other similar sectors, such as, Marc Andreessen and Ben Horowitz were both successful entrepreneurs before they founded Andreessen Horowitz, one of the leading VC firms in Silicon Valley. Consequently, this concept of value-addition has generated a novel ground of research that focuses on identifying how human capital factors influence venture capital firms. Similarly, Bygrave and Parhankangas, and Hellström (2007) find that VCs with focussed industrial experience, typically fund more risk ventures at early-stage. It is also stated that industry-specific human capital is certainly connected to VC performance. While Bottazzi et al. (2008) discovers that VC investors with prior knowledge in the related industry are more aggressively involved in VC-financed enterprises.

In contrast, Dimov and Shepherd (2005) find no positive relationship between industry-specific human capital and venture performance. Moreover, they seem to have reservations about both human capital and agency theories as they offer inadequate academic literature focused on VC networks. The human capital concept has stimulated more debate concerning its capability to deliver complete academic insight into VCs and their associated value-added skills to portfolio companies. More so, these theories do not entirely embody the societal nature of VC ecosystems, mainly in the developing economies. These arguments lead to debate and the development of our second research hypothesis.

**3.2. H2: VC firms are the central drivers of evolving early-stage enterprises' investment returns**

Whereas the entrepreneurs are often excited about strategic networking advice offered by the VCs, they lack a good understanding of the expert skills essential for nurturing the growth of SMEs. In such circumstances, entrepreneurs are probably more interested in value-adding skills from the VC fund managers (Barney et al., 1996; Bygrave and Timmons, 1992; Dotzler, 2001; Eldridge, 2007; Chemmanur et al., 2014). For that reason, VCs engage their business networks to assist business entrepreneurs in expanding their supplier chain management and potential partners. Such strategic network partnerships hasten the entrepreneurs' accessibility to external funding (OECD, 2013; Proksch, et al., 2017; NVCA, 2021; Deloitte & NVCA, 2022). Thus, the amount of this non-financial value-adding may differ depending on the VCs' experience, venture needs, and entrepreneur's skills (Slimanne et al., 2016). In contrast, if entrepreneurs are more knowledgeable, less value may be recognised from the VCs' professional advice (Sapienza et al., 1996).

On a different standpoint, Giacomo and Gigante (2021) study using a panel of corporate venture companies (CVC) associated with the European listed firms from 2008 to 2019, exposed VCs created value-added assistance consistent with North American's past evidence. The limitation of this study is that the focus was directed to corporate venture companies, whereas our study investigates the value-adding activities offered the private VCs to their funded companies. Therefore, the scope of this research is to provide a new understanding of how VC involvement in the portfolio companies is beneficial for value creation and innovation for SMEs in Uganda.

Kumar (2013) examined the value-added services in India, and the results revealed various value-added assistance offered by VC firms, such as marketing, customer network, and monitoring services improved with the increase in financing. But again, there is evidence of the replacement of CEOs, which seemed to have no well in the eyes of the founder entrepreneurs. While Jin et al. (2021) showed that VC-backed firms are more successful owing to VC firms' entrepreneurial skills, motivations, and strategy. While entrepreneurs yearn for most strategic value-added assistance, especially in the form of financial support and networking advice given by VC investors, again they are unclear about guidance regarding inner organisation problems. They may only demand VC expertise only when they observe a problem (Barney et al., 1996; Bygrave and Timmons, 1992). Therefore, research has shown that more experienced entrepreneurs may not require the services of the VCs in business management and operational advice (Barney et al., 1996). Sapienza et al. (1996). In conclusion, we observe a significant relationship between the VCs' experience and value-added and innovation in the young innovative firms they finance.

**3.3. H3: VC firms play a significant role in innovation and employment creation in early-stage enterprises**

Recent studies exposed that VCs' role has a significant positive impact on the growth of the VC financed companies, manifested in employment, productivity, and sales growth (Bertoni et al., 2011). It is alleged that frequent interactions between the investors and entrepreneurs attract greater value-added offered by VCs (Sapienza, 1992). As result, the financial support and non-value-added assistance combined have a vital effect on the growth of the portfolio companies (Bertoni et al., 2011).

Considering value-adding activities, VCs' involvement may be the most significant driver shaping the amount of value-added to their investee companies. We discover that VCs who have financed and monitored hundreds of new ventures have started some of their own, hence contributing to employment creation. VCs provide money and non-monetary contributions to high-growth ventures to help them become great companies (Sapienza 1989; Wiencke, 2017). Whereas we observe appealing results presented from developed countries, the situation in Uganda appears different. The VC market is predominant in South Africa, Kenya, Nigeria, and, lately, Egypt, which accounts for greater than 85% of Africa's entire gross VC investment (SAVCA, 2020). Our analysis of Uganda's VC contribution is virtually less than 5%, a clear demonstration of the underdevelopment of this industry in the country. It necessarily follows that little is known to entrepreneur founders about the value-added

skills delivered by the private VC firms to their start-ups in Uganda. Thus, this paper contributes a novel monography supporting the benefits of value-adding activities to entrepreneurs.

We also further investigate the extent to which VCs may inspire the growth and innovation of early-stage firms. Currently, VCs are recognized as the main source of innovation and new jobs, and the growth engine of an economy (Gompers et al., 2020; NVCA, 2020). Lately, VC fund managers have invested in a handful of portfolio companies because VCs are new in Uganda and are in their early-stage development. Our literature analysis reveals that Uganda has fewer than 25 VC companies. There is a lack of data about closed deals, besides data management companies' offering generic information. Therefore, empirical future research in this field is essential to close this knowledge deficit. Comparison to earlier studies find that VCs in the US and UK take a hands-off approach to oversight, nonetheless, VC firms in Uganda are actively involved in the VC-backed companies (Divakaran et al., 2014).

#### **4. Research design/method**

##### **4.1 Sample and sampling techniques**

The study aimed to debate to what extent VCs contribute to value-adding skills in the portfolio companies and their ensuing impact on the success of early-stage enterprises. The authors used both stratified and purposive sampling techniques to select the respondents. Whereas the stratified sampling technique enabled the researcher to select participants from the four districts of Kampala, Wakiso, Mukono, and Jinja known locations for a huge number of SMEs in Uganda, the purposive technique was vital in choosing entrepreneurs with more than 5 years of experience in business operation. Additionally, the experimental mixed-method research design was implemented, which permitted a quantitative research method to construct on a qualitative one (Creswell, 2013). The qualitative approach allowed the study to extensively explore to what extent VCs' efforts nurture value-added skills and SMEs' successful development.

The data presented in this article was a follow-up based on the interviews and prior empirical work of 2019–2020. In a way to adequately measure the role of VCs in value-adding activities, we conducted a supplementary survey from July–December 2021. The standardised questionnaire contained closed and open-ended questions to explore when and how the VC firms contribute to value-added assistance to the portfolio companies. We administered the study to 96 key informant respondents purposively selected from the primary dataset of the Uganda Investment Authority (UIA) and the online profiles for VC firms (Table 1). These categories of respondents were essential to the study as they are alleged to hold a rich understanding of the VC industry in Uganda. Additionally, our study sample comprised key infants stratified and purposively selected from four commercial business districts in Uganda including Kampala, Wakiso, Mukono, and Jinja, because above 35% of the SMEs in the country are located in these districts. The approach applied to data collection was consistent with earlier studies (Manigart et al., 1996; Sapienza, 1994; Kato & Tsoka, 2022) which also involved similar respondents.

**Table 1.** Sample size distribution

Respondent Categories	No of Respondents	Survey responses	Response %
VC investors (Venture capitalists)	36	30	83%
VC-funded Innovative firms	58	45	78%
Government Agencies	1	1	100%
SMES associations	1	1	100%
Total	96	77	80%

Source: Primary Data, (2021)

As it can be seen in Table 1, we received a very high response rate of 80%, where 77 questionnaires were completed and returned from 96 issued to the respondents. An earlier study by Kato and Tsoka (2020) revealed that a response rate of 80% demonstrated an excellent and reliable sample for the study. We selected a bigger proportion of VC-backed companies and VC investors because value-addition is essentially offered by the VC companies to their ventures. Such a selection approach ensures the collection of reliable data as the two categories of the respondents are interdependent in terms of promoting value-adding activities in high-growth companies.

**Table 2.** Value-adding activities offered to VC-funded companies

Variables	No of Respondents (N=77)	% Response
Growth of SMEs into IPOs	15	20%
Introduction to potential customers and suppliers	52	68%
Increased investment returns	54	70%
Market share expansion	59	76%
Help get steady financing	60	78%
Recruitment of top management	62	80%
Networking for strategic partnerships	62	80%
Sounding BOD for CEOs	62	80%
Innovation capacity	65	84%
Strategic planning	69	90%
Improved profits	71	92%
Improved sales turnover	72	94%
Financial management	74	96%

Source: Primary data, (2020–2021)

As it can be seen from Table 2, 74 of 77 respondents reported financial management as one of the key value-adding activities provided by VCs to the young innovative firms. This resonates well with the preliminary work done by the VC investors to ensure that VC-backed firms allocate funds following the strategic work plan. We also observe improved sales turnover and profits as significant value-added arising from the VC efforts, 72 respondents out of 77 favoured sales turnover, while 71 out of 77 agreed to improved profits due to the superior skills of the VC investors. However, IPOs/trade sales received the least respondents of only 15 of 77 respondents supporting the VC role in encouraging IPOs that is 20%. As we conclude, we discover that financial management ranked the highest at 96%, followed by sales turnover at 96% and improved profits at 94%. This confirms that VCs' role in value-added activities is more outstanding in financial management sales turnover and improved profits.

Second, we conducted 24 in-depth face-to-face interviews with the same group to expound on the statistical results, as value-adding activities are more validated qualitatively. These interviews reported a very high response rate of 80%, where 24 of 30 respondents provided excellent feedback on the VCs' major roles in the POs. The interviews were recorded, data transcripts were validated by the interviewees, and a content analysis was used to generate the results. This access enabled us to collect in-depth qualitative data regarding the value-added activities and general quantitative data about the investments. The limitation of this study is that it relied on data collected from four districts in Uganda (Kampala, Wakiso, Mukono, and Jinja), hence the results ought to be used with caution as they may not represent the general picture of VC in Uganda. We depend on content analysis to regulate value-adding activities VCs apply to enhance success in their portfolio firms. This process involves a systematic method to understand a body of manuscripts, pictures, tables, and videos, essentially not from authors or users.

#### **4.2. Measuring value-adding activities offered to the VC firms**

It centered the essential concepts in this study on how the VC companies contribute to value addition and successful development of VC-backed enterprises. As earlier noted in the literature analysis, VCs influence and support unswerving VC projects through active involvement in the business processes of the VC-backed firms, for instance, at board meetings, recruiting senior management staff, creating networks for strategic partnerships, financial management, improved profits, market share expansion, strategic planning and other informal interactions with CEOs. To measure the value-added activities provided by the VC firms, we asked VCs, government representatives, and entrepreneurs to rate the significance of these activities to the portfolio companies, on a scale from 1 = unimportant at all, to 5 = of great importance. These roles were derived from prior research (Gorman & Sahlman, 1989) and our own fieldwork. VCs also rated their effectiveness in conducting these roles (from 1 = not at all effective, to 5 = extremely effective). By multiplying the importance by the effectiveness rating, we derived a measure of value-added for each role (with a range of 1 = no value added to 5 = very high value-added).

We unquestionably used this data collection method because several studies that have examined VC performance have largely used a quantitative approach in isolation from the qualitative one, to collect data. However, these types of data collection are subject to several limitations. In most cases, the response rate of surveys is rather low, which reduces the relevance of the study because it represents only a small share of the whole population. Besides, databases are limited in detail because they are primarily based on publicly available data and thus do not offer data on the internal practices of VC companies.

The study analysed using a Meta-analysis, which is a set of analytical tools that allow researchers to bring coherence to varying findings across studies and draw robust conclusions about whether and how much a theoretical relationship has received empirical support. Uncovering to what extent findings support established theory is important because such knowledge becomes the foundation upon which new and more detailed theoretical relationships can be developed.



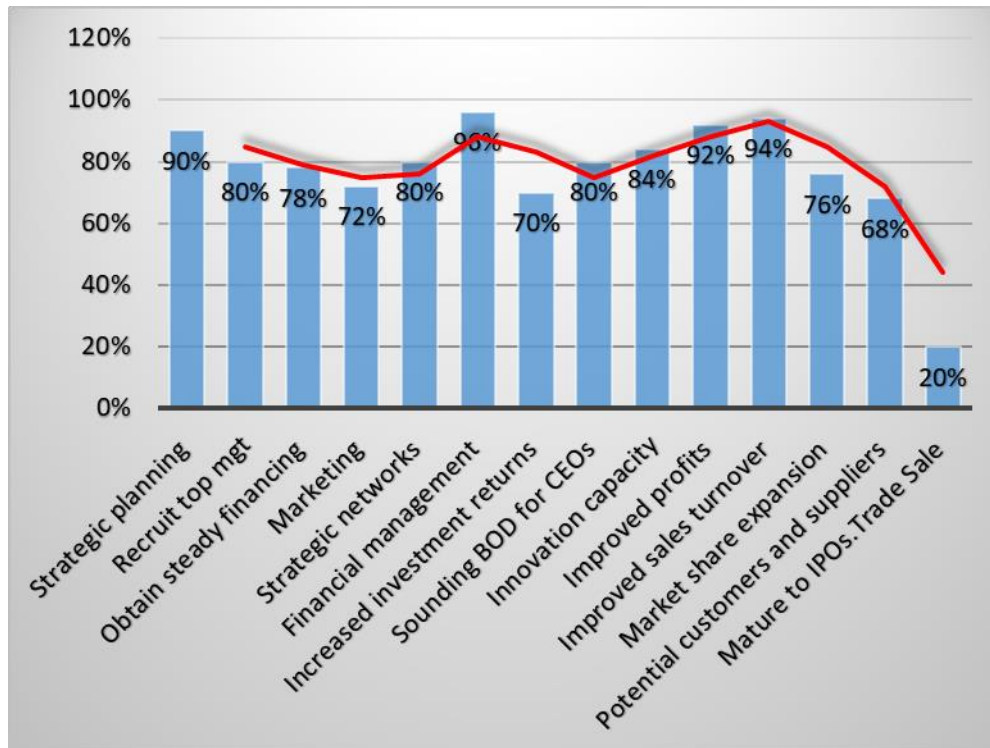
## 5. Results and Discussion

In this section, we debate results explaining how VC role influences the value-added assistance and innovation of the high growth potential firms. Our results are organised according to the three study hypotheses as earlier mentioned in the theoretical review section and hypothesis development. In a way to adequately analyse the specific research hypotheses, we conducted various methodical data analyses such as descriptive statistics, sample-paired correction results, and ANOVA analysis using SPSS computer-aided software, while for interview data, we relied on Atlas.ti software recommended for qualitative data analysis. We tested the survey questionnaire for normality factor analysis, and it was found normally distributed.

We asked the VC firms and entrepreneurial founders and senior management team a series of questions to collect their views about a set of value-added assistance provided by the VCS to the portfolio companies using a 5-point scale survey questionnaire. We conducted an extensive analysis covering the non-financial value-adding activities which were supported by evidence from the financial performance, for instance, a surge in profits, investment returns, market share expansion, and sales turnover. In the next section, we present our findings concerning VCs' role in value-added mechanisms and the success of the VC-backed start-ups.

### 5.1. VC firms' role in value-adding activities and success of early-stage firms

To measure the value-adding activities provided by the VCs to their funded companies, we use role VCs on the BOD, VC finance, and VCs' experience and skills, as our independent variables. While for the dependent variables, we applied a robust set as illustrated in Fig. 1 to assist in identifying the value-adding activities evident in the disruptive young firms. These variables were comprehensively assessed to establish how they are truly manipulated by the VC's presence in the business processes of their ventures. Our approach to the analysis of value-adding activities is categorised into non-financial value-added and financial value-added to the investee companies.



**Figure 1.** Value-adding activities provided by VCs to the Innovative early-stage firms

Source: primary data: 2019–2020



We asked the key informants to give their opinion on the most value-adding activities provided by the VC firms to the young innovative firms (Figure 1). We noticed that financial management received the highest score of 96% (74 Of 77 respondents), closely followed by sales turnover of 94% (72 Of 77 respondents) and improved profits at 92%, (71 of 77 respondents), and strategic planning at 90% (69 of 77 respondents). We observe that financial management appeared on top of the value-added assistance to start-ups because it is fundamental to determining the growth or failure of a company. VCs' priority is to deal with information asymmetries in their ventures. It involves training staff in financial management, marketing, and human resources among others. Once a company has a sound financial management system, this provides a platform for the firms to interest more value-added skills. As a matter of emphasis, 94% of the respondents confirmed a surge in sales turnover, while 92% submitted a great improvement in annual profits after the elimination of financial information asymmetries. It is also important to report that 90% of the respondents were happy about the VCs' role in strategic planning. Our study unveiled a prodigious diversity of value-adding activities, some of which support the conclusions of earlier studies (Fried & Hisrich, 1995; Sapienza, Manigart & Vermeir, 1996; Jeong, et al., 2020; Gompers et al., 2020; Lerner, 2010; Slimane et al., 2020; Deloitte & NVCA, 2022) as well contributes to contemporary literature.

More results from descriptive statistics conveyed recruitment of senior managers-80%, strategic partnerships ranked also 80% and steady financing was ranked 78%. Our findings support recent studies (e.g. Bygrave and Taylor, 1989; Sapienza & Timmons, 1989; Hellmann & Puri, 2002). They also attest that VC involvement is critical for value-added and innovation in young innovative firms because it differentiates VC funding from other sources of funds. In a nutshell, we are compelled to deduce that financial improvements, a surge in sales turnover, annual profits, and strategic planning, besides BOD governance improvements, are among the most frequently recorded value-adding activities. Our findings are consistent with the conclusions of Hellmann and Puri (2002). These results address the research hypothesis H1 which states "VC firms' role in the early-stage firms positively contributes to value-adding activities and success of early-stage firms. In a nutshell, while we performed a robust evaluation of several value-adding activities, financial management, improved sales turnover and profits, and strategic planning emerged as the most value-adding activities provided by the VC investors to their ventures. Unlike prior scholars whose conclusions are largely confined to developed nations, this paper provides a distinguished understanding of VCs' value-creation and innovation in the young innovative firms in emerging economies like Uganda. In summary, results extracted from the survey corroborate well with our first research hypothesis presented as the following: H1.

Additionally, results from the face-to-face interviews correspondingly expose irresistible evidence of value addition to start-ups, displayed in mentoring exercises, access to international markets, coaching in financial management, and delivering hands-on assistance to companies through their networks. Our findings support earlier findings (e.g Large & Muegge, 2008, Lerner, 2010, Gompers et al., 2020). They argue that the most important value-added contribution of VCs rests in the development of the right professional group for the venture. Mutually, survey questionnaires and face-to-face interviews convey similar results in supporting our first research hypothesis.

In contrast, when we asked the respondents about how many innovative firms have successfully been elevated to the level of IPOs or trade sales. Surprisingly, only 20% of the respondents knew IPOs or trade sales. Besides, there has not been a single formerly VC-backed presented for IPOs on Uganda's Stock exchange market as reported in comparable emerging economies. Uganda's stock exchange market is still small compared to those of Kenya, Nigeria, and South Africa. Specifically, the Kenya VC industry has witnessed many originally VC-financed companies listed on the Nairobi Stock exchange market for instance recent empirical studies in Kenya Jumia, SafariCom, M-Pesa among others. Consistent with our findings, Gompers (1996) displays that realising a successful IPO exit is valuable for VC companies to create a standing and advance new capital in agreement. This study conveys that either the VC investors in Uganda fear exit due to unsatisfactory returns or a potential

threat to creating a strategic acquisition, instead of a divestiture. In conclusion, this paper serves as a springboard to facilitate future additional studies that can investigate why the Uganda VC market has not registered any IPOs arising from the VC-backed companies. We argue that future studies should examine 'VC exit successes as a high-impact-dependent variable, and place greater emphasis on the measurement of directly observable events for both value-adding inputs and value-added outcomes.

## 5.2. VC firms as drivers for investment returns for early-stage enterprises

In this section, we discuss Ha2, which presupposes that *VC firms' presence in their ventures assists to increase their investment returns*. Empirically, it is difficult to measure the exact returns on investment earned by VC companies using commercially available datasets because doing so requires data on deal structure and eventual exits that are usually unavailable. Therefore, to adequately estimate returns on investment, we employed both survey questionnaire and interview approaches, to get a deeper understanding of the value-added concept. Since returns on investment is the outcome of a profitable business venture, we used robust non-financial and financial performance variables. These variables facilitated the evaluation of Hypothesis H2: We uncover how far the individual responses from the survey differ from the mean. Using the standard deviation method facilitated the researcher to establish how the responses are spread out, for instance, if our results have a normal distribution with no outliers from the mean results.

**Table 3.** Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Financial management	77	2.0	5.0	4.351	.6441
Improved sales turnover	77	2.0	5.0	4.184	.7017
Improved profits	77	2.0	5.0	4.065	.7837
Strategic planning	77	1.0	5.0	3.974	.8881
Innovation capacity	77	1.0	5.0	3.844	1.0009
Sounding BOD for CEOs	77	2.0	5.0	3.779	.9545
Recruitment of top management	77	1.0	5.0	3.779	.9950
Networking for strategic partnerships	77	1.0	5.0	3.779	1.0339
New technology	77	1.0	5.0	3.740	.7678
Help get steady financing	77	1.0	5.0	3.701	.9876
<b>VC firms' increase investment returns</b>	<b>77</b>	<b>2.0</b>	<b>5.0</b>	<b>3.675</b>	<b>.8498</b>
Market share expansion	77	1.0	5.0	3.659	1.0073
Transfer of Technologies to VC -funded companies	77	2.0	5.0	3.636	.8570
Increased investment returns	77	2.0	5.0	3.597	1.1501
Introd'n to potential customers and suppliers	77	1.0	5.0	3.506	1.1428
Growth of SMEs into IPOs	77	1.0	5.0	2.540	1.0188
Valid N (listwise)	77				

Source: Primary Data, (2021)

As it can be seen in Table 3, survey responses convey SD results that are concentrated around the mean, it appears that there are no outliers as the results do not show an extreme deviation from the mean. Returns on investments portray a mean-rounded score of 3.7 and SD 0.8498. When we compare these results with the determinants of investment returns for instance financial planning generated a SD 0.6441, ale turnover, 0.7017 And profits SD 0.7837 respectively. The survey results, when rounded off, almost all generated a mean score of 4 which was denoted as agree. Looking at the mean alone, financial management was ranked the highest value-added to the VC-backed firms with a mean of 4.35. But observing the mean alone in the isolation of standard deviation (SD) and standard error may not convey reliable results. Therefore, we further assess the distribution and validity of the survey responses in consideration of SD, which is adequate for measuring how far the survey responses are concentrated or scattered from the mean. It can be inferred observed that investment returns are one of the most value-adding activities offered by VC firms to their ventures. Our findings are like the studies of (Hellman & Puri, 2008; Slimanne et al., 2016). Besides, these results collaborate positively with our hypothesis H4<sub>2</sub>: *VC firms are the central drivers of developing early-stage enterprises' investment returns.*

In addition, we also discovered that VC participation on the BOD received a mean score of 3.78 and SD 0.9545. It can be observed that the standard deviation results range from 0 to 1, an indication that our results command no outliers. The implication of these outcomes is that VCs typically secure minority seats in the BOD to boost start-ups' financial performance to achieve high returns. To sustain our declarations, a VC stated, *"We are cautious of the extent to which equity relates to what we do when we invest. We are looking for an exit. One channel of exiting is when we come out of the business and we are ready to sell our stake, either to the business owners or to the equity market. This can only be successful if there is an opportunity to list, for which there has not been a typical prime channel for an exit. But if there is an opportunity to list, we may monitor to see when the best time to bring that exit to the IPOs, but that has not been the case so far"* The point to make here is that VCs find it difficult to exit by making a trade sale to the equity markets since Uganda's stock exchange market is not developed to deliver a prime channel to IPOs. Most VCs were quick to point out that government support has been vital for the success of the VC market in Israel, New Zealand, Thailand, and above all US. This study supports previous literature work of Lerner (1995), Gompers and Lerner (2001), Tykvova (2018). VC firms play a cardinal role in remitting to limited partners' good investment returns to attract higher capital funding opportunities from the pension funding. It is not surprising that VC investments are associated with high value-added assistance to portfolio companies. For that reason, VCs secure minority seats in the BOD to ensure that the CEOs of the POs adhere to their recommendations. In this scenario, the Uganda government must develop the stock markets if the VC market is to realise better performance.

We also find that expanding VC access at the different funding stages, such as seed, expansion, and IPOs or buyouts, comes along with-it value addition to the funded companies. This financial strategy helps the fund managers to quickly detect and minimise the financial risks, which would otherwise impede expected investment returns from their ventures. Furthermore, Respondent DRS12 reported that *"We are not there to bring only cash on the table, but rather bring broader networks and talent for further financing to help POs grow. We also come along with experience from other markets in terms of how we scale businesses.* Our results conform to the findings of (Sapienza, 1992). It is therefore important to say that VCs add value to the POs in terms of scaling up the networks for future funding opportunities, talent development, and vast experience from other markets, which escalates the SMEs' growth.

Considering value-creation in the young innovative firms, we discover that VC investors work with the business entrepreneurs by acquiring equity shares and ensuring steady growth to get good returns on investment. Besides, contrary to bank financing that hinges on monthly instalments recovery irrespective of the business performance, VCs significantly support the growth of early-stage firms and are often ready to share both losses and profits. This arrangement of business partnerships promotes the growth of the small-medium enterprises. Likewise, the respondent (DRS05) commented that VC secures BOD seats to quickly discover the financial risks at an early

stage. It is also vital to underscore that VC firms with experienced fund managers, ordinarily conduct less monitoring than those with junior managers. These results are to the outcomes of Khan et al., (2021) study in Europe, who illuminated that the US VC investors conduct not as much monitoring as the European VC firms because they are more skilful and knowledgeable.

### 5.3. Role of VC firms in innovation and employment creation

Considering innovation and employment creation as non-financial value-adding activities, we use a bivariate Pearson Correlation to test whether there is a statistically significant linear relationship between VC role in nurturing innovation capacity and employment creation in the young innovative firms and to conclude the strength and direction of the relationship. To evaluate the null hypothesis (H0) and alternative hypothesis (H1) of the significance test for correlation, we express the significance level as a two-tailed test.

Two-tailed significance test assumptions

H0:  $\rho = 0$  (population correlation coefficient is 0; there is no association)

H1:  $\rho \neq 0$  (population correlation coefficient is not 0; there is a correlation relationship).

**Table 4.** Pearson Correlations analysis

Pearson Correction		VC firms	Employment	Innovation capacity	Investment returns
VC firms	Pearson Correlation	1	.348**	.538**	.554**
	Sig. (2-tailed)		0,004	0,000	0,000
	N	68	68	68	68
Employment	Pearson Correlation	.348**	1	0,185	.335**
	Sig. (2-tailed)	0,004		0,131	0,005
	N	68	68	68	68
Innovation capacity	Pearson Correlation	.538**	0,185	1	.463**
	Sig. (2-tailed)	0,000	0,131		0,000
	N	68	68	68	68
Investment returns	Pearson Correlation	.554**	.335**	.463**	1
	Sig. (2-tailed)	0,000	0,005	0,000	
	N	68	68	68	68
**. Correlation is significant at the 0.01 level (2-tailed).					
*. Correlation is significant at the 0.05 level (2-tailed).					

Source: Primary data, (2021)

As it can be seen in Table 4, Pearson correlation coefficient 'r' for VCs' role in innovation capacity, employment creation, and investment returns, there is a significant correction because  $p < .001$  for a two-tailed. The results convey that VCs role and employment creation have a statistically significant linear relationship ( $r=.348$ ,  $p < .001$ ), while innovation capacity and VC's experience also show a strong correlation as  $r=.535$ ,  $p<.001$ ). The p value (quoted under Sig. (2-tailed) is .000 (reported as  $p < .001$ ) that is less than 0.05. We can therefore conclude that there is significant evidence to reject the null hypothesis that the correlation is 0. As a result, there is evidence to conclude that VCs' role in the young innovative firms they finance contributes to their innovation capacity, employment creation, and surge in the investment returns. As such, for entrepreneurs looking out to grow their companies, it is inevitable to partner with the VC firms since they have the expertise needed for the success of these firms.

Existing studies (e.g. Barney et al. 1996; Dotzler, 2001) convey that the superior skills of employees positively contribute to labour productivity. Consistent with the later author, Gompers et al. (2020) state that experienced VCs spent less time on monitoring the VC-funded companies compared to less skilled VC fund managers. VCs in advanced markets like US, UK, and Canada typically seek to add value to the funded firms, which is alleged to be one of the critical aspects of their success. However, as reported earlier, VCs' role is limited in the funded companies in emerging markets, VC contracts appear complex to enforce in Uganda because of the prevalence of family business. Since most SMEs are family-owned their capacity to interest the VC investors is limited, this slows down their ability to create more employment opportunities. But some of the VC recipients have reported a positive increase in the number of employees.

Besides, VCs recruit only competent employees with vast knowledge to keep their ventures growing. In a worse situation, they are compelled to fire the entrepreneur founders if they are unable to demonstrate good leadership of the funded companies. Therefore, on the face of it, it may appear to contribute to the creation of more jobs, nonetheless, they are also held accountable for replacing the CEOs, which usually sparks organisational conflicts. Companies (Belke et al., 2017). A recent study of NVCA (2021) reveals that the impact of VC is beyond investment returns. In the US, several VC-backed companies have scaled, gone public, and become household names and at the same time have generated high-skilled jobs and trillions of dollars of benefit for the US economy.

Unfortunately, Uganda's VC market is still grappling with no record of any IPOs compared to Kenya and South Africa. Despite the slow take of the VC industry in Uganda, interview results revealed an average of 40% new job creation by VC recipient companies. Although these companies are known to employ a few employees, such achievements cannot go unnoticed. Besides, VC-funded companies have been in a position to conduct R&D to improve product development. Some of the portfolio companies reported tremendous innovation capacity in their production that facilitated their expansion to regional markets for their products. The Uganda government has also joined the race by creating less competitive local markets with foreign investors. Because foreign companies come along with technology that the locals do not have. Besides, they increase investment in the country, which creates job opportunities, thus contributing to economic growth. Playing the game with previous studies (Fired & Hisrich, 1995; Khan et al., 2021), our study conveyed similar results suggesting that VCs can play a significant role over and above those commonly discussed in the current literature.

## **6. Conclusion and Future research directions**

This paper explored the role of venture capital firms in harnessing value-adding activities and innovation of high growth firms in Uganda. VCs have been playing an increasingly important role in the growth of early-stage companies around the globe. For many years now, VC firms have been hailed for their enormous contribution to value-creation and innovation in their high-growth start-ups, however, there is limited information in the public domain to underpin this new human capital concept. We find that VC role is significantly related to enhancing much value-adding activities in the young innovative firms, for instance financial management, a surge in sales turnover, profitability growth, strategic planning, recruitment of senior management, employment creation, returns on investment among others.

Therefore, this article delivers concrete information beneficial to the entrepreneurs/founder managers seeking to enhance the growth of their enterprises by partnering with the VCs that are more knowledgeable in managing the financial risks. Such partnerships may help close the financing gap hindering small firms' growth. More so, our results are beneficial not just for entrepreneurs anticipating obtaining money. They also offer insights to educators teaching the subsequent generation of founders and investors; leaders of current companies pursuing to match the VC process; policymakers demanding to shape start-up ecosystems; and university officials who hope to commercialise innovations developed in their schools.



Furthermore, this study contributes to the under-studied space of VC value-creation and innovation, especially in Uganda, where there is limited academic literature in this field. Thus, our study offers an insight into how value-added is created between the VCs and the high-growth entrepreneur firms, as well as contributes to closing this knowledge deficit in the arena of VC role to value-adding activities. As such, our results may support entrepreneurs/government to engage in lucrative partnerships with experienced VC firms that have the capacity to bridge the SMEs' equity financing gap at an early stage. Finally, this paper offers a foundation for future research direction. On this note, it would be beneficial for the Uganda government to enact policies that make it easier for firms to develop and commercialise new ideas by lowering the costs of failure and encouraging firms to experiment with potential growth opportunities.

As earlier empirical surveys, our study also suffered some limitations such as, it was confined to early-stage enterprises selected from four districts in Uganda. Therefore, the results may not be generalised to represent the entire VC industry performance in Uganda and similar emerging economies. Also, future research should try investigating the impact of the VC in IPOs as our sample revealed no VC-backed companies, which had matured to IPO level. Our results further show that VCs cut down on the time they devote to their portfolio companies owing to the proximity and geographical location of the firms they finance. The geographic distance significantly limits face-to-face interaction, and it appears to have less impact on the amount of value-added.

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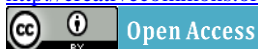
**Dr. Ahmed I. KATO** is a Postdoctoral Research Fellow in the Department of Applied Management, University of South Africa, Pretoria. He has published several articles in accredited journals with a special interest in venture capital, entrepreneurship, and SME development. Moreover, he holds over 14 year's vast experience in financial management and strengthening research capacity in the NGO sector.  
ORCID ID: <https://orcid.org/0000-0002-1811-6138>

**Prof. Germinah Evelyn CHILOANE-TSOKA** is a Professor of Entrepreneurship in Department of Applied Management, University of South Africa, Pretoria. Prof. Chiloane-Tsoka has served in different academic position throughout her entire career, and she has published several articles in accredited journals, written books and presented several papers in international conferences.  
ORCID ID: <https://orcid.org/0000-0002-0460-6291>

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## CHANGES IN THE SKILLS OF THE WORKFORCE FOR FUTURE DEVELOPMENT OF THE LABOR MARKET IN THE SLOVAK REPUBLIC\*

Andrea Horváthová<sup>1</sup>, Michal Hrnčiar<sup>2</sup>, Eva Rievajová<sup>3</sup>

<sup>1</sup>Trenčianska univerzita Alexandra Dubčeka v Trenčíne, Faculty of Social and Economic Relations, Trenčín, Slovakia

<sup>2,3</sup>University of Economics in Bratislava, Faculty of National Economy, Bratislava, Slovakia

E-mails: <sup>1</sup>[andrea.horvathova@student.tnuni.sk](mailto:andrea.horvathova@student.tnuni.sk); <sup>2</sup>[michal.hrnciar@euba.sk](mailto:michal.hrnciar@euba.sk); <sup>3</sup>[eva.rievajova@euba.sk](mailto:eva.rievajova@euba.sk)

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**Abstract.** A deep knowledge of the changes that are important for the link between the labor market and human resources is a prerequisite for the right link between education and the labor market. Undoubtedly, the most important element for the coming period are innovative changes that significantly change the nature of employees' work. For employers to remain competitive, they need a skilled workforce. The presented paper has a theoretical-empirical character. In the article, we used research methods such as synthesis of available bibliographic references, induction, and deduction as a theoretical general method of scientific knowledge. The questionnaire method was used in the creation of the paper, through which the selected results of the questionnaire survey were evaluated, within which we determined the importance of individual skills for the future labor market. In Part 1, the paper focuses on the theoretical basis of business education with an emphasis on highlighting innovation trends and new demands on the workforce. In the 2nd Part of the paper, through the analysis of the results of the survey, the future key skills that the workforce will have to have by 2030 are identified. As well as in the labor market comprehensively. The results of the survey showed the importance of digital, interpersonal, and cognitive skills. In addition, the survey found that the workforce in the Slovak Republic will have to use a higher level of skills by 2030, such as effective teamwork, the ability to achieve goals or self-control. The main goal of this paper is to examine two areas that will face significant changes in the coming period - the labor market and employee training. The aim of the paper is based on the analysis of domestic and foreign literature, and processing of research findings from the questionnaire survey to provide insight into what the system of formal and non-formal education we will have to pay the highest attention in the next 10 years, especially in preparing future graduates. In addition, it is important information for companies that need to train employees.

**Keywords:** education; labor market; human resources; innovation; soft skills

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## 1. Introduction

The labor market in Slovakia has changed over the last 20 years. Employment is growing slightly and a change in the structure of employment can be seen. Even though until 2019 we witnessed the most significant economic expansion in the labor market in the history of the independence of the Slovak Republic, from a long-term perspective, only a slight increase in the number of employed persons can be observed. In 2016, the magic limit of 2 million employed inhabitants was exceeded in the conditions of the Slovak Republic, which happened for the first time in the last 20 years. On the other hand, many foreign studies evaluate the countries of Eastern and Southern Europe, and others as being significantly threatened by job automation (Nedelkoska, Quintini, 2018; Snieska et al., 2020; Fakunle, Ajani, 2021). Human progress inevitably brings about changes that are largely reflected in the labor market. Globalization, automation, digitization, and dozens of other innovative trends are changing the demands of employers for their potential employees. Companies expect technologies such as cloud computing, Big Data Analysis, and the Internet of Things to be a high priority by 2025 (World Economic Forum, 2020). Big data analytics has become an important topic among policy makers and practitioners in relation to the large volumes of diverse data and associated new data information practices which have become available to firms (Niebel, 2019). Other element of innovation is communications technology development that create and enable communications networks between machines and the wider internet, i.e., Internet of Things (Edquist, 2021).

Due to changes in the business environment, i.e. the growing importance of creativity, services, knowledge, the information technology development, digitalization, globalization, and the surge of intellectual property, a new approach of companies has been created; therefore, the value creation ability has shifted from tangible resources to intangible resources, i.e. creativity, knowledge, unique organizational culture, corporate reputation, innovation (Kamasak, 2015). Indeed, structural changes in the labor market are becoming more and more dynamic, which is growing and the importance of anticipating them will grow. Technological progress and process automation increasingly changing the labor market. Therefore, technological innovations can have an impact on labor markets, wherein technological change can either substitute for or complement various types of labor. This can lead in changes in demand, and hence wages for certain types of labor (Naudé, 2021). The rate of replacement of labor by capital is thus constantly increasing and is not an issue “if”, but the question “when” there will be an industrial revolution that will reduce the need for human labor in several sectors to a minimum. However, such a revolution may not have negative consequences for the labor market, employment and unemployment, as it will develop other areas of economic life. There is a place for innovative changes in the labor market through the use of new trends in education, which companies will develop and adapt to the current situation. It is important to know the development in the field of innovation trends and thus prepare the workforce adequately for changes in the necessary skills. OECD estimates suggest that almost two thirds of jobs in the Slovak Republic are at risk, with up to 34.6% of all jobs in Slovakia being highly automated and a further 31% at risk from a substantial change in the way they are carried out (Georgieff, Milanez, 2021). In addition, labor market disparities are a significant problem in the Slovak Republic. Almost two thirds of high school and university graduates work in positions that do not correspond to the field of study (Trexima Bratislava, 2019). The skills of school graduates and those in the labor market are not in line with the needs of a rapidly changing labor market, which poses a long-standing challenge for education and training, including lifelong learning. Only 33% of Slovaks currently have basic digital skills (Európska komisia, 2019). Recommendations of the European Commission's in relation to Slovakia's National Reform Program highlight the importance of lifelong learning, intensified cooperation between business and the education system at all levels and better linking training and retraining programs to current and future labor market needs, strengthening digital skills and ensuring equal access to quality education. The change in the educational and age structure of the population will affect unemployment. The reason is that different age and educational groups are characterized by different unemployment rates. In general, unemployment is higher among young people, people with low education and many times near people of



retirement age. The aim of this paper is therefore in the first part to theoretically analyze current trends in education in relation to innovative changes and in the second empirical part to point out the expected trends in changes in skills from the perspective of employers in the future. These are evaluated on the basis of the results of a questionnaire survey, which was prepared by the author of the paper for the National Union of Employers.

*Note: Author of the paper Ing. Michal Hrnčiar participated in the author's team in creating an analysis called "SKILLS FOR THE FUTURE OF THE COMPETITIVE LABOR MARKET IN SLOVAKIA", which was carried out for the National Union of Employers in 2021. Data on the results of the questionnaire survey were drawn from the analysis in question for the purposes of the submitted contribution.*

## 2. Literature Review

### 2.1 Aspects of examining trends in education in labor market conditions

One of the key tasks of active labor market policy is to reduce the mismatch between labor supply and demand. Such a disparity tip arises even if the employee does not have sufficient skills and qualifications to be able to perform his work as the employer expects. In the future, we can expect a growing need for retraining, which can provide the current workforce with the opportunity not to end up without work. Employers can react to upcoming innovation trends in advance and thus secure a skilled workforce already today. Supporting employee training brings a large number of benefits. Trained employees provide better services, better communication with co-workers and customers, i.e. customers get a much more professional service.

For the company, employee training should ensure a better position in the competitive environment and better company performance. The burden of developing the required qualified group lies on individuals in the field of learning management, to develop knowledge, skills and abilities related to the area in accordance with the needs of society (Vojtovič, 2016; Sinlarat, 2016). However, the fact that not all tasks and competencies can be replaced by automation and other innovative elements remains an important element. According to the author David (2015), there are less endangered positions that require creativity and intuitive judgment. According to authors Šárka, Petříková (2015) the companies which are able to represent potential of its employees in terms of creativity, knowledge and ability to implemen innovations are the highest price. The author of Kutrzeba (2018), in turn, describes critical thinking, ingenuity, and complex cognitive and social skills as those in which people continue to overcome intelligent machines. In addition, it is necessary to build on historical experience, when the introduction of new technologies has also created new jobs. An example is the period from 1999 to 2010, when computerization created more than 11 million jobs (Gregory et al., 2021).

The aim of the paper is to provide insight into what the system of formal and non-formal education we will have to pay the highest attention in the next 10 years, especially in preparing future graduates.

### 2.2 Areas of education and their trends for the future

The digital transformation that is taking place around the world, for which new positions are constantly being created and for which jobs in the services sector are being lost, is replacing human resources to a certain extent with technology. Human society is currently facing various challenges that have not been solved by any sector. New trends and technologies are emerging to help meet the challenges. Among the new technologies are, for example, cooperative systems, new forms of massive data processing, so-called "big data", robots for the maintenance of transport infrastructure and vehicles, nanotechnologies or new materials that can regenerate themselves. The new services will be, for example, vehicle sharing, personalization of the service or transport on demand according to the order. These innovations will also affect business and working conditions in the sector. Employees will often not be physically tied to a specific job, their work will be more flexible, e-commerce services or collective financing schemes will be used. In the future, not only new knowledge will be important,



but also the way it will reach students or staff. Traditional forms of teaching, where the teacher is at the center, should replace new ones, where the learner gets more opportunities. These include brainstorming, cooperative learning, developing critical thinking, using virtual reality, gamification, personalized training, etc. However, the author Axryd (2019) points out that technology is not everything. According to the analysis, most large data projects fail due to a lack of expertise - employees do not have data and management skills that lack big data leadership and skills.

If companies realize the importance of training their employees even in soft skills, success will ultimately be realized for both the company and the employees. The allocation of soft skills forms an important basis for the interaction of business and education (Gruzdev et al., 2018). In contrast “non-cognitive skills“ or personality traits, i.e. “soft skills“ are usually combined through many experiential abilities and skills, including motivation, social skills and work habits (Laskey, 2010). The bridge between work and personal life in connection with soft skills is offered by the author Prince (2016). She understands “soft skills“ as the advantage that allows a person to be more successful in the workplace and beyond. She defines soft skills as personal competencies which, unlike hard skills, are the driving force on the way to the realization of their potential. Thanks to them, we can face challenges and work for change. Improving skills “upskilling“, and adult retraining “reskilling” is an urgent priority for European policy makers and stakeholders.

Rapidly changing labor markets and multiple challenges, such as digitalisation and its implications for the future of work, technological change, the environment, aging societies and social inclusion, require a solid skills base and the constant renewal and acquisition of new skills, knowledge and competences. The term education is currently used in the field of education “upskilling” – it is not retraining, but increasing your existing skills, abilities and competencies; also the acquisition of new ones, while performing work. “Reskilling“ is gaining a new useful ability, a new qualification. Investments in upskilling and retraining low-skilled adults are even more urgent as our societies and economies face the unprecedented consequences of the Covid-19 pandemic. If the use of information and communication technologies for education is to be beneficial, it is necessary that teachers and future teachers have professional skills that would be able to evaluate the use of information and communication technologies in the psyche of its user. The aim is to focus on developing coherent and coordinated approaches to skills development for low-skilled adults. It is becoming a priority to develop an analytical framework for skills development for low-skilled adults that can support policy makers and stakeholders in designing and implementing coordinated and coherent approaches for comprehensive, sustainable, inclusive and flexible pathways, tailored to individual needs (Cedefop, 2020).

Some contours of the new educational concept are presented in the study of Wu et al. (2013). These include, for example:

- E-Learning: learning with the help of electronic teaching devices;
- Mobile learning: teaching through mobile devices;
- Combined learning: a learning model combining full-time education and online learning;
- Contextual learning: learning by context, through localization devices;
- Collaborative environments: learn in highly interactive environments;
- Cloud computing (storage): using cloud computing technology.

Digital technologies make it possible to simplify teamwork in workplaces in different sectors, where soft skills need to be used for better collaboration and communication. To implement the digital transformation of education, it is necessary to develop an action plan - setting systemic measures, goals, their implementation in the short and long term, a system of criteria and a mechanism for assessing their fulfillment. It is important not to put pressure on people's performance and to communicate with employees clearly, sensitively, directly and in detail. In the hybrid world of work and education that is currently underway, this is a necessity. The inner motivation of each person will depend on whether they want to manage the task or take a different attitude. It is important for

companies to be able to anticipate the direction of development of their business area and to prepare their employees in a targeted manner, and not just to respond to emerging skills. Not every organization can define it.

There are several agencies on offer that companies can help. However, the company must have clearly defined what it wants to achieve. The main trend in education is to move away from the classical classroom. Increasing emphasis will be placed on online managers, as they are in direct contact with employees, affecting the productivity and success of the individual or team. There is room for companies to give employees the opportunity to develop their competencies and support their efforts to learn. As in other areas of human life, responsibility for professional and personal growth is transferred to the individual in education.

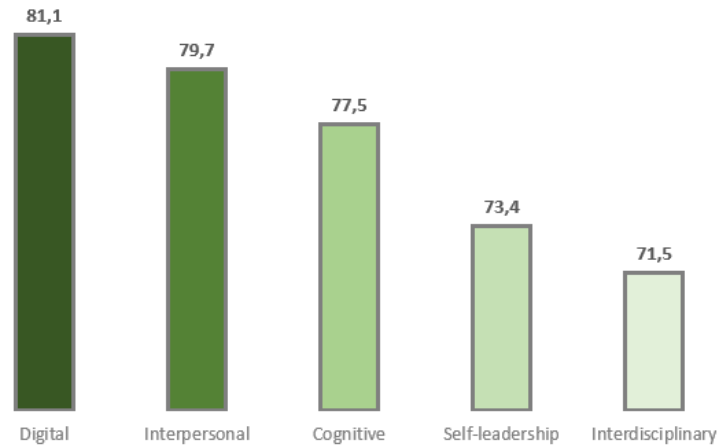
### **3. Results and discussion**

An important challenge for the training of the current and future workforce is its preparation in accordance with the requirements of employers on the labor market and in connection with current innovation trends. It is the employers who work with innovations, new trends in practice and who introduce new technologies into their production processes in order to streamline production, save time and minimize their costs. Global trends show us which innovations will be most important in the future. But do employers operating in the Slovak Republic perceive these trends as importantly? Will the threat that a significant part of jobs are threatened by informatization materialize? (Frey, Osborne, 2013). This answer is offered by the results of a questionnaire survey conducted by one of the authors of the submitted contribution for the National Union of Employers.

The starting point for creating the questionnaire survey was the study “Defining the skills citizens will need in the future world of work“ implemented by McKinsey & Company in 2021 (Dondi et al. 2021). This study defined 13 categories of future skills. These were expanded by the author of the paper to a final number of 19. In December 2021, a nationwide questionnaire survey was conducted, which was attended by more than 500 respondents. Employers with an account created on the job portal were contacted “Online job market guide “ [www.istp.sk](http://www.istp.sk), who have given their consent to the sending of marketing messages. In addition, the experts represented within the national project Sector-Driven Innovations for an Effective Labor Market (Ústredie práce, sociálnych vecí a rodiny, 2021) and, last but not least, members of the National Employers' Union were addressed.

The results of the questionnaire survey pointed to interesting trends in the importance of individual skills in the future (2030). In this survey, the respondent was to assess the current need for 19 monitored skills and then assess the future expected importance of these skills. The slider bar function was used for evaluation, which contained numeric values from 0 to 100 (with 0 expressing the lowest level of importance and a value of 100 expressing the highest value of importance). When filling in the questionnaire, the respondent could enter his ID number, which was then possible for the author's team to analyze the results from different perspectives - e.g., size category of the organization, branch according to the Statistical Classification of Branches SK NACE Rev. 2 etc.

Selected survey results are summarized in the following section. All 19 skills examined were grouped into 5 main categories. The aim was to offer the respondent the opportunity to assess the future importance of large categories and then individually evaluate the expected trends in 19 skills. Graph no. 1 shows the results of the assessment of the expected importance of skills categories. The results show a clear dominance of the first two categories - digital and surprisingly interpersonal skills. In the general assessment, however, it can be argued that all five examined categories of skills will be important from the point of view of employers in the Slovak Republic in the future (2030). The respondent rated the skill categories in question on a scale of 0 to 100, with a value of 0 representing the lowest level of importance and a value of 100 representing the highest level of importance.



**Figure 1.** Expected level of importance of skills categories by 2030 (maximum number of points 100)

*Source:* Skills analysis for the future of a competitive labor market in Slovakia (2021)

Based on a study by Dondi et al. (2021) provided by McKinsey, our questionnaire survey confirmed that Digital skills are perceived by employers in the Slovak Republic as the most important part of the competency model of their employees in the future (2030). This is proof that the growing trend of digital transformation and digitization will be more pronounced in the national economy in the coming years, which is in line with the expectations of the advanced world economies. It is interesting to see how respondents perceive the importance of individual skills now and in the future. For all monitored skills, an expected increase in importance was recorded by 2030. The table 1 below shows in which skills respondents expect the highest increase in importance in the future and in which, on the contrary, the lowest.

**Table 1.** Expected change in the importance of the skills examined (comparison of components and future - year 2030)

NAME OF SKILL	DIFFERENCE BETWEEN CURRENT AND FUTURE LEVEL OF IMPORTANCE	Level of importance	Level of importance
		<i>present</i>	<i>future</i>
Environmental literacy	18,4	56,5	74,9
Knowledge of a foreign language	17,0	47	64
Understanding the digital system	16,1	49,3	65,4
Digital skills	15,6	60,5	76,1
Technical literacy	13,1	59,3	72,4
Use and development of software	12,9	45,2	58
Economic and financial literacy	12,7	57,6	70,3
Entrepreneurship	12,5	53,7	66,2
Mobilization	11,6	57,1	68,7
Mathematical literacy	11,5	53,8	65,4
Achieving goals	11,5	64,9	76,4
Self-awareness and self-management	11,5	64,7	76,2
Effective teamwork	11,0	66,5	77,5
Mental flexibility	10,6	64,4	74,9
Planning and ways of working	8,5	66,8	75,3
Critical thinking	8,5	65,5	74
Developing relationships	8,3	66,6	74,9
Analytical thinking	7,6	66,4	74
Communication	6,8	67,7	74,5

*Source:* Skills analysis for the future of a competitive labor market in Slovakia (2021)

From the above, it is possible to observe the highest expected increase in the importance of environmental literacy. Respondents expect an increase in importance from the current value of 56.5 points to the level of 74.9 points (the maximum number of points in the evaluation of importance was 100). In addition, respondents expect a significant increase in the importance of skills such as: knowledge of a foreign language; digital system understanding; digital capabilities, etc. In addition, the 19 skills in question were evaluated in terms of expected importance in 2030. This ranking highlights important information on which skills will be most important to employees in the future (see table 2 below).

**Table 2.** Ranking the skills examined according to the highest expected importance in the future

NAME OF SKILL	Level of importance	Level of importance
	<i>present</i>	<i>future</i>
Effective teamwork	66,5	77,5
Achieving goals	64,9	76,4
Self-awareness and self-management	64,7	76,2
Digital skills	60,5	76,1
Planning and ways of working	66,8	75,3
Environmental literacy	56,5	74,9
Mental flexibility	64,4	74,9
Developing relationships	66,6	74,9
Communication	67,7	74,5
Critical thinking	65,5	74,0
Analytical thinking	66,4	74,0
Technical literacy	59,3	72,4
Economic and financial literacy	57,6	70,3
Mobilization	57,1	68,7
Entrepreneurship	53,7	66,2
Understanding the digital system	49,3	65,4
Mathematical literacy	53,8	65,4
Knowledge of a foreign language	47,0	64,0
Use and development of software	45,2	58,0

*Source:* Skills analysis for the future of a competitive labor market in Slovakia (2021)

Although digital competences gained the highest points in 2030 in terms of importance in the evaluation of large categories of skills (Chart 1), the evaluation of 19 sub-skills shows that the first digital skills (Digital Competences) finished in fourth place in terms of future importance. However, the difference compared to the most important partial skill is minimal, so the digital capability must be considered as one of the key future skills of employees.

According to the respondents, effective teamwork appears to be the most important skill in 2030. This fact is also reflected by Graczyk-Kucharska et al. (2020), who consider skills such as: entrepreneurship, teamwork, creativity and communication to be key to future labor market requirements. On the contrary, respondents expect the lowest level of importance in the skill of using and developing software, which is probably related to the fact that it is a specific skill that is not used in all types of employment.

In the survey, all 19 skills were examined in depth, the authors focused on the current and future expected level of importance of the skills. In addition, these results of individual skills were analyzed in terms of the type of work performed, industry, type of ownership (domestic or foreign) and size category of the organization that the respondent represents. For the purposes of this paper, we present one of the most important skills of the future - **Digital skills**. Respondents rated digital skill in terms of its importance in performing work now and in the future. At present, respondents perceive the importance of digital skills at the level of 60.5 points out of a possible 100. By 2030, they perceive an increase in importance to the level of 76.1 points. These results confirm the European

Commission's priorities (2019), according to which the improvement of ICT skills and basic digital competences should be in line with the European Digital Learning Action Plan, as well as the focus on artificial intelligence. In addition, the World Economic Forum (2020) has identified a high rate of acceleration of digitization into work processes (for example, a significantly higher need for control of digital tools is expected, etc.)

THE IMPORTANCE OF DIGITAL  
SKILLS TODAY

60,5

THE IMPORTANCE OF DIGITAL  
SKILLS IN THE FUTURE

76,1

Source: Skills analysis for the future of a competitive labor market in Slovakia (2021)

As part of the evaluation of the questionnaire survey, the author also focused on the division of employees. The starting point for dividing employees into two groups is the common English term „White and Blue collar“ – division of employees into those who perform physical and mental work. Some companies, and perhaps most of them, are completely dependent on recognizing, developing and retaining talented people in terms of their survival. Long-term success in acquiring, retaining, developing, motivating and using the best talents in a given field will probably become the most important factor determining the long-term viability of a company. Part of the traditional mistrust of human resource management has been the fact that talent and knowledge are extremely difficult to measure. Organizations prefer cost measurability and productivity that are easier to measure.

Note: *Workers with a predominance MENTAL WORK perform specialized, technical, managerial and administrative tasks mainly in the office or in other administrative premises. Workers with a predominance PHYSICAL WORK perform manual, craft work in the workshop, in the field, on the construction site, in the hall, means of transport, in catering and hotel operations outside the office premises.*

When dividing employees into these two groups, significant differences can be observed within the importance of the skills examined. While for employees performing mental work, respondents expect the importance of this skill at the level of 90.9 points out of a maximum of 100, for employees performing physical work it is only 61.2 points.

THE IMPORTANCE OF DIGITAL  
SKILLS TODAY

EMPLOYEES PERFORMING  
INTELLECTUAL WORK

77,8

THE IMPORTANCE OF DIGITAL  
SKILLS TODAY

90,9

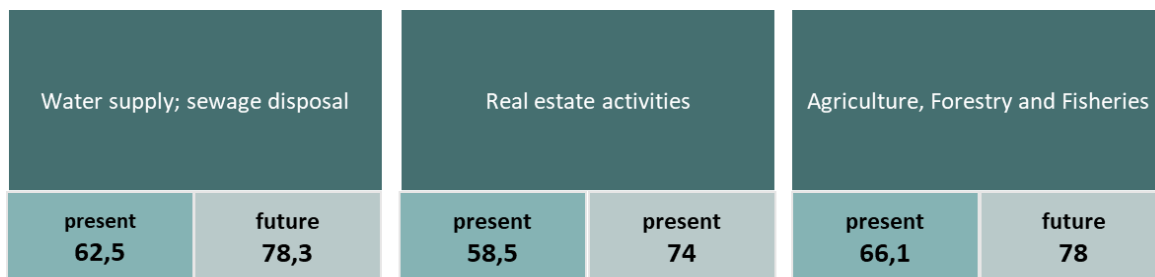
EMPLOYEES PERFORMING  
PHYSICAL WORK

43,1

61,2

Source: Skills analysis for the future of a competitive labor market in Slovakia (2021)

In terms of the highest expected increase in importance (comparison of current value and future value), the authors evaluated the sectors of the national economy. The graphics below show the TOP three industries with the highest expected increase in the importance of digital capabilities by 2030.



Source: Skills analysis for the future of a competitive labor market in Slovakia (2021)

The importance of skills Digital skills are similarly perceived by respondents representing both domestic and foreign organizations. A slightly higher degree of expected importance in the future (until 2030) was recorded in the case of domestic organizations.



Source: Skills analysis for the future of a competitive labor market in Slovakia (2021)

## Conclusion

Based on the evaluation of current trends and key competencies, we analyzed the global trends within the theoretical basis, which will significantly change the labor market in the coming period. These trends were subsequently examined in a questionnaire survey, the aim of which was to monitor and evaluate the importance of selected skills in employees until 2030. By 2030, all the skills examined for employees are expected to be at a higher level, compared to the current level of importance. These valuable data from employers operating in the Slovak Republic are an important basis for setting the policy of employee training in companies and also for the preparation of the future workforce. The current and future workforce will have to master skills that will meet the requirements of employers for employment in the labor market, where soft skills in particular come to the fore. From the results of the questionnaire survey, digital and interpersonal skills can be characterized as those that will be significantly needed in the future in the performance of employees' work. In addition, the following skills will be important: Environmental literacy; Knowledge of a foreign language; Understanding digital systems; Digital skills - with these skills, employers' representatives in the Slovak Republic expect the highest increase in the level of importance of a given skill in the future (2030), compared to the current situation. In the conditions of the Slovak Republic, the expectation that the demand for technological, social, emotional and higher cognitive abilities will be to grow. Following a study by McKinsey, our questionnaire survey confirmed that Digital Skills is perceived by employers in the Slovak Republic as the most important part of their employees' competency model in the future (2030). This is proof that the growing trend of digital transformation and digitization will be



more pronounced in the national economy in the coming years, which is in line with the expectations of the advanced world economies.

The author of the paper, as a co-author of the analysis Lednárová-Dítětová et al. (2021), in collaboration with other authors has developed a unique evaluation of future skills broken down according to their importance until 2030. A selected part of these results was used in the present paper. The results of the questionnaire survey provided an interesting view of which skills / competencies will be most important in the conditions of the Slovak Republic by 2030. The findings are important for stakeholders such as employers, educational institutions preparing future graduates, social partners operating in the Slovak Republic, trade unions representing employers, employers' and professional organizations, the Ministry of Education, etc.

For employers, the most important goal remains to be competitive even in the global market, where innovation trends are gradually being introduced in all areas of production and service provision. Until now, the usual working system has consisted of the following steps like skills development in primary, secondary and tertiary education, the use of these skills in only one sector. Due to technological changes and changes in the company, this structure changes as follows: skills development takes place not only during the first part of life (at school), but also throughout life, education is complemented by "Early Childhood education" and care, effective use of skills not only in one sector in one job, but during the working life to use your skills in several jobs and sectors, i.e. "Multiple jobs, multiple sectors" (Hrnčiar, Rievajová, 2019). If an employer wants to keep up with these changes, he must have a workforce that is adequately prepared to work with innovation trends and able to communicate his requirements. That is why it is essential that the skills examined, in view of their expected importance, be translated into the education system as part of the training of the future workforce and at the same time into the training programs of individual employers. This research is not definitive and we see room for further research that will further determine the priorities of employers in education, where they will seek access to employees through key competencies so that both parties can benefit from it. It will be crucial for the employer to set the priorities for which he will want to train employees. On the employee's side, there will be an opportunity to move up the career ladder and thus improve one's conditions. We anticipate that teamwork, creativity and communicativeness as tools for the future will benefit society and can keep it coherent and goal-oriented. In addition, it is a challenge for national governments to work with employers. According to the Deloitte study, governments and employers should identify the main drivers that motivate workers to engage in training to provide the right guidelines for retraining and training. According to the authors Baláž, et al. (2017) a sustainable economy will require improving the quality and providing inclusive education for all for the needs of the labor market, as well as for the needs of the modern digital economy and society. In this regard, multinational companies play an important role in the current global economic turbulent processes in ensuring sustainable economic growth in the world economy and increasing competitiveness in the global economy (Kordos, Vojtovic, 2016). Our research supports these authors' views and provides important information and findings for the education system and employers. If the Slovak Republic is to remain competitive, it must develop its education system in the same direction as new technologies and innovations. Without knowledge of future labor market needs, we will not be able to secure a skilled workforce.

The limit of our research was the conditions in which the questionnaires were created and applied. The reason is the pandemic situation, which did not allow structured interviews to be conducted directly with the respondents. In addition, we consider the fact that respondents' answers about future skills may change in a short time to be a limitation. Ensuring inclusive education is not that simple and labor market needs are dynamic and growing.

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Ing. **Andrea HORVÁTHOVÁ**, PhD. Candidate at the Faculty of Social and Economic Relations at the Trenčianska univerzita Alexandra Dubčeka v Trenčíne, Slovak Republic.

**ORCID ID:** <https://orcid.org/0000-0001-9143-9120>

Ing. **Michal HRNČIAR**, PhD. Candidate at the Faculty of National Economy at the University of Economics in Bratislava, Slovakia.

**ORCID ID:** <https://orcid.org/my-orcid?orcid=0000-0001-7801-4064>

Prof. Ing. **Eva RIEVAJOVÁ**, PhD. is a professor at Faculty of National Economy at the University of Economics in Bratislava, Slovakia. During the span of years 2007 - 2014 she has been the Head of the Department of Social Development and Labor. She was the head of VEGA research projects and co-solver of international COST projects. The projects focused on the issue of new trends in the social system of Slovakia with an emphasis on the labor market and employment policy in the process of involvement in European structures, and on the area of social security with an emphasis on pension systems. She is also currently the main researcher of the Vega project entitled "New challenges and solutions for employment growth in changing socio-economic conditions".

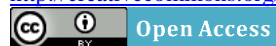
**ORCID ID:** <https://orcid.org/0000-0003-0769-989X>

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## FEMALE SOCIAL ENTREPRENEURS IN AFRICA CREATING SOCIAL VALUE THROUGH INNOVATION\*

**Cecile Nieuwenhuizen**

*College of Business and Economics, DHET-NRF SARChI Entrepreneurship Education, University of Johannesburg,  
PO Box 524 Auckland Park 2006, South Africa*

*E-mail: [cecilen@uj.ac.za](mailto:cecilen@uj.ac.za)*

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**Abstract.** The objectives of the study were to identify the types and levels of innovations and the business categories of Female Social Entrepreneurs in Africa (FSEAs) and to determine how these FSEAs create social value in their societies. The database of Ashoka, an international organisation promoting exceptional social entrepreneurs, known as changemakers, were used to identify 142 FSEAs from 20 African countries. Schumpeter's (1939) typology of innovation and Hamel and Breen's (2007) hierarchy of innovation were used to determine the type and social value created and the FSEAs' contribution to society. The results indicate that at 85%, most FSEAs have post-school qualifications, of which 43% have a degree and 24% post graduate qualifications. The business categories of the majority of FSEAs are in Education and Learning (30), Development and Prosperity (30), and Health and Fitness (21). Furthermore, the Schumpeterian type of innovation of the majority is Opening of New Markets (78) and Introduction of New Products or Services (46). The Hamel and Breen's level of innovation of the majority of FSEAs is Product and Service Innovation (114). We found that the FSEAs identified and addressed important challenges in their communities through various types of innovation. This process created valuable social contributions to their communities, the broader society and, in some instances, other African countries.

**Keywords:** Africa; female; innovation; social entrepreneurs; social value

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## **1. Introduction**

Female entrepreneurs are more inclined to contribute to society than to create personal wealth, therefore, they are important for the socio-economic development of their countries (Bosma, Ionescu-Somers, Kelley, Levie & Tanarwa, 2019; Veras, 2015). In this study we investigated the level and types of innovations of female social entrepreneurs in Africa (FSEAs) and how they create value in their societies. From the literature it is clear that innovation is an essential entrepreneurial activity (Guerrero & Urbano, 2021; Lumpkin & Frese, 2009; Pearce, Fritz & Davis, 2010; Rauch, Wiklund, Schumpeter & Miller, 1987; Yusoff, Razak, Hassan & Zainol, 2018). Entrepreneurship theories have identified different types (Schumpeter, 1939; Zhao, 2005) and levels (Elbaz, Binkour & Majdouline, 2013; Hamel & Breen, 2007; Lewrick, Williams, Omar & Tjandra, 2015) of innovation. Entrepreneurs create commercial value and contribute to economic development (Loof & Heshmati, 2006; Lumpkin & Frese, 2009; Neneh & Van Zyl, 2017; Rauch, Wiklund & Schumpeter, 1965) whereas the primary aim of social entrepreneurs is to create social value (Nicholls, 2008; Porter & Kramer, 2020; Schumpeter, 1909). Furthermore, the contribution or value created by female entrepreneurs is important for economic development (Ambrish, 2014; Veras, 2005) and the aim of their businesses is to make a difference and improve society (Bosma et al., 2019). A gap in the literature is that limited empirical research have been conducted to determine the social value that FSEAs create through their innovations.

The objectives of this study are to:

- (1) Identify the types and levels of innovations of FSEAs.
- (2) Determine how these FSEAs create social value in their societies.

Therefore, the contribution of this study is to provide an understanding of the importance, relevance and value that FSEAs create through innovations in their societies. The study thus addresses three primary research questions:

- (1) What are the types of innovations introduced by FSEAs?
- (2) What are the level of innovations introduced by FSEAs?
- (3) What social value do FSEAs create in their societies?

The structure of the paper is as follows:

A literature review section to conceptualise the most important concepts and theories relevant to the study, including social entrepreneurship, female entrepreneurs, value creation and innovation. This section culminates in a discussion of the relevant theories and associated propositions to be investigated.

The research methodology section explains FSEAs' type and level of innovation, while the social value that they add is explored through a qualitative research approach.

In the results section the information obtained through the questionnaires are analysed and this section is followed by a discussion of the findings and the conclusions drawn.

This study contributes to the understanding of the innovations and social value created by FSEAs.

## **2. Literature Review**

Entrepreneurship, social entrepreneurship, female entrepreneurs, social value and innovation are contextualised as being relevant to this study.

### **2.1. Entrepreneurship and Social Entrepreneurship**

In some economies, including South Africa, Guatemala, Panama and India, at least seven out of 10 entrepreneurs indicated that they started their organisations to 'make a difference in the world'. The motivation of less than two out of 10 entrepreneurs in Norway and Poland is to build wealth. These results illustrate that the entrepreneurs have aspirations other than wealth creation (Bosma et al, 2019). Entrepreneurs are unique because few have the ability and confidence to act beyond the familiar, know how to overcome resistance, and are resilient when facing



adversity (Schumpeter, 1949). Analysis of Schumpeter's texts (1909,1934) (published by Taylor & Francis, 2003), through a social innovation and social entrepreneurship lens, indicate that entrepreneurs drive economic development based on creativity. According to McNeill (2012), Schumpeter's (1909, 1934) definition of an entrepreneur as a person who reconfigures the allocation of existing resources, generates new value, and moves towards egalitarianism, demonstrates a link between social and commercial entrepreneurship. However, it seems that social entrepreneurs are even more exceptional than commercial entrepreneurs. They adapt existing models for the benefit of people, communities, and countries, believing that they can change communities and societies. Thus, they act creatively by combining business, charity and social models to address communities' problems and ensure sustainable new social value (Nicholls, 2008). Porter and Kramer (2020) indicate that the capitalist system is under scrutiny with the view that companies prosper at the expense of the general community and propose resetting the boundaries of capitalism through shared value. Shared value involves expansion of the total pool of economic and social value and opens up new avenues for innovation. Serving developing economies, that are usually home to many disadvantaged communities, offers excellent opportunities as viable markets. Social entrepreneurs use viable business models and new product concepts to meet social needs and create shared value (Porter & Kramer, 2020). According to Schumpeter (1909), social entrepreneurs have bold visions and a social mission. They make fundamental changes to address the cause of problems in the social sector to reform and revolutionize societies. They aim to make beneficial changes to societal systems and ensure the sustainability of their improvements. Their initiatives in areas such as economic development, education, health care and other social fields usually start in local communities but are often replicable and can contribute to improvements globally. Santos (2012) opines that an organization should have a dominant focus, either value capture as in commercial entrepreneurial organizations, or value creation as in social entrepreneurship. From the reviewed literature it can be concluded that all entrepreneurs are creative and innovative to ensure viable business models. Yet, there is clear distinction between commercial and social entrepreneurs. Social entrepreneurship focuses on social value creation and long-term change as opposed to commercial entrepreneurship that is primarily concerned with profit or value capture. Therefore, social entrepreneurs are a special type of entrepreneur – they are changemakers who create social value within the societies in which they operate.

Studies in the field of social entrepreneurship indicate that these entrepreneurs are motivated by the non-pecuniary benefits of innovations aimed at improving people's lives (Dacin, Dacin & Matear, 2010; Jensen, Liu & Schött, 2017). Yet, earning an income and/or profitability are also vital to social entrepreneurs to ensure the sustainability of their businesses. Thus, innovation is important because, according to Jensen et al. (2017), the level of innovation of a business increases the self-determination of entrepreneurs and ensures financial and non-financial benefits, including job and life satisfaction. In addition, and due to severe resource constraints of social entrepreneurs, their ability to rely on their network building and relationship management contributes to their success (Austin, Stevenson & Wei-Skillern, 2006). Thus, it is clear that the primary motivation of social entrepreneurs is to create social value, but their businesses have to ensure income through their personal networks and be sufficiently profitable to ensure sustainability.

## 2.2. Female entrepreneurs

Female entrepreneurship is vital in many countries and, according to a United Nations report, the advancement of females contributes to economic development and steady economic growth. In contrast, economies in which women do not participate remain stagnant (Ambrish, 2014). Vêras (2015) found that female owned businesses are moving from “economically insignificant to growing contributors to the economy” and that their increased relevance should be taken into consideration because they can grow their businesses in their countries as well as internationally. Empowerment of female entrepreneurship can contribute significantly to economic growth. Women who start businesses more often agree that their motivation for so doing is to make a difference to the world and that entrepreneurship is critical to alleviate female poverty (Bosma, Ionescu-Somers, Kelley, Levie & Tanarwa, 2019). According to Brush and Cooper (2012) less than 10% of all research in the field of entrepreneurship is about women entrepreneurs, therefore, even though their contribution to employment,

innovation and the welfare of society is essential, our knowledge about them is limited. In addition, most of the studies on female entrepreneurs are on women in developed countries with little research having been undertaken on women in developing countries. In agreement, Meyer (2018) states there is limited research on women, entrepreneurship and their contribution to business and society. She also found that there are fewer female entrepreneurs than males and that women are less likely to grow their businesses. Women's motivation to remain in business includes independence, work-life balance, the challenges involved and their contribution to society (Meyer, 2018). Due to business opportunities entrepreneurship is a viable career option for women in Africa. Thus, women play an essential role in society and specifically in their contribution to economic welfare as employees, managers, entrepreneurs and leaders. These women create businesses to earn an income for themselves and their employees. Some of these women are social entrepreneurs whose primary objectives are to create social value in their communities.

Generally, the belief is that male entrepreneurs outperform female entrepreneurs (Amine & Straub, 2009; Nichter & Goldmark, 2009). In a study involving 937 South African enterprises Williams and Kedir (2018) found that businesses with a female owner, sometimes in conjunction with a male owner, outperformed those owned by males only. Their findings are in agreement with those of Robson and Obeng (2008) and Badran (2014) who determined that the performance of female entrepreneurs is equal to those of males, while other researchers (Deshpande & Sharma, 2013; Sasidharan & Raj, 2013; Zolin, Stuetzer & Watson, 2013) determined that females outperformed their male counterparts). Kariv (2010), however, found that the role of gender does not affect business performance significantly, rather that creativity and innovation contribute significantly to business performance. Veras (2015) found that female entrepreneurs often address societal needs resulting in social improvement and economic progress. Scarlata, Alemany and Zacharakis (2021) found that teams with a higher proportion of females in venture philanthropy firms have a higher risk-taking profile than teams dominated by men. This implies that social entrepreneurs looking for financing might have a better chance of getting their investment approved if the venture philanthropy management team has a higher proportion of females. The reason can be that when confronted with critical issues such as poverty, climate change, malnutrition, access to education and other social problems women are willing to take more risks. Due to their orientation to create social value the higher risk propensity of females versus males might also be a distinguishing characteristic for female social entrepreneurs.

Thus, as stated previously, the value and contribution of female entrepreneurs are significant and warrant the dedication of more resources to promote female involvement in business ownership. Their social contribution can be increased by supporting female entrepreneurship through education, training and opportunities, as well as resources such as capital and land.

### **2.3. Innovation**

Although there are various definitions of entrepreneurship, most conclude that entrepreneurship is the process that an entrepreneur follows to establish an organisation that starts with identifying an opportunity and an innovation that the entrepreneur can commercialise through planning, start-up, managing and growing the business. Innovation is a continuous process of exploring, learning and improving that is always accompanied by the risk of failure (Dees, Emerson & Economy, 2001). However, innovative and ambitious entrepreneurs are more likely to grow their organizations; therefore, the focus has moved to growth and innovation-oriented entrepreneurship rather than increasing the number of small and medium enterprises (Stam, 2015). According to Anwar, Khan and Khan (2018), entrepreneurial innovation determines a country's competitive advantage. Autio, Kenney, Mustar, Siegel and Wright (2014) point to the importance of the entrepreneurial ecosystem that influences the quality and quantity of entrepreneurial innovation because it affects the potential rewards of entrepreneurship. The present study acknowledges the importance and relevance of innovation as a key requirement of successful entrepreneurs.

#### 2.4. Innovation theories and models

Godin (2019:180) analysed theories on innovation and found while there are many models, approaches and conceptual thoughts on innovation, comprehensive theories are limited and modest. He determined that the theory of innovation formulated by Schumpeter (Business Cycles, 1939:87-102), one of the first authors who reflected on innovation, is a theory of technological change based on an analytical tool or model to explain the causes of change in economic life. Innovation is a theoretical concept implying to do something differently through the introduction of new ideas, methods or products. The entrepreneur combines resources or production factors to ensure innovative new combinations, and, as a result, becomes a 'change-maker'. The innovation model applied in the present study consists of five types of innovation (Schumpeter, 1934), and adapted to the more recent social innovation models of the OECD (2010) and of Porter and Kramer (2019):

- Introduction of a new product or service or new quality of product or service, that are unfamiliar to consumers. According to the OECD (2010) identifying and delivering new products and services that improve the quality of life of individuals and communities.
- Introduction of a new method of production, not necessarily a new discovery but applied in another context. According to the OECD (2010) identifying and implementing new labour market integration processes, new competencies, new jobs, and new forms of participation, as diverse elements that each contribute to improving the position of individuals in the workforce.
- Opening of a new market, thus introducing something that is new to a specific market and, according to Porter and Kramer (2019), reconceiving products and markets.
- A new source of supply of raw materials or semi-manufactured goods.
- Carrying out the new organisation of any industry.

Based on this model proposition 1 is:

#### **Proposition 1: FSEAs apply at least one type of innovation.**

To determine the value of an innovation, Hamel and Breen (2007:14) developed a hierarchy of innovation whereby they propose that higher tiers will contribute to higher levels of value creation. Building up from the base the innovation hierarchy are:

- Level 1 – Operational Innovation: makes it possible for businesses to operate better, at a higher and/or leaner pace by improving inter alia their manufacturing, service delivery and administration processes.
- Level 2 – Product and Service Innovation: varies from completely new products or services, repositioning existing products or services, new product lines or extending product and/or services lines.
- Level 3 – Business Model Innovation: when a business manages to gain value from a new business model by successfully commercialising it.
- Level 4 – Architectural Innovation: reconfiguration of a system by linking the components of the system innovatively.
- Level 5 – Management Innovation: innovative management of any processes including strategic-, knowledge- and project management to allocating capital, managing science, technology and intangible assets, capturing employees' wisdom and developing international businesses.

Based on the Hamel and Breen (2007) hierarchy proposition 2 is as follows:

#### **Proposition 2: Through analysis of their business strategies the level of innovation of FSEAs can be identified.**

In their study Guerrero and Urbano (2021) found that the effects of entrepreneurial innovation improved capabilities in their businesses through the implementation of innovation mixed practices, through innovation in product/services, and through innovation in processes. When businesses developed innovation capabilities in innovation mixed practices of products and processes the probability of developing sustainable entrepreneurial

innovation projects increases. They suggest that business managers should evaluate the costs and the benefits of sustainable innovative and entrepreneurial projects.

### **Social Value**

Businesses, and especially social enterprises, can create economic value by creating social value in three ways “by reconceiving products and markets, redefining productivity in the value chain, and building supportive industry clusters at the company’s locations” (Porter & Kramer, 2020:59).

In common with commercial entrepreneurs, innovation is core to social entrepreneurs. The difference is that social entrepreneurs innovate to add social value (Duvnäs, Stenholm, Brännback & Carsrud, 2012) It is, however, difficult to determine the contribution, value created and/or impact that social entrepreneurs have on their communities and societies and to justify the resources used to create such social value. As so aptly noted by Dees (2001:3): “It is inherently difficult to measure social value creation. How much social value is created by reducing pollution in a given stream, by saving the spotted owl, or by providing companionship to the elderly? The calculations are not only hard but also contentious. Even when improvements can be measured, it is often difficult to attribute them to a specific intervention”.

According to Gasparin, Green, Lilley, Quinn, Saren & Schinckus (2020) a creative ecosystem includes economic, social and cultural values, which are crucial to the socio-economic development of a country. They define a creative ecosystem as network of stakeholders, including individuals and organisations whose goal is to create economic, social and cultural values through creative and innovative activities. Their strategic framework for social innovation includes the positive impact that social innovation can have on society and describes methods to create and capture economic, social, cultural and ecological values.

Gasparin and Quin (2020) found that in transitional economies the focus of value creation should not be, as in Western studies, primarily on economic value but rather on a combination of economic, social, and cultural value creation. They conclude that social, economic and cultural values are created in transitional economies as innovation ecosystems develop, even in the absence of formal governance.

### **Proposition 3: Through their innovations FSEAs are change makers and add social value.**

To determine acceptance or decline of the three propositions (listed above) a qualitative research approach was followed. The following section explains the research methodology used in this study.

## **3. Research Methodology**

For this study a qualitative research approach was utilized as it enables deeper insight and understanding of the topic under discussion. McNeill (2012) points to viewing practice-based source materials through a social lens for a better understanding of the processes and impacts of social innovation and social entrepreneurship. To gain in depth insights about women entrepreneurs, de Bruin, Brush and Welter (2007) indicate a need for a more qualitative research approach to complement and contrast the primarily quantitative studies previously undertaken in the field of entrepreneurship. This statement aligns well with Schumpeter’s (1949) notion that the analysis of existing data, such as biographies of businesspeople, could be used advantageously to better understand their entrepreneurship processes, innovation and impact. This research study followed a collective case study approach through which detailed information on various businesses of female social entrepreneurs was collected from a reliable database (Ashoka) and webpages of the FSEAs’ businesses. From this information a questionnaire with open-ended questions were completed on each FSEA. The data thus collected was used and quantitatively analysed.

For this study the population is all social entrepreneurs associated with Ashoka, an international organisation with a comprehensive data base of social entrepreneurs, referred to as ‘Ashoka Fellows’. Through a rigorous selection process these social entrepreneurs become Ashoka fellows who are committed to ‘championing new patterns of social good’. Open access is available to the Ashoka web page and profiles of all Ashoka Fellows as per their web page <https://www.ashoka.org/en-za/our-network>. Globally there is a total of 3500 Ashoka Fellows.

In line with the objective of the study, the sample consists of all female social entrepreneurs from Africa (FSEA) who are Ashoka Fellows. Through a network search option, the sample was drawn from the comprehensive data base of social entrepreneurs on the Ashoka web page ([www.ashoka.org](http://www.ashoka.org)). A total of 142 female social entrepreneurs from African countries were identified.

On the Ashoka web page, the profile of each of the 142 identified Ashoka Fellow is comprehensive and presented in the format of a transcribed interview. This information was used to complete questionnaires on each of the identified FSEAs. In addition, all web links to these particular organisations were followed to gain additional information. Some organisations did not have other active and/or accessible web pages, and in these cases, their Ashoka profiles were used as the only source of data. Completion of the questionnaires was done with the assistance of a research assistant and finalised and verified by the researcher.

Based on the objectives, reviewed literature and propositions, a questionnaire was developed to collect information regarding inter alia:

- Demographics such as countries in which these Ashoka Fellows operate and their level of education
- Business categories, i.e. business; economic development, education and training; employment; gender, health and social issues.
- The problems they identified and their business ideas to solve these,
- The type and level of innovation
- The value that the social entrepreneurs created for their communities and societies.

Through manual content analysis of the individual questionnaires of each of the 142 FSEAs, information was categorised as ‘demographics’, ‘type and level of innovation’ and ‘social value created’ to address the research questions. The collated data from all the study participants was then summarised, combined and structured to determine trends and insight on FSEAs and to address the propositions and objectives of this research study.

### **Ethical considerations**

The data set for this study was compiled from information that was in the public domain and confirmed by Ashoka as such. The requirement from Ashoka indicates that we should keep the social entrepreneurs anonymous, therefore, numbers from [1] to [142] were allocated to the study participants and no specific reference is made to any personal trait. However, in some instances where FSEAs have active websites names of their businesses might be included. An Ethical Clearance application to conduct the study was submitted to the College of Business and Economics Research Ethics Committee, University of Johannesburg, South Africa, and permission to do so was granted on 31 March 2020 with the Ethical Clearance Code 20SOM04.

### **Trustworthiness**

Trustworthiness of the study are based on the credibility, transferability, dependability and conformability of the study. Credibility was ensured by utilising the Ashoka database of leading social entrepreneurs in the world to complete questionnaires, together with additional information from their businesses’ web pages. The questionnaires were completed by a research assistant and validated by the researcher. The data of all 142 participants was combined, categorised, analysed and interpreted. This is a qualitative study, thus, the findings are non-generalisable but can be transferable to other contexts and similar populations. Content analysis was conducted to categorise information on innovations and for thick descriptions of social value created by FSEAs to enable transferability. The results of the study are dependable because they are based upon reliable data obtained



from the Ashoka database and web pages of reputable businesses. Confirmability was ensured because the research process was transparent and the researcher is accountable for any deviations, such as the use of the available web pages of some participants.

#### 4. Results

The results reflect some relevant demographics of the FSEAs. Their type and level of innovation as well as the social value created by the FSEAs, together with the findings of the associated propositions, are presented in this section.

##### Demographics

The Ashoka FSEAs originate from 20 African countries. The majority of the FSEAs (47) are from South Africa, followed by Nigeria (25), Burkina Faso (12), Kenya (11) and Senegal (9). There are eight (8) FSEAs from Uganda, six (6) from Egypt, five (5) from Mali, four (4) from Zimbabwe, two (2) from each of Cote d'Ivoire, Gambia, Ghana and Liberia, and one (1) from each of Botswana, Libya, Mozambique, Rwanda, Togo, Tunisia and Zambia.

A summary of the highest level of education is presented in Table 1 below. The majority (85%) of the FSEA have post school qualifications. Of these 43% have a first degree and 34% have post graduate qualifications of which 8% have Doctorates.

**Table 1.** Level of education

Level of education	Number of SEs	Percentage
School dropout	3	2%
School completed	10	7%
Some post school	26	18%
Degree or equivalent	61	43%
Honours or equivalent	4	3%
Master	18	13%
Doctor	12	8%
Don't know	8	6%
Total	142	100%

##### Categories of businesses and examples of the value created by FSEAs

FSEAs in the various categories make valuable contributions to the communities and societies in which they operate. Table 2 below reflects the different business categories, the number of FSEAs involved in each business category and the number of FSEAs from respective countries.



**Table 2.** Business categories with numbers of FSEAs and countries

Business Categories	No. of FSEAs	Countries
Education and Learning	30	South Africa x12; Nigeria x6; Senegal x4; Burkina Faso x2; Egypt x1; Gambia x1; Ghana x1; Mali x1; Mozambique x1; Uganda x1.
Development and Prosperity	30	South Africa x8; Nigeria x7; Kenya x5; Senegal x2; Uganda x2; Zimbabwe x2; Burkina Faso x2; Egypt x1, Mali x1.
Health and Fitness	21	Nigeria x7; South Africa x6; Uganda x3; Kenya x2; Burkina Faso x1; Cote d'Ivoire x1; Mali x1.
Human Rights and Equality	16	South Africa x5; Burkina Faso x2; Nigeria x2; Cote d'Ivoire x1; Egypt x1 Gambia x1; Kenya x1; Libya x1; Mali x1; Rwanda x1.
Business and Social Enterprise	12	South Africa x4; Kenya x2; Senegal x2; Burkina Faso x1; Ghana x1; Uganda x1; Zambia x1.
Children and Youth	11	South Africa x4; Egypt x2; Burkina Faso x1; Kenya x1; Liberia x1; Nigeria x1; Senegal x1.
Citizen and Community Participation	9	South Africa x3; Zimbabwe x2; Burkina Faso x2; Egypt x1; Liberia x1.
Environment and Sustainability	6	South Africa x2; Burkina Faso x1; Botswana x1; Nigeria x1; Togo x1
Peace and Harmonious Relations	4	South Africa x3; Uganda x1.
Civic Engagement	3	Mali x1; Nigeria x1; Tunisia x1.
Total	142	

### Type and Level of Innovations

The questionnaires of the FSEAs were analysed to determine the types of innovations (Table 3 below) and levels of innovation (Table 4 below). In Table 3 some examples of innovations are included.

**Table 3.** Types of innovations

Type of Innovation	No. of SEs	Examples
1.Introduction of new product or service	46	[76] Girls from marginalised backgrounds attend a course in creative coding and careers in the ICT field. [60] Training programme in mechanics for females [14] Assists Vitiligo patients by changing the attitudes of people towards those suffering from this disease and involving doctors and dermatologists in caring for them.
2.Introduction of new method of production or operation	8	[83] Developed the innovative reel gardening concept – a bio-degradable tape that consists of seeds spaced correctly for the plants to grow. [128] Loans money to groups of seven to ten members in which members are co-guarantors for other members
3.Opening a new market	78	[86] Assisted 2300 Kenyan artisans to connect directly with the international market, customers and industry
4.Utilisation of new resources of supply for raw materials or intermediate goods	9	[130] Assists small farmers to access an 84% reliable weather forecasting system upon which they can base their decisions to increase efficiency and yield. [10] Combines high level scientific research empowering farmers to improve resistance to disease of food crops.
5.Carrying out some new organisational form of the industry	6	[8] Researched and developed innovative methods of production to make quality hygiene products affordable to millions of young girls.
Total	147*	

[Number replaces FSEA's name]

\*The total is more than 142 entries because some FSEAs have more than one innovation: [8] has four types of innovation; [2] has two types of innovation (new product and service; opening new market). 142 participants, 1 with 4 types, 1 with 2 types = 147

Proposition 1 is accepted as FSEAs apply at least one type of innovation as indicated in Table 3 above.

**Table 4.** Level of Innovation

Level of Innovation	Participant
1.Operational innovation	10
2.Product and service innovation	114
3.Business model innovation	20
4.Architectural innovation	0
5.Management innovation	3
Total	147*

Based on Hamel & Breen's (2007) Levels of innovation.

\*A total of 147, not 142 because some FSEAs' innovations are at multiple levels. FSEA [8]'s innovation is at an impressive three levels: operational; product and service and business model. Three are at two levels: [10] business model and management; [31] and [53] at two levels: product and service and business model.

Proposition 2 is accepted because through the analysis of their business strategies the FSEAs' level of innovation could be identified, as illustrated in Table 4 above.

### Social Value Created by the FSEAs

An analysis of the 142 FSEAs proved that all made valuable contributions directly to people, communities, other organisations and countries. Table 5 below is a brief summary of examples of the FSEAs' different businesses and the value created through their innovations.

**Table 5.** Social Value created by FSEAs

Business description of the FSEA	Social value created by FSEA's business.
<b>Business Categories: Education and Learning (30) and Children and youth (11)</b>	
<b>Business description [FSEA]</b>	<b>Social value created by business.</b>
[99] Enables disadvantaged youth to access tertiary education or employment by linking successful graduates to support learners from disadvantaged backgrounds in their final year of high school.	More than 5,000 learners from 30 township locations are supported. Of those who completed grade 12, 84% passed and 73% were eligible for tertiary education and 85% have accessed post-school opportunities such as tertiary education, learnerships, employment and upgrading of their matric to ensure better opportunities.
[11] Provides affordable vocational education and training to the youth of Southern Africa through training centres. These training centres are learning spaces as well as business hubs for entrepreneurs. The entrepreneurs housed in the centres are also involved in training students in their respective fields.	Has enabled 26,000 youths to graduate in Zimbabwe and Mozambique, approximately 83% of the Mozambican graduates gained employment or self-employment.
[13] Teaches learners mathematics and science through culturally relevant learning methodology that integrates rural knowledge systems into the school curriculum.	Has trained 900 teachers from 30 schools benefiting 50,000 learners in rural districts.
[76] Exposes young girls from marginalised backgrounds to a course in creative coding and careers in the ICT field. The course is based on local content and applied to familiar things to teach algorithms and integrates play and dance to make coding understandable.	More than 200 volunteers who are computer scientists or engineers from four universities as well as alumni are mentors to more than 4,500 mentees in Ghana. The curriculum is also available in French with plans to bring coding to girls in French speaking African countries.
[77] Expands the opportunities of rural youth and their mothers who are farmers by assisting them to develop and expand sustainable businesses in agriculture.	More than 1.6 million youth and women that have been trained, 14,000 businesses have been created and expanded and 320,000 youth have graduated with 96% continuing to higher education and 55% in technology-related fields.
[81] Creates enabling environments for females in ICT centres providing training services as well as childcare support.	Has reached more than 32,000 women and girls of whom more than 1,800 started or expanded their businesses after the ICT training.
[83] Developed the innovative Reel gardening concept that is a bio-degradable tape that consists of seeds spaced correctly for the plants to grow. The seed tapes make gardening possible for anyone. Reel gardening are introduced to schools by linking	Has provided disadvantaged communities with access to fruit and vegetables and encouraged them to start their own gardens. Has implemented the project in 2,700 schools impacting 111,000 people in South Africa. Over 1,000,000 metres of seed tape have been donated by

nutritional education, practical gardening and the national school curriculum. Equips schools with gardens and trains teachers to use gardens as a teaching tool. A free App guides teachers and learners through the gardening process.	Reel gardening and sponsors and 13,000,000 litres of water saved (Reelgardening, 2021).
<b>Business Categories: Development and Prosperity (30) and Business and Social Enterprise (12)</b>	
<b>Business description [FSEA]</b>	<b>Social value created by business.</b>
[128] Makes group lending through micro-credit available to women in Zimbabwe who borrow money for micro-enterprises and projects. Based on the principle to loan money to groups of seven to ten members where members are co-guarantors for other members and that their enterprises have to be in operation for at least 12 months (Similar to the Grameen Bank of Bangladesh.)	Has provided thousands of members with millions in loans for micro-enterprise assistance, more than 30,000 beneficiaries have benefitted from this project. Has an excellent repayment record.
[23] Empowers the youth by creating connections across socio-economic and cultural differences.	Has trained 4,300 people, 90% of these practice entrepreneurial skills, has initiated 1,100 social impact projects and benefited 85,000 participants and secondary beneficiaries.
[34] Provides access to good quality clothing and appliance merchandise at discounted prices from top retail companies in South Africa to unemployed mothers (clothing) and fathers (appliances) who can then trade with it, primarily in the informal sector. They go through an intensive two year practical and experiential training and mentorship programme covering topics such as life -, business -, financial - and computer skills, to assist them to grow their businesses. The third project is the establishment of early childhood development centres through social-franchising in disadvantaged communities that are also financially sustainable businesses.	Has established nine branches during a 5-year period, 12 retail partners, recruited 3,663 women generating more than R356.5million profit; 321 men that generated more than R10 million profit; established 43 schools with 1,599 children creating jobs for 217 people.
[42] Assists Kenyans to start their own businesses	Has assisted hundreds of thousands of Kenyans to start their own businesses and enabled them to move from slums to new houses and have access to medical insurance.
[60] Offers training programmes in mechanics for women in Nigeria	Has broken stereotype by establishing successful female mechanics throughout Nigeria, assisted them to gain employment in mechanical workshops, helps those who want to start their own businesses to get small loans and technical support. Together with apprentices offer car safety classes to businesses to cover operating costs and support growth and expansion of the FSEA.
[86] Assists artisans throughout Kenya to connect directly with the international market, customers and industry through accessibility to mobile phones.	More than 2,300 artisans receive orders and payment directly from the virtual factory network and earn five times more than they would for similar work done through other channels.
[130] Provides small farmers with access to a reliable weather forecasting system at 84% reliability of prediction of tropical weather patterns at a hyperlocal range on which they can base their decisions to increase efficiency and yield. Users do not need smartphones as forecasts are delivered by SMS.	Due to decrease in risk and loss farmers have experienced up to 80% increase in income. Works with over 700 field officers and civil sector organisations who work with the farmers on a daily basis.
[112] Promotes the use of nutritious products based on bananas, a primary crop in a region of Senegal to overcome child malnutrition in low-income families. The fruit and skin of the banana is combined with other ingredients to produce various products including nutritious baby food.	Has assisted women producers in the community, 14 villages with 300 members have become entrepreneurs and earn an income. They have commercialised the multipurpose banana flour, created couscous, beignets, soap to cure skin problems and, most importantly addressed, child malnutrition.
[114] Creates an appreciation of local, traditional and nutritious food in Zambia by creating entrepreneurial hubs to ensure markets for these foods and developing an appreciation for local food.	Has trained more than 20,800 farmers to supply products, and organised farmers' clubs that work together to address challenges and ensure quality products. Has addressed high levels of poverty and helped small farmers to become commercial farmers of local food, thus contributing to economic and social development. From leaves of pumpkin, sweet potato and cassava and moringa, her company produces moringa soup, teabags, cereals, orange maize cereal for a school feeding programme and export some of these foods. Has received more than 60 local and international awards and now offers training in Zambia, Mozambique and Tanzania.
[10] Uses a variety of scientific and community interventions to increase food security and incomes of small farmers throughout Africa. She did this by combining high level scientific research to	Has involved over 500,000 farmers in Kenya in food security projects who now earn three times more income than previously. Aims to provide 300 million people in Africa access to healthy, vitamin- and iron-rich

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improve resistance to disease of food crops and empowering farmers.	drought-resistant sorghum.
[50] Uses agriculture and livestock research and development experience to increase the productivity of poor livestock farmers through service centres. The service centres are franchises that provide access to affordable and high-quality products and services to farmers.	Has reached more than 200,000 farmers through this initiative, 93% of farmers working with the service centres have increased their income from crops and livestock. 160,000 farmers and professionals received training through these centres.

<b>Health and fitness (21)</b>	
<b>Business description [FSEA]</b>	<b>Social value created by business.</b>
[33]; [45], [48]; [82]; [121]; [124]; [129]; [141] provides medical, emotional and social care to people living with HIV/AIDS.	Has trained and employed people with AIDS as caretakers and supporters. Training programmes include counselling, testing, medical treatment, access to AZT and tri-therapy medication, as well as social support to become healthy and access to microfinance to enable them to generate income. Also assists home-based care for sick or dying, help with childcare. Established telephone hotlines that provide anonymous information and assistance. Thousands of infected people belong to these HIV/AIDS assistance groups.
[35] Improves the quality of life of people with moderate to severe disabilities. Posture support, wheelchairs, mobility equipment and positioning devices are designed, manufactured and supplied to those in need.	Has supplied over 70,000 wheelchairs and support devices and improved the lives of more than 450,000 users and their families. Aims to supply 250,000 people in Southern Africa with wheelchairs and support devices.
[29] Equips unemployed youth in Africa to create employment for themselves and others by becoming professional yoga teachers. She actively develops the market for their skills and creates new opportunities.	Has used her business model to make the health and wellness benefits of yoga accessible to low- and middle-income communities in Kenya and other African countries. More than 400 young people have been trained as yoga teachers and are earning an income by teaching yoga to thousands of participants in hundreds of community yoga classes.
[8] Provides access to quality hygiene products to young girls to ensure dignity in their puberty years.	Has provided sanitary products and services to 2.5 million schoolgirls and women in Kenya by 2020. Products include sanitary pads (18 million by 2014) underwear (900,000 pairs by 2014).
<b>Business Category: Human Rights and equality (16)</b>	
<b>Business description [FSEA]</b>	<b>Social value created by business.</b>
[55] Makes information on women's rights accessible and understandable to all ages.	Has empowered thousands of women to make informed choices on maternal and new-born health and sexual and reproductive health services.
[56] Has established a girl child network that educates children and the youth and supports rights, gender equality and inclusion in Zimbabwe.	Has benefitted hundreds of thousands of children through this initiative.
[57] Builds the capacity of women to advocate for their rights and become involved in governance structures and political processes at local, state and federal government levels in Nigeria.	Has enabled many women to attain positions at various levels of government.
[37] Addresses child sexual abuse cases by mobilising communities to make the criminal justice system accountable, ensure swift prosecution and ensure sensitive treatment of victims.	Has reached more than 4,500 children per month, has made hundreds of court appearances in support of abused children and feeds 1,200 children every month with the support of sponsors.
[21] Provides counselling and support groups to assist women who are victims of violence with skills training to enable them to gain employment so that they can become independent and free from abusive relationships.	Has assisted more than 50,000 women and girls annually in South Africa to survive the trauma of domestic violence, including rape and other forms of sexual assault.
<b>Business Category: Citizen and community participation (9)</b>	
<b>Business description [FSEA]</b>	<b>Social value created by business.</b>
[127] Turns passionate retired civil servants from the public sector into agents of change as adjudicators in courts.	Has mobilised leaders and women's groups to help women to own land, has enlisted the assistance of elders to intervene on a case-to-case basis by using bylaws in the courts and, thus, has assisted women to become prosperous.

In [...] is the reference number of the FSEA/[number replaces FSEA's name]

In (..) is the number of FSEAs in the category

Proposition 3 is accepted because through their innovations FSEAs are change makers and add social value as illustrated in Table 5 above.

## 5. Discussion

There is a correlation between the number of FSEAs and the size of the economies of their countries. Countries with the most FSEAs are South Africa (47) and Nigeria (25), which have the largest economies on the continent. Smaller economies are represented by less FSEAs. Social entrepreneurs experience serious resource constraints (Austin, Stevenson & Wei-Skillern, 2006) a situation that is exacerbated in poorer countries with restricted economies.

The levels of education of the FSEAs investigated in this study are exceptionally high with 43% having a first degree and 34% post graduate qualifications. This result is in accordance with the findings of Bosma, Schott, Terjesen and Kew (2015) that indicate that in general the level of education of social entrepreneurs is higher than commercial entrepreneurs. In addition, various authors have identified a positive correlation between an entrepreneur's level of education and ability to start and manage a business successfully (Clercq & Arenius, 2006; Roxas, Cayoca-Panizales & de Jesus, 2008; Kalyoncuoglu, Aydintan & Goksel, 2017).

From the results of this study, it is clear that there is a relatively limited number of Ashoka FSEAs who qualify as changemakers or innovative social entrepreneurs in Africa – a total of only 142 in fact. Yet, they are innovative with the majority (78) who opened a new market for new or existing products and services in a variety of ways, such as linking small scale farmers with businesses that need their produce and artisans with international markets. Forty-six FSEAs developed new products and services ranging from hygienic products to food gardening applications (Apps) and supplying high quality clothing at affordable prices to the poor. These facts confirm the findings of Bosma et al. (2019) who state that many small and medium enterprises introduce new products and services, with these often being new only to the local area.

Nine FSEAs utilised new or alternative resources, such as using grandmothers to educate girls and address other female issues. Eight FSEAs applied new methods of production, such as improving food crops' resistance to disease thereby increasing the output of farmers. Six FSEAs carried out some new organisational form of the industry such as the creation of a tool that provides farmers with real-time data and the current prices of different crops in specific markets thereby enabling them to conduct their businesses efficiently and effectively. This finding regarding the innovation of social entrepreneurs confirms that they are nearly indistinguishable from commercial entrepreneurs because they are equally innovative in their attempt to reach their goals (Dacin et al, 2010; Meyskins et al, 2010).

FSEAs social value exists in the benefits they provide for people and communities through their various business categories such as Education and Learning (30) and Development and Prosperity (30). The benefactors of their value creation ranges from a few hundred to millions of individuals, through to communities and their countries and even extending to other countries. *Inter alia* they make access to training and education possible at various levels, create employment, assist the disadvantaged people to start, grow and/or improve their businesses and farming operations, provide guidance on nutrition, healthy living, health care, human rights and community participation. The results of this study confirm those of Veras (2015) who states that female entrepreneurs are valuable contributors to the economy and, in the case of the FSEAs discussed in this study, to society both locally and nationally. Many of these FSEAs empowered other females to start a business or to make a difference in their communities. Through their businesses FSEAs not only create value in the communities and societies in which they operate but also grow their own businesses, thus, proving how efficient they are in creating shared value (Porter & Kramer, 2020).



## 6. Future research

Recommendations for future research on the innovation and social value created by social entrepreneurs are:

A quantitative study that investigates the relationships between *inter alia* types of innovation and social value created by social entrepreneurs, level and type of education and extent of value created.

To investigate the social entrepreneurial innovation of female social entrepreneurs in various countries;

A quantitative study to compare male and female social entrepreneurs, including their leadership styles, business objectives and approach towards business growth.

A more diverse study that includes smaller and less prominent social entrepreneurs for a more balanced view of social entrepreneurs because the majority of them operate small businesses.

The role of entrepreneurship education in the operation and success of social entrepreneurs.

## 7. Conclusion

The objectives of this study were to determine the contribution of FSEAs to create value for their communities and society through innovation.

Proposition 1 is accepted because FSEAs apply at least one type of innovation as is indicated in Table 3 above. The type of innovation of the majority (78) of FSEAs involves the opening of a new market, with 46 of them having also introduced new products or services.

Proposition 2 is accepted because through the analysis of their business strategies the level of innovation of FSEAs could be identified. In the vast majority (114) this aspect involved product and service innovations.

Proposition 3 is accepted because through their innovations FSEAs are change makers and add social value to their communities and often to their countries. It seems as if most social value is created in the business categories of Education and Learning (30), Development and Prosperity (30) and Health and Fitness (21).

It was found that in spite of the small number of Ashoka FSEAs (142) identified in this study, their individual and combined contributions to individuals, their communities and extended societies are magnificent. Such benefits range from reaching a few hundred to millions of beneficiaries and improving their lives, health and well-being, as well as educating them and saving their lives. These findings exhibit the ripple effect of an innovation initiated by a single person that initially affects her community, then the wider society and sometimes spreads across multiple countries.

The contribution of this study is a better understanding of the types and levels of innovations instigated by FSEAs and the importance, relevance and value that they create.

## 8. Limitations

This study's sample of 142 FSEAs is large for a qualitative study but the aim was to acquire an in-depth understanding of the social value created by FSEAs. Hence, a qualitative study with thick descriptions of social value and associated innovations was deemed appropriate. Secondary data was used to complete questionnaires on each of the 142 FSEAs. Although this method could be deemed a limitation, the advantage is that the data is exceptionally detailed and the profiles and web pages contain the same or more information than what would be obtained through interviews.



The sample included only prominent Ashoka fellows, whereas the majority of social entrepreneurs have small businesses and are not Ashoka fellows. A future study should include smaller or less prominent social entrepreneurs.

Ashoka has existed for more than 35 years, thus, some of the profiles of Ashoka fellows are old and have not been updated. Some of the names of businesses or ownership might have changed over the years. As far as possible, these were updated with information from their business web sites.

For the data analysis process it was not always possible to determine the updated and exact social value created by FSEAs because current information was not always available or quantifiable. In these cases, general information was deduced from their Ashoka profiles and web pages as far as possible. In some instances, information on the the FSEAs was limited and, thus, the types and levels of their innovations difficult to identify. In these cases, the knowledge and analysis of the researchers were relied on.

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**Cecile NIEUWENHUIZEN**, prof. DHET-NRF SARChI Entrepreneurship Education Chair, College of Business and Economics, University of Johannesburg, Auckland Park, South Africa

**ORCID ID:** 0000-0003-4925-3212

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## GENDER PARITY AMONG RESEARCHERS IN SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS

**Steven Kayambazinthu Msosa <sup>1\*</sup>, Bhekabantu A. Ntshangase <sup>2</sup>, Courage Mlambo <sup>3</sup>**

<sup>1\*,2,3</sup> *Faculty of Management Sciences, Mangosuthu University of Technology, Durban, South Africa*

E-mails: <sup>1\*</sup> [msosa.steven@mut.ac.za](mailto:msosa.steven@mut.ac.za) (Corresponding author); <sup>2</sup> [ntshangase.alson@mut.ac.za](mailto:ntshangase.alson@mut.ac.za); <sup>3</sup> [mlambo.courage@mut.ac.za](mailto:mlambo.courage@mut.ac.za)

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**Abstract.** This study compares women's disparity in science over a period of 5 years (2013–2017) in eight continental regions of the world using synthesised data from a UNESCO scientific report with a desktop literature review and deductive inference from statistical analysis. The different descriptive measures, such as mean percentages, correlations, multifactor analysis (MFA), and non-linear regression, identify the trend, change points, factors, and best-fit exponential time series for decision-making. We determined that each continent follows the same exponential smoothing trend, with a correlation coefficient of 0.67, over the years of study and that the year of study exhibits a different exponential trend that varies over the different continental regions' counterparts. The study also highlights gender bias, family life, mentoring, and stereotypes as significant factors contributing to the relationship between science and gender parity. Therefore, this study advocates policy implementation of science, technology, engineering, and mathematics (STEM) to ensure women's representation in scientific research.

**Keywords:** Gender parity; STEM; Women in science; Research

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**JEL Classifications:** 039, I23

**Additional disciplines:** Science and technology

## 1. Introduction

The underrepresentation of women and girls in the science, technology, engineering, and mathematics (STEM) sectors is a global concern (Cheryan, Ziegler, Montoya & Jiang, 2017). Currently, the world is witnessing a leaky pipeline regarding women's engagement in research. Extant research suggests that women actively seek bachelor's and master's degrees and even outnumber men at these levels, accounting for 53% of graduates, but their numbers decrease precipitously at the doctoral level. Furthermore, men account for 72% of the global pool of researchers, widening the gender gap even further. As a result, the high number of women in tertiary education does not always imply a greater representation in research (Huyer, 2015). Between 2011 and 2013, the percentage of female researchers increased in South Africa (437%), Egypt (428%), Morocco (302%), Senegal (249%), Nigeria (233%), Rwanda (218%), Cameroon (218%), and Ethiopia (133%). However, a decline in women advancing along the scientific research career path has been observed. Thus, gender gaps in the scientific workforce continue to exist (Bezrukova, Spell, Perry & Jehn, 2016; Cech & Blair-Loy, 2010).

Another school of thought suggests that even though women constitute only 28% of global researchers, this figure masks significant differences at national and regional levels based on current data. For instance, women are overrepresented in Southeast Europe (49%) and the Caribbean, Central Asia, and Latin America (44%). One in every three researchers in the Arab States (37%) is a woman, followed by the European Free Trade Association (34%), the European Union (33%), and Sub-Saharan Africa (30%) (Huyer, 2015). According to UNESCO (2015), women now account for 53% of all bachelor's and master's degree holders in STEM, though only 30% of all researchers. Women leave the field at a higher rate than men, indicating a waste of social investment, individual effort, and systemic issues with maintaining women in STEM careers. Although women have reached parity in the life sciences in many nations, they are chronically underrepresented in engineering and computer science (Sirimanne, 2019). For instance, women in the European Union graduated primarily in health and welfare, humanities and the arts, social sciences, business, and law in 2014. In contrast, men are more likely to have degrees in engineering, manufacturing, and construction, followed by technology, science, and math. Despite an increase in the overall number of STEM students between 2003 and 2013, the gender gap remains the same (European Institute for Gender Equality, 2017).

Despite the rising acknowledgement of the significance of this issue in developing nations, most of the literature on gender inequality in STEM and the policies to address it has been centred on the United States and Europe. Not only are women underrepresented in STEM disciplines in developing nations, but they are also under-measured, and a lack of data has hampered academics from gaining a better understanding of the reasons for this disparity (Castillo, Grazzi & Tacsir, 2014). Other variables that may contribute to women's difficulty in advancing in scientific and technological fields include the presence of stereotypes, which may limit their ability to secure a better job or research funding (Suter, 2006). Furthermore, according to UNESCO (2007), taking time off work while her children are young may impact a woman's professional advancement. Consequently, it is difficult to return to a position equal to those who have not taken time off and gradually advanced in their jobs. This is especially true in scientific research, where publishing is a critical growth component. According to Dasgupta (2017), there is a naturally growing demand for scientists, engineers, and mathematicians (STEM). However, women, who account for more than half of the world's population, are underrepresented in these fields. Men continue to dominate in many countries' STEM workforces. In 2016, women constituted less than one third (29.3%) of individuals working globally in scientific research and development. The only locations where women formed more than one-third of the R&D workforce were Central Asia (48.2%), Latin America and the Caribbean (45.1%), the Arab States (41.5%), and Central and Eastern Europe (39.5%) (UNESCO Institute for Statistics, 2019). Therefore, this study provides a comparative analysis of regional and continental gender parity among researchers in science.



## **2. Literature review**

### **2.1 Disparities in STEM education between women and men**

Science and gender equality are critical to the world's ability to achieve long-term development goals. Moreover, much has been carried out to encourage women and girls to study and work in technical disciplines in recent years; however, women are still barred from actively engaging in them (Wood, 2020). Gender disparities in STEM are visible in terms of representation (especially in the high-level roles and subfields of computer science and engineering), remuneration, and, to a lesser extent, grants, publications, and awards. The weight of evidence no longer supports the notion that fundamental differences in ability cause these inequalities. Instead, gender disparities in STEM appear to be partly caused by variations in perceived values and opportunities in related contexts and ubiquitous implicit and explicit prejudices that impact these beliefs (Charlesworth & Banaji, 2019). Persistent gender inequality severely restricts women's ability to reach their full potential and contribute effectively to development. Furthermore, women scientists are frequently concentrated in the lower tiers of responsibility and decision-making, with few prospects for leadership; for example, lecturers and assistant researchers in universities, with very few professors. Women are rarely research directors or primary investigators in extensive studies at research institutions (African Academy of Sciences, 2020). Researchers studying discrimination have distinguished between aggressive and benign forms of sexism, with both involving attitudes that men should be dominant over women. However, while aggressive forms include disparaging and exploitative views and behaviours against women, benign forms include affectionate views of and behaviours towards women (e.g., the roles of men as the provider and protector and women as the nurturer). Both forms of sexism operate to keep women out of power and to maintain patriarchy in place; however, benign forms of sexism are frequently dismissed as types of sexism and may not even be viewed as harmful to women (Wang & Degol, 2017).

### **2.2 Factors that contribute to women's underrepresentation in the sciences**

Several variables contribute to the disproportionate participation of women in STEM, including social and psychological considerations. To comprehend women's experiences in the workplace, the "glass ceiling" metaphor has been used to characterise the barriers to women's professional advancement (Morrison et al., 1987). The number of women in the STEM academic pipeline has decreased. Women face several challenges as they rise up the educational ladder in research and teaching. Several factors contribute to this problem, some of which may be more relevant in particular regions of the world. Overall, women have difficulty remaining in their employment positions and progressing in their careers. These problems are coupled with a lack of clearly defined institutional regulations governing advancement, access to resources, and job training. Other factors prevalent all around the globe that make it difficult for women to progress in their participation include a lack of networking, mentoring, and leadership coaching (Cummings, 2015). Women working in technological areas face several obstacles that prohibit them from starting or succeeding in their careers. The following factors were identified as significant impediments in a recent global survey of women working in technology: 48% of the respondents reported a shortage of mentors during their professional careers; 42% believed that there were insufficient female role models; gender bias in the workplace was experienced by 39%; in comparison to men, 36% believed that they had unequal prospects for advancement; and there was a gender wage discrepancy for the same skills, according to 35% of the respondents (Heilman, 1995).

### 2.2.1 Gender bias

Women in STEM fields are more likely to report gender discrimination in the workplace than men. Half (50%) of women in STEM careers report experiencing workplace discrimination due to their gender being higher than women in non-STEM jobs (41%) and significantly more than males in STEM occupations (19%). The most common forms of gender discrimination experienced by women in STEM jobs include earning less than a man doing the same job (29%); being treated as incompetent (29%); experiencing repeated, minor insults in the workplace (20%); and receiving less support from senior leaders than a man doing the same job (18%) (Funk & Parker, 2018). Similar barriers to women's access and advancement have been reported for industrial research jobs, such as limited access to industrial jobs in science and engineering, the "old boys network" effect in recruitment and hiring practices, paternalism, sexual harassment, allegations of reverse discrimination, different standards for judging men's and women's work, lower salaries relative to male peers, inequitable job assignments, and other aspects of a male-oriented culture (Etzkowitz & Ranga, 2011). This view has been reinforced by Wood (2020), who observed that women who choose to accept the challenge and pursue a STEM job might face unequal remuneration and limited future career advancement.

Gender balance in the workplace is essential for women in non-STEM positions as well, but those in STEM jobs noticeably encounter workplace discrimination. There is a feeling that they need to prove themselves in order to be respected by co-workers, accompanied by their belief that, overall, their gender has made it more difficult for them to succeed at work. In contrast, gender balance in the workplace has generally been linked to opinions on gender parity (Funk & Parker, 2018). Makarova, Aeschlimann and Herzog (2016) argued that it is challenging for young women to integrate within a male-dominated professional setting. They must be highly resilient in the face of gender-biased sentiments. At the same time, they must identify their place, submit themselves to predominantly masculine workplace culture, demonstrate strong performance dedication, and avoid uncomfortable situations. Oliveira, Unbehau and Gava (2019) averred that there is a need to take steps to ensure that women have an equal voice in all aspects of social, economic, and political life, including the creation and advancement of new scientific and technological developments and innovations. In this instance, for gender equality, equal participation can only be achieved by removing the barriers preventing some individuals from engaging as equals.

### 2.2.2 Family life

The absence of gender-sensitive policy frameworks, such as on-site childcare or career re-entry programmes to encourage women scientists to return to science after taking leave to start a family, contributes to women scientists abandoning the science profession, thereby enlarging the gender divide in health research. This is exacerbated by the lack of gender-sensitive promotion mechanisms to ensure women's professional development. Not only can these approaches discourage individuals from pursuing long-term careers in research, but they also often result in women leaving the profession to pursue other interests (Muthumbi & Sommerfeld, 2015). According to the human capital theory, women are disadvantaged in the sciences due to a lack of human capital resources. This is manifested as a decreased level of competence and abilities due to employment interruptions, such as family leaves. Over time, their knowledge and professional experience become outdated or are lost, but their male colleagues increase their productivity. As a result, when women return to work, they will not pursue the

same professional path as males (such as a permanent employment contract, tenure track, or the prospects for commercialising their knowledge). The human capital theory assumes that human capital resources are based on individual choices made by employees in the past (for women, this involves the decision to give birth to and raise a child). Because of these decisions, women are less likely to be promoted to science positions (Polkowska, 2013).

When women decide to have children, the overlap between their optimal years of fertility and tenure pursuits causes many to regard STEM fields, or tenure-track academic employment in general, as unsuitable for accomplishing their familial goals (Williams & Ceci, 2012). Many women who work in research must combine their careers with caring for their children. Having a solid support structure from their family has been critical for many women. Teaching partners and families to be more supportive and participative would be a major benefit, as would emphasising the engagement and involvement of males in taking on family obligations, which would help promote a structural and societal shift (Tiedeu, Para-Mallam & Nyambi, 2019). Another school of thought suggests that family obligations and departments' work-life policies have a more significant impact on female faculty satisfaction than male faculty members, given that women care for young children and the elderly at a higher rate than males. The difficulty of balancing caregiving with work responsibilities is exacerbated by the fact that most colleges do not offer child care. Women's travel to conferences, where colleagues outside their home university might learn about their work, is restricted by caregiving duties. Absence from the conference and invited lecture circuit, on the other hand, makes it more challenging to achieve the worldwide reputation essential for promotion to full professor. According to recent retention research, women are more likely to cite family-related difficulties and a lack of time as reasons for quitting STEM jobs than males (Frehill, Di Fabio, Hill, Trager & Buono, 2008).

### **2.2.3 Mentoring**

The availability of role models and mentors impacts the achievement of professional development. Young adults identify with successful female role models whose presence inspires them to believe that "if she can be successful, so can I," and "I want to be like her." On the other hand, female college students are more likely to encounter few same-sex role models who work in STEM departments because STEM faculty members are four times more likely to be men than women, particularly in full physical sciences and engineering (National Science Foundation [NSF], 2013). Therefore, academic departments should seek out senior women in STEM to present their technical work at department colloquia, brown-bag luncheons, and other special events, allowing these speakers to meet and mentor students. The Computing Research Association, for example, sponsors the Distributed Lecture Series, which brings female teachers and technical researchers from businesses to university campuses to serve as female role models (Dasgupta & Stout, 2014). Thus, young women with successful female STEM professionals (such as scientists, engineers, mathematicians, and computer scientists) foster a proper understanding of STEM fields and access to female role models. Contact with STEM workers could begin in primary school and continue throughout schooling and early career development (Marginson, Tytler, Freeman & Roberts, 2013).

There is a need to combine efforts and interventions, such as mentorship projects, outreach activities, and professional development programmes to break prejudices regarding who can do STEM and what

can be accomplished with STEM studies (Kigotho, 2021). Aside from inspiring others, role models may also function as mentors. Thus, they provide the growth, promotion, and broadening of students' perspectives and build a network of like-minded professionals. The lack of female role models makes it more difficult for women in their initial years of college to understand how to navigate the road to a job in STEM, which necessitates the formation of social capital (Dasgupta & Stout, 2014). Mentoring is critical in increasing and retaining women in scientific and technical jobs. Mentoring addresses stereotypical conceptions of STEM occupations as inflexible or male-dominated, preventing many girls from engaging in STEM disciplines by connecting existing role models with nascent STEM professionals. Furthermore, increasing the representation of women and girls in scientific and technological disciplines is a global necessity. The potential for advancement is excellent as STEM skills become increasingly vital in a globally networked economy (Executive Office of the President of the United States of America, 2013). University and research organisations must make STEM occupations more appealing to women, and tackling the current causes of underrepresentation necessitates reforms in policies and teaching techniques. A lack of inspiring role models, work cultures that do not provide enough support, and the perception of the information and communications technology (ICT) working environment as male-dominated and aggressive (in terms of self-confidence) are all viewed as barriers to women entering the field (Su, Rounds & Armstrong, 2009).

#### 2.2.4 Stereotypes

Stereotypes pervade society and can impact opinions concerning an individual's strengths and weaknesses, even when evidence of their skill level suggests otherwise. These ideas can impact how people think, act, and feel about their skills and how they perceive others (Wang & Degol, 2016). Stereotypes hamper the test performance of ability-stigmatised groups, and they fail to reach their full potential. This is an essential channel for explaining why girls perform worse in mathematics when they are assigned to more biased teachers, but it is also broadly relevant because it suggests that exposure to gender stereotypes is at least partially responsible for women's lower self-confidence in scientific fields. Implicit preconceptions produce a self-fulfilling prophecy that perpetuates gender inequalities in mathematics performance (Carlana, 2019). The continuance of horizontal gender segregation in educational and vocational domains adds significantly to the development of gender-stereotypic notions regarding women's natural fit in more expressive and human-centred fields and that of males in technical and math-intensive fields (Charles & Bradley, 2009). Implicit gender-science stereotypes exist throughout the lifespan of both men and women in every society and throughout history. Such persistence and prevalence in unconscious biases are consistent with gender gaps in STEM representation, income, and recognition (Charlesworth & Banaji, 2019).

Change is unlikely unless individuals acknowledge that stereotypes are the basis of gender disparities in society and seek to identify and fix their own prejudices (Ellmers, 2018). Gender bias and stereotypes begin at a young age, with young girls growing up in an environment with few female scientists in the public spotlight. This type of imbalance provides a clear signal to girls at a young age that they do not match the stereotypical mould of a scientist, and, as a result, girls lose confidence in their STEM ability at an early age. When choosing a discipline for university is concerned, it is unsurprising that young women are disinclined to pursue STEM careers (Australian Government, 2019). Women are stereotypically assigned communal attributes such as warmth and caring, whilst males are stereotypically assigned agentic traits, such as competence and assertiveness, with the latter being far

more congruent with competitive STEM areas (Settles et al., 2016). Conversely, McKinnon and O'Connell (2020) noted that the top three stereotype categories for women in science who publicly express their work are that they are "bitchy," have a lack of "credibility," and are assessed on their "appearance," with the stereotypical terms being "bossy," "bitchy," "emotional," and "motherly."

### 3. Research methodology

To date, women's inclusion in STEM has only been descriptive or intuitively differentiated. An intercontinental survey has not been explored to find gender disparity evidence in formative research. This study provides a comparative framework using the UNESCO scientific report from 2013 to 2017 by exploring the global percentage of women in STEM in relation to other continentally documented percentages of women (UNESCO Institute for Statistics, 2015-2020). It ranks the formation of either the high or low percentages. A validity pre-test of the collected data was conducted to detect irrelevant ambiguous, and redundant values. This test includes normality and probability tests to study the data distribution consisting of the mean and standard deviation of all the different continents and years in the dataset. Thereafter, differencing was performed. Differencing shows one way to make a non-stationary time series stationary, and it computes the differences between consecutive observations. This data transformation technique helps stabilise the mean and variance of a time series. It removes changes in a time series level and, therefore, eliminates (or reduces) trends and seasonality (Cochrane, 2018). Statistical tools are not limited to analysing trends for change-point analysis in different continents. Therefore, yearly time-series variation was used to ascertain the degree of severance, whether low or high, for each continent, while multiple factor analysis (MFA) was used to uncover the latent structure (dimensions) in assessing the variables. Its principal component analysis reduces the attribute space from a larger number of variables to a smaller number of factors. Principal component analysis (PCA) as a choice of factor analysis (FA) explains the contribution of the unobserved common features in a target event from the observed ones. Purposely, it reduces the variety of collected data matrices to form a few selected derived component variables, which form a true representation of the original sets.

The Kaiser–Meyer–Olkin (KMO) test was used to abstract the factor analysis; this test measures the strength of the relationship among the variables. The KMO test determines whether the responses given with the sample are adequate; the result from this test should be 0.5 or more for satisfactory factor analysis to proceed (Tabachnick & Fidell, 2007). Correlation is another indication of the strength of the relationship among the subject variables. Correlations are useful for indicating a predictive relationship that can be exploited in practice. The correlation matrix is an identity matrix. Therefore, the result from this test should be 0.05 or less for satisfactory factor analysis to proceed (Mukaka, 2012). A correlation was used as part of the inferential statistics analyses to test the relationship between factors that influence each continent and the years considered, while regression analyses were used to determine if there was any relationship between the determining factor and other independent variables that explained the relationship. The goal of logistic regression is to correctly predict the category of output for individual cases using the most parsimonious model (Machira & Palamuleni, 2017). Logistic regression calculates the probability of success over the probability of failure, and the result of the analysis is in the form of an odds ratio. One can compute the slope and intercept for different equations by minimising an asymmetrically weighted sum of absolute errors. In this way, one can obtain information about the presence of non-linear trends for other data distribution levels. The significance of the slope is computed using bootstrapping to highlight its effective significance level  $\alpha$  equal to 5% in women participation value.

The coefficient of correlation (CC) and root mean square error (RMSE) are the most frequently used for performance evaluation measures for actual and predicted values. The CC is expressed as in Equation 1:



$$CC = \frac{\sum_{i=1}^n [(Q_i - \hat{Q}_i)(P_i - \hat{P}_i)]}{\sqrt{\sum_{i=1}^n (Q_i - \hat{Q}_i)^2 \cdot \sum_{i=1}^n (P_i - \hat{P}_i)^2}}, \quad (1)$$

where  $Q_i$  is the observed value at time  $i$ ,  $P_i$  is the simulated value at time  $I$ , and  $\hat{Q}$  and  $\hat{P}$  are the mean for the observed values.

#### 4. Results and discussion

Tables 1 and 2 summarise the pre-data-analysis results for different continental regions and years.

**Table 1.** Summary of the continental regions

<i>Continent</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
1. Arab States	195.900	39.180	5.047
2. Central and Eastern Europe	197.300	39.460	0.113
3. Central Asia	239.100	47.820	0.397
4. East Asia and the Pacific	117.800	23.560	0.893
5. Latin America and the Caribbean	225.300	45.060	0.343
6. North America and Western Europe	162.100	32.420	0.137
7. South and Western Asia	98.000	19.600	3.880
8. Sub-Saharan Africa	154.600	30.920	0.517

**Table 2.** Summary by year

<i>Year</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
2013	271.600	33.950	99.757
2014	272.800	34.100	98.894
2015	278.400	34.800	107.357
2016	281.000	35.125	106.836
2017	286.300	35.788	86.567

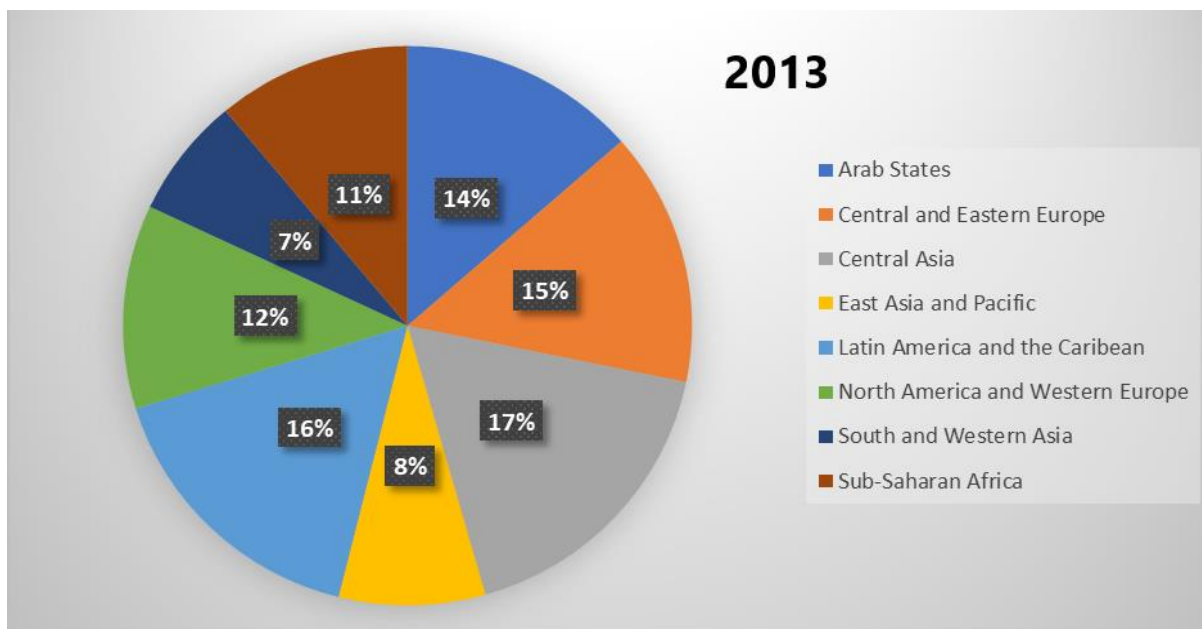
Likewise, the availability of average and variance distributions (Table 3) of the continental summary over 5 years for the data analysis of the distribution of women in research helps depict the level of the relationship between each continent and the measured years.

**Table 3.** Kolmogorov–Smirnov test

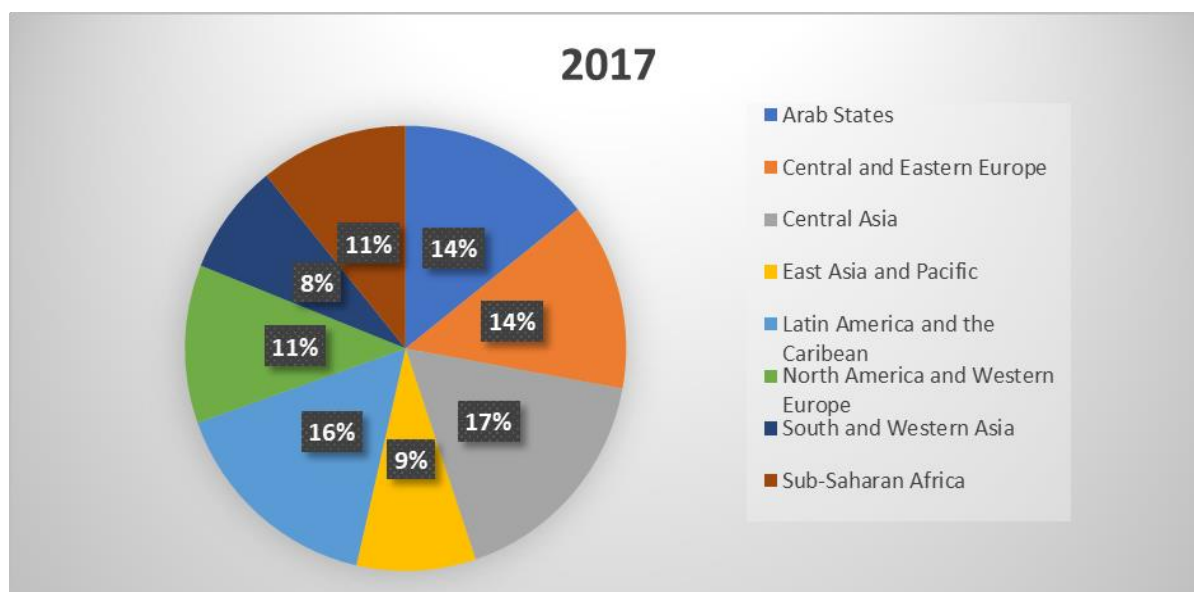
D	0.444
p-value (two-tailed)	< 0.0001
alpha	0.05

The null assumption ( $H_0$ ) is that the sample follows a normal distribution, but as the computed p-value is lower than the significance level of  $\alpha=0.05$ , we concluded that the sample does not follow a normal distribution. The pictorial representations of women in science on various continents are depicted in Figures 1 and 2. The pie charts include the descriptions of the study regions for the years 2013 and 2017. One of the continents (South and Western Asia) has average women deviations of 19.8 and 3.5, implying that 2 out of 10 STEM women are employed.



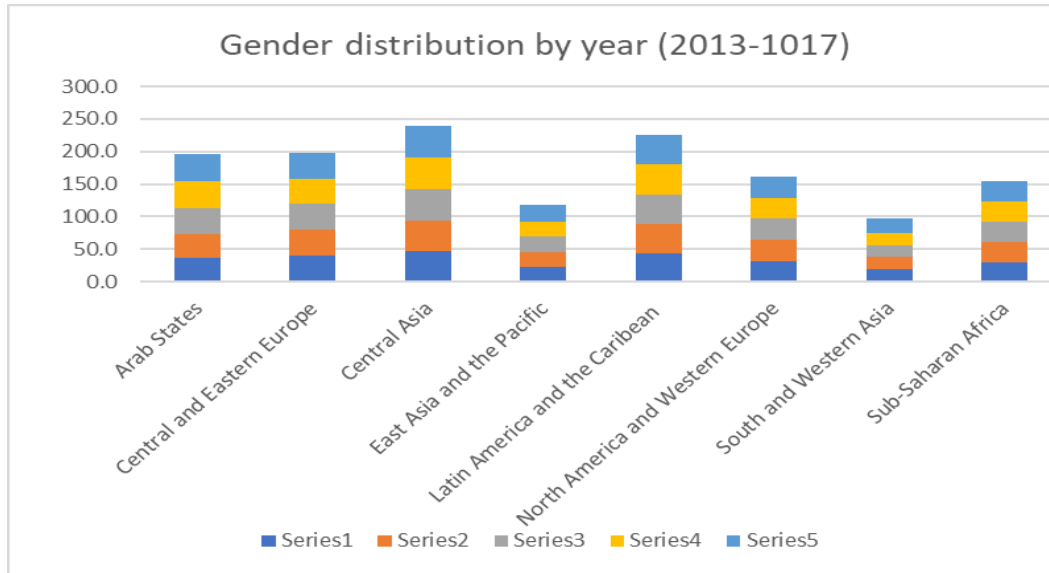


**Figure 1.** Pictorial representation of women in science in various continental regions for 2013



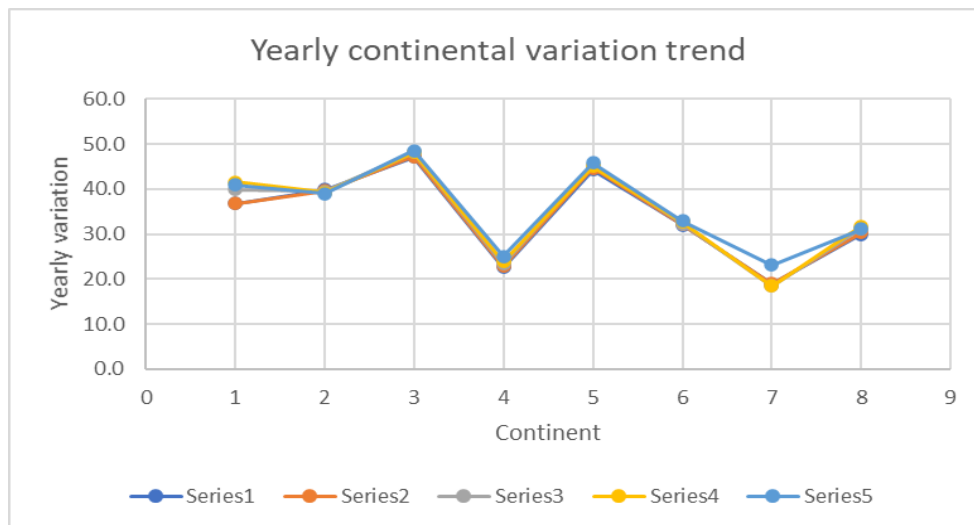
**Figure 2.** Pictorial representation of women in science in various continental regions for 2017

Figure 3 depicts the analytics comparison of different years for each continental region. The histogram shows the frequency distribution of women in science over each continental region.



**Figure 3.** Analytics comparison of different years for each region

Figure 3 shows how the frequency distribution of women in science in different regions varies over time. Overall, Central Asia accounts for the highest increase in the attraction and recruitment of women into STEM, while East Asia and the Pacific depict the need to provide gender-inclusive solutions for a better future. Many studies have indicated varied reasons for women leaving the STEM sector, including a lack of career advancement compared to their male counterparts, gender-discriminatory organisational structures, and a lack of mentorship (Cummings, 2015). Figure 4 illustrates the fluctuating continental regions comparisons for different years, and Table 4 presents the correlation coefficient matrix of the different continental regions.



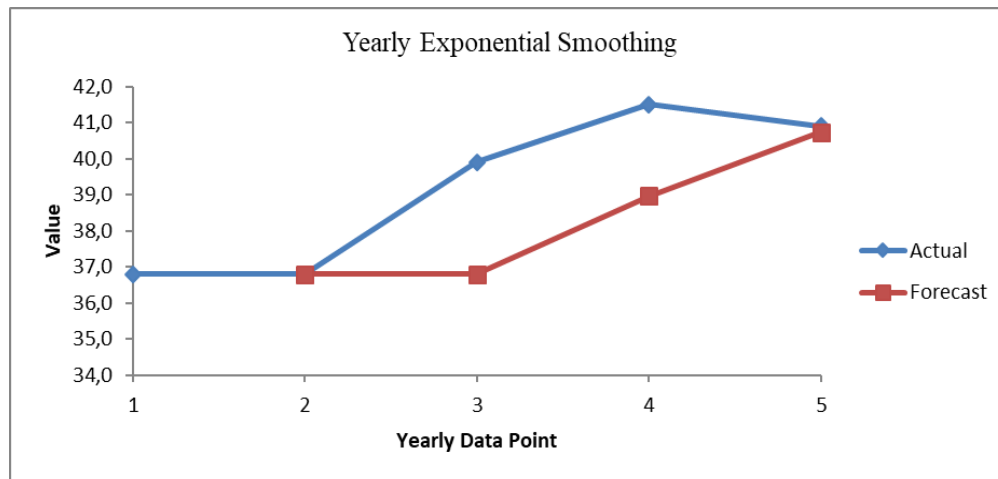
Yearly continental variation trend, where series 1=2013, series 2=2014, series 3=2015, series 4=2016, and series 5=2017.

**Figure 4.** Yearly continental regions variation trend

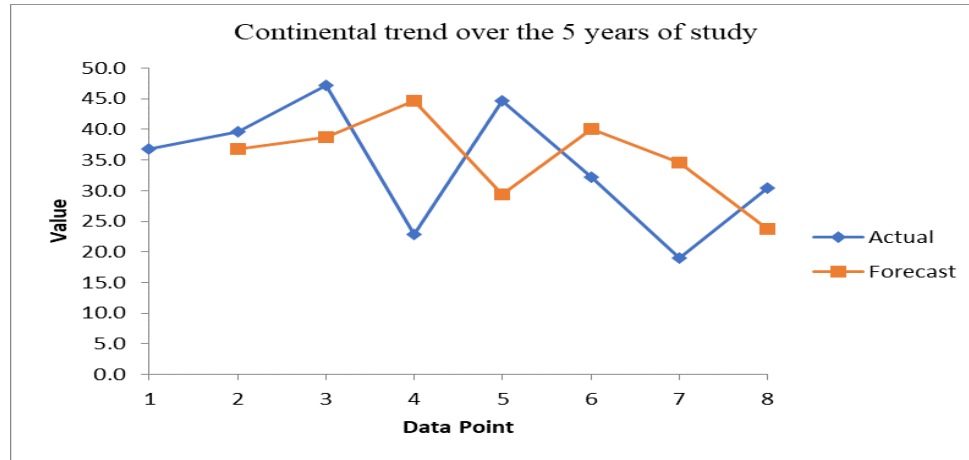
**Table 4.** Correlation coefficient matrix of different regions

	<i>Arab States</i>	<i>Central and Eastern Europe</i>		<i>Central Asia</i>	<i>East Asia and the Pacific</i>	<i>Latin America and the Caribbean</i>	<i>North America and Western Europe</i>	<i>South and Western Asia</i>	<i>Sub-Saharan Africa</i>
Arab States	1.000								
Central and Eastern Europe	-0.832	1.000							
Central Asia	0.961	-0.904		1.000					
East Asia and the Pacific	0.825	-0.974		0.909	1.000	1			
Latin America and the Caribbean	0.812	-0.912		0.938	0.900	1.000			
North America and Western Europe	0.875	-0.977		0.898	0.968	0.835	1.000		
South and Western Asia	0.326	-0.706		0.510	0.794	0.633	0.662	1.000	
Sub-Saharan Africa	0.937	-0.710		0.854	0.634	0.703	0.740	0.035	1.000

In Table 4, positive values indicate an increase or a strong relation between the compared continental regions, and the opposite is true for the negative values, except for the relation between Sub-Saharan Africa and South and Western Asia (0.035,  $p < 0.05$ ). The CC with the lowest value indicates the level of the relationship between the compared continents to reveal how it varies with time. Exponential smoothing was used to fit a statistical model to predict the yearly continental trend for women in science. The performance of the annual trend measurement in comparison with the forecasted continental trend is illustrated in Figures 5 and 6. The CC and RMSE with the lowest value indicate the model fitting strength.



**Figure 5.** Forecasting the yearly trend over the continental regions



**Figure 6.** Forecasting each continental region's trend over the five years of study

In terms of the yearly continental data in Figure 5, there was a large gap between the actual and the forecasted data – this may be due to the residual error taken at time  $t$ , which does not correlate well with the measurements taken at time  $t-k$ . Figure 6, on the other hand, depicts how well the projected women's continental regions data follows the same pattern as the actual data. This implies that the developed forecasted trend model shows a strong likelihood for the representation of women disparity among the different continents. This does not portray a good reliability distribution in women's participation. Table 5 includes the coefficients of statistical performance, with a comparison by year and continent.

**Table 5.** Coefficients of statistical performance comparison

	Year	Regions
$R^2$	0.045	0.650
Adjusted $R^2$	0.076	0.045
RMSE	0.023	0.325

With logistic regression, we modelled the natural log odds as a linear function of the explanatory variable. Thus, the logistic regression analysis of other continents' women in science was compared to the world average to reveal whether it was high or low—a high/low  $F$ , with  $F(a, b, c, d, e, f, g, h)$  being a binary logit function, where  $F$  is the world (global) average;  $a$ , the Arab States;  $b$ , Central and Eastern Europe;  $c$ , Central Asia;  $d$ , East Asia and the Pacific;  $e$ , Latin America and the Caribbean;  $f$ , North America and Western Europe;  $g$ , South and Western Asia; and  $h$ , Sub-Saharan Africa. The Akaike's Information Criterion (AIC) value and the residual measured sum-of-squares errors were used to obtain the best-fit model. The results of the logistic regression model are given in Table 6. The logistic regression equation is presented as in Equation 2:

$$Y = -12111.41 - 0.014*a + 0.000*b + 0.7000*c - 0.6586*d + 0.000*e + 0.0069*f + 0.000*g - 0.0043*h \quad (2)$$

**Table 6.** Statistics of the predictors in the logistic regression model

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	-12111.41	0.852	-14221.1	0.0000	-12113.3	-12109.6
Arab States	-0.014	0.000	-4290.12	0.0000	-0.0136	-0.0136
Central and Eastern Europe	0.000	0.000	-1194.97	0.0000	0.0000	0.0000
Central Asia	0.000	0.000	65535.00	0.0000	0.0000	0.0000
East Asia and the Pacific	0.6586	0.000	57497.20	0.0000	0.6586	0.6587
Latin America and the Caribbean	0.0000	0.001	-0.0810	0.9370	-0.0003	0.0003
North America and Western Europe	0.0069	0.0045	1.5283	0.1574	-0.0032	0.0169
South and Western Asia	0.0000	0.0000	-0.6865	0.5080	0.0000	0.0000
Sub-Saharan Africa	-0.0043	0.0023	-1.8977	0.0870	-0.0094	0.0007

In Table 6, a positive coefficient with a p-value < 0.05 indicates a directly proportional relationship between the variables (high), while a negative value indicates an inverse relationship (low). Based on the measured data, the Arab States and Sub-Saharan Africa have contributed negatively (non-significant) to the global women in science, while other continental parameters gave a positive value for other continents to illustrate their level of contribution. From Table 7, the study concluded that the computed pseudo R square for the goodness of fit implies that other continental variables are significantly associated with global women in STEM. Although there is substantial individual variability that these variables cannot explain, this reflects that other system factors are responsible for women's parity in professional jobs. The model with the lowest AIC and residual error represents the best goodness of fit analysis.

**Table 7.** Logit regression statistics

Null deviance	589.41
Residual deviance	543.90
AIC	569.50
Pseudo R Square	0.59
Standard Error	0.003443
Observations	21

From the ANOVA fit results in Table 8, the comparison level of other continents to the world average women participation in research shows that the probability value for the F-critical test statistic (2.714) has a p-value less than 0.05 (5% level of significance), which indicates that the model is adequate. This implies that the association of the predictors significantly combines with and relates well to the global women representation. In addition, one can refer to the null hypothesis  $H_{01}$ , which states that there is no difference between continental groups or no relationship between variables. However, since the p-value is less than 0.05, there is a significant relationship between other continental women's representation and the global women variables. Thus, there is a low occurrence or paucity of women in the STEM profession across the continents.

**Table 8.** ANOVA Test on continental regions data

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	18.256	4	4.564	4.724	0.005	2.714
Columns	3468.832	7	495.547	512.913	0.000	2.359
Error	27.052	28	0.966			
Total	3514.14	39				

Table 8 reveals a statistically significant impact on global continental women's inclusion in comparison to each continental contribution of women researchers in STEM. The global aggregated continental study data indicates a high perceived number  $F(512.913) = F_{crit}(2.359)$ ,  $P=0.000 < 0.05$ , to signpost a significant relation. The mean and standard deviation ranges ( $M=33.95-35.125$ ,  $SD=99.757-106.836$ ) for Europe, North America, and Western Europe show an increasing trend over the measured years. The perception of lower success for women in STEM was witnessed in Sub-Saharan Africa and Latin America. Using PCA as a choice of FA Table 9 indicates the contribution of the squared cosine of the factor variables, identifying most significant variables that affect women in STEM on different continents through an explorative literature review. It can be observed that factor loading, as depicted in Figure 7 (values of F1–F3 in bold from Table 9), explains the degree of most of the identified contributing variables. Thus, PC1 is a more significant component than both PC2 and PC3. Using the corresponding factor loading value as in Table 9, the scores on PC1 can be computed as in Equation 3, while the scores on PC2 and PC3 can also be estimated from F2 and F3, respectively.

$$PC1 = 0.668 \times A + 0.824 \times B + 0.743 \times C + 0.786 \times D + 0.680 \times E + 0.786 \times F + 0.859 \times G + 0.115 \times H \quad (3)$$

**Table 9.** Contribution of the squared cosine of the factor variables

	F1	F2	F3
Arab States	<b>0.668</b>	0.003	0.013
Central and Eastern Europe	<b>0.824</b>	0.032	0.003
Central Asia	<b>0.743</b>	0.121	0.015
East Asia and the Pacific	<b>0.786</b>	0.007	0.046
Latin America and the Caribbean	<b>0.680</b>	0.005	0.016
North America and Western Europe	<b>0.798</b>	0.004	0.006
South and Western Asia	<b>0.858</b>	0.014	0.099
Sub-Saharan Africa	0.115	<b>0.890</b>	0.003

Note: For each variable, the values in bold correspond to the factor for which the squared cosine is the largest



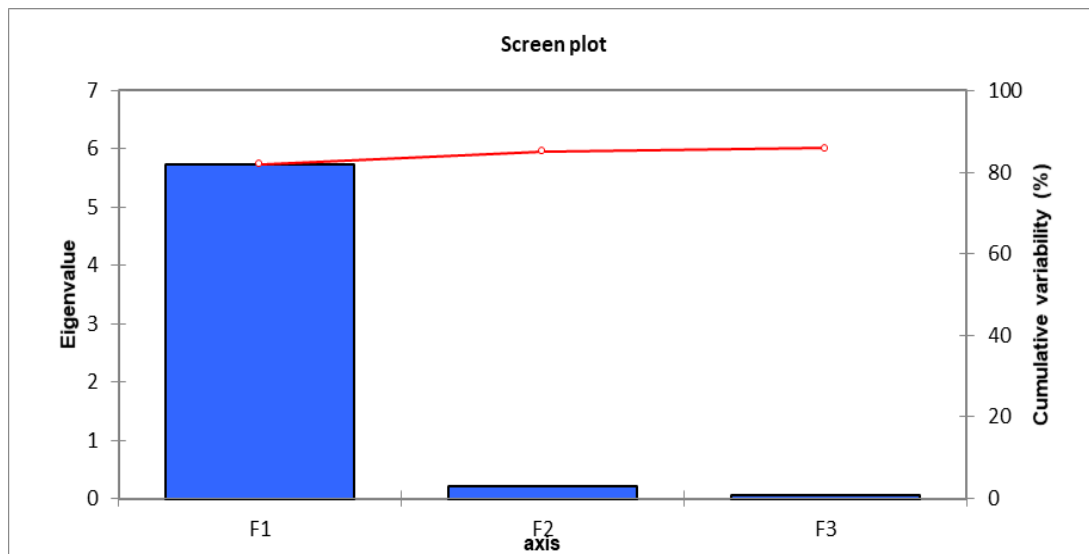


Figure 7. Factor analysis

These results indicate the factor variables' squared cosine contribution for the documented factors, which may be due to gender bias, family life, mentoring, and stereotypical considerations. The results show that a higher level of education allows women to participate more confidently in Europe and other continents compared to Sub-Saharan Africa. This shows how education is a powerful force to rectify an erroneous world outlook and promote a rational causal attribution that is fundamental to nurturing a spirit of self-worth and a realistic assessment of women's value in STEM professions. Table 9 shows that F1 (gender bias) accounts for the highest variance of 82.10%, while F2 (family life) and F3 (mentoring) explain approximately 8.07% and 2.03% of the total variance, respectively.

## 5. Conclusions

This study offered a quantitative assessment of women's disparity in STEM, comparing different continental regions over a 5-year period and considering the world (global) average of women in STEM. The explored best-fit exponential model showed a downward trend and a threat to women's inclusion in science. Thus, the assumption that women are increasingly assuming positions once considered "male" roles, overcoming outdated stereotypes, and thriving and succeeding in the STEM profession on different continents is far from true. The developed forecasted trend model shows the likelihood of disparity in women's representation, which does not portray a good reliability distribution in women's participation. The overall results showed the adequacy of multivariate correlation and factor analysis for developing a modelling framework to satisfy inquiry for equality inclusion of women in science over the documented distribution of the different continents for gender empowerment. The insight gained from the different verified continental yearly data indicates the need for real-time data usage on the different continents for affirmation investigations.

Institutional leaders need to provide a conducive environment where women can participate freely in science and research. Understanding the stereotypes, gender biases, and policy failures are critical to avoid perpetuating women's challenges. McKinnon and O'Connell (2020) believe that by observing and evaluating individual responses to stereotypes ascribed to women in STEM, one may better understand where one's prejudice stems from and how to confront it. It also allows one to look into the impact of role modelling on and openly discuss science with women in STEM. In addition, understanding stereotypes and one's reactions to them could lead to the creation of more effective methods to support women in STEM who take on leadership roles. The developed applied explorative literature review and procedural model are limited to secondary aggregated mean percentage

data. Thus, caution should be exercised in considering the deduced inferences and perceptions formed to visualise the latent information in each continental quoted value. This paper has contributed to the literature on women in science from different continental regions and provides a picture of the levels of participation and the challenges women encounter in their quest to make a mark in a field that men dominate. Future research should focus on a comparative analysis of the challenges that women encounter in different regions or continents and country-focused research. This will facilitate an understanding of the prevalent challenges in a particular region or country, thereby enabling policy makers to develop targeted interventions.

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**Steven Kayambazinthu MSOSA** is a Research Fellow and Lecturer in the marketing department at the Mangosuthu University of Technology. His research interests are Corporate Social Responsibility, Sustainability, Service Failure, Higher Education Marketing, Multi-level Marketing, Relationship Marketing and Integrated Marketing Communication.

ORCID ID: <https://orcid.org/0000-0001-9074-5644>

**Bhekabantu A. NTSHANGASE** is the Acting Dean of the faculty of management sciences at the Mangosuthu University of Technology. Dr Ntshangase's research interests include public administration, service delivery, public-private partnerships, land reform and management, women's cooperative and entrepreneurship.

ORCID ID: <https://orcid.org/0000-0002-5410-7036>

**Courage MLAMBO** is a Research Fellow and Lecturer in the public administration and economics department at the Mangosuthu University of Technology. Dr Mlambo's research interests lie in Development Economics, politics, and economics. However, his research and publication repertoire is versatile, including Economics of regulation, Monetary Economics, Labour economics, Macroeconomics, Social Justice, Gender, Politics, Banking and Finance.

ORCID ID: <https://orcid.org/0000-0002-4765-9318>

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## CHANGES IN BUSINESS MODELS IMPLIED BY THE USE OF DIGITAL TECHNOLOGY PLATFORMS

**Krzysztof Bartczak**

*Faculty of Management, Warsaw University of Technology, ul. Narbutta 85, 02-524 Warsaw, Poland*

*E-mail: [krzysztof.bartczak@pw.edu.pl](mailto:krzysztof.bartczak@pw.edu.pl)*

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**Abstract.** The research work concerns digital technology platforms. They are tools that allow for establishing and intensifying various types of relationships between market participants. Due to their constantly growing importance in the economy, it is important to discuss various aspects related to it. The work focuses on examining the impact of such platforms on changes in business models. The main objective is to determine whether these platforms contribute to the implementation of innovative solutions within business models and whether they affect the level of competitiveness of enterprises. Two research methods were used in the implementation of the topic. The first is computer assisted telephone interviews. They were carried out among enterprises that received funding for the implementation and development of digital technology platforms under the Innovative Economy Operational Program. The second method is the regression analysis for CATREG (categorical regression) qualitative variables, where a model for measuring attitudes towards these platforms was developed. As a result of the research, it was found that digital technology platforms significantly influence changes in modern business models, promoting the implementation of innovative solutions within them. As a result, they constitute an important and new factor in the competitiveness of companies in the digital economy. The conducted research creates a wide field for further exploration regarding the impact of digital technology platforms on the functioning of modern enterprises and the business models used by them.

**Keywords:** model; business model; innovation; digital technology platforms

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**JEL Classifications:** 031, 033

### 1. Introduction

The article deals with issues related to changes in modern business models. Such changes on a wide scale, which are connected with the necessity for enterprises to respond to the constantly changing needs of consumers, fight against competition on the market or implement their strategies in a dynamically functioning environment. Such changes, which should be emphasised, are largely based on innovative technologies and solutions (Teece, 2010). Thanks to this, it has become possible to obtain a permanent competitive advantage by entities operating on the market (Amit and Zott, 2012).



These changes are intensified by the use of digital technology platforms (DTP). Currently, they are one of the basic tools for undertaking transactions between market participants, including establishing communication (Broekhuizen et al. 2021). Due to their growing importance in the economy, they are even considered as completely independent business models (Morgan et al., 2016). In addition, the literature often refers to the term 'platform business models' (Täuscher and Laudien, 2018, Venkatesh and Singhal 2019, Stojan and Tohanean 2021), which alludes to the fact that DTP are able to significantly influence many business models and lead to their transformation, including those based on modern technologies such as ICT (i.e., information and communication technologies) (Jetter et al., 2009, Veit et al., 2014, Obukhova et al. 2020).

The main goal of the article is to show the importance of digital technology platforms in the context of implementing changes in contemporary business models. In addition, the article aims to answer the question whether these changes, which DTP is involved in, can be regarded as a new factor in the competitiveness of enterprises. It was decided to put forward the thesis that digital technology platforms significantly influence changes in modern business models by promoting the implementation of innovative solutions within them and thus constitute a new factor of competitiveness of enterprises in the digital economy. The article, aside from literature considerations, is based on its own research results. The research was conducted on a group of 120 Polish enterprises using the CATI method and the CATREG model.

## **2. Literature review**

### **2.1. Key definitions**

The starting point for the considerations undertaken in this article is to define a business model and digital technology platforms. The business model is related to:

- a) a conceptual tool by means of which it is possible to present the logic of the functioning of the enterprise, including the way in which it generates profits as a result of the generated value, with the basic feature of this model being that it takes into account all the components of the enterprise and the relationships that occur between them (Osterwalder et al., 2005);
- b) revenue streams – including future ones – and the cost structure and margin levels as well as the relationship between these variables (Thompson and Strickland, 2003);
- c) the operating logic of an enterprise in which the generation of value for the customer is predominant (Fielt, 2013).

Digital technology platforms have a strong relationship with the virtual environment and innovation. Therefore, it is necessary here to define a digital business model and an innovative business model. The digital business model is identified with all types of solutions or business strategies in which modern technologies play a decisive role by favouring changes in the way business is conducted, resource optimisation or profit growth (Li et al., 2012, Planning, 2017, Bican and Brem 2020). On the other hand, Brousseau and Penard (2007) emphasised the fact that the digital business model is modular, meaning that it is possible to implement new functions or packages into it at any time. These functions and packages form an inseparable whole and only if they occur together, within one model, can we generate concrete value for the company and its stakeholders. An innovative business model, in turn, is one in which a strong emphasis is placed on promoting new ideas that are used to create modern products, services and production systems (Lindgren and Bandsholm, 2016).

When it comes to the definition of digital technology platforms, it should be noted that this concept has a wide scope – which is largely related to the interchangeable use of different terms by individual authors in relation to it (e.g., digital platforms (Reuver et al., 2015, Bonina et al. 2021), technology (technological) platforms (Corin Stig, 2015, Chursin et al. 2021), IT-platforms (Sun et al., 2015) or digital business technology platforms (LeHong et al., 2016)). In scientific literature, DTP is mainly considered to be a digital tool for establishing and intensifying relations between the various market players, including businesses and consumers, and even administrative bodies (public administrations). This is done by enabling these entities to transact and interact – including business ones – and to communicate with each other using the Internet. The direct effect of this is connecting trade partners and creating business networks (Sun et al. 2015, Constantinides et al., 2018, Rangaswamy et al. 2020). Another definition indicates that digital technology platforms are the base on which the foundations of a given IT or technology system are built. A characteristic feature of DTP is the ability to implement new functionalities and develop complementary products, services and technologies (Gawer, 2014).

to the multiplicity, complexity and variety of definitions related to DTP, an individual approach to them was developed. It has been asserted that these platforms are electronic (digital) tools that can take the form of services or content through which it is possible to create the basis for establishing and intensifying contacts between various entities operating on the market. A very important feature of these platforms is the possibility of constantly expanding them with new modules or functionalities.

## **2.2. Changes in business models conditioned by the use of DTP**

Changes in business models are largely determined by the development of digital technology platforms. In this regard, Zott et al. (2011) pointed out that these changes are mainly due to the convergence of different tools and channels, which has been and is evident (*inter alia*) in the media industry. This results in the creation of large, integrated platforms – including those related to communication and mobile technologies. Importantly, the new platforms form the basis for building and developing new business models.

Brousseau and Penard (2007) noted that modern business models, digital in nature, do not imply changes in the digital sphere alone. The authors pointed out that these changes can be seen as "intermodal" (i.e., those that are visible within the various areas of the organisation). These changes, therefore, concern not only digital content but also physical products and services together with related infrastructure. Moreover, digital business models largely "intersect" with traditional models thus resulting in innovation and new marketing strategies – also in industries that are not directly related to the digital market. This shows the great complexity of the changes that are induced in modern business models, including those based on digital technology platforms.

These changes, compared to traditional models, are manifested in several basic areas. This applies primarily to the entity responsible for the particular model. In the past, it used to be a producer acting either in a direct relationship with the supplier or in a network built by the supplier. Today, the business model works largely thanks to an intermediary that creates the basis for interaction between other entities. Such an intermediary may be a digital technology platform. Differences can also be seen in relation to the owner of the products (formerly a specific company and now more and more users of the platform), sources of value (nowadays interactions between users, while previously features or functions of products and services), the basis for gaining competitiveness (product development versus continuous development of the business model) and sources of profit (previously revenues from the sales of products and services, and now a number of other sources including, for example, commission paid for access to complex functionalities of a given platform) (Zhao et al., 2020). It is worth noting that the vast majority of digital business models are currently created on the basis of DTP. This is because it is these platforms that create the basis for extensive interaction between businesses and customers (B2C relations) or the businesses themselves (B2B relations) (Mourtzis, Angelopoulos and Panopoulos 2020), for example.

This creates business ecosystems that bring together a growing number of actors. Such ecosystems are built on modern platforms using the PFI model for planning and practical implementation of innovative activities. This model may lead to the construction of a platform that integrates the activities of different stakeholders based on a specific ecosystem. In such an ecosystem – which, as it should be emphasised, functions on the basis of networks, replacing hierarchical and vertically integrated structures – all of these stakeholders play an important role, including even customers who become generators of new ideas and creators of innovation (Teece and Linden, 2017, Hein et al. 2019).

As the digitisation and implementation of modern technologies or management methods become more and more advanced, those organisations which have used traditional business models (referred to as *incumbent*) are gradually being replaced by organisations that use innovative business models. In this context, the phenomenon is referred to as *uberisation*, (from the name of the company *Uber*, which introduced a revolutionary way of offering taxi services based on a digital technology platform). This phenomenon leads to the dissemination of modern business models (i.e., those that lead to the displacement of previously proven patterns and methods of functioning of the organisation on the market). They are referred to as hyper-disruptive business models (Zeamari 2020). Among them, there is the Access over Ownership model – one in which access to specific services is possible without purchase (Zipcar platform for car rental for minutes) – or the Freemium model (access to a given service is free but using additional functionalities requires incurring certain costs – for example, the Dropbox platform that allows data storage). It is worth adding that the practical expression of the existence of the first model is the concept of a sharing economy in which various goods are exchanged between people and is mediated by various platforms such as Airbnb thus enabling accommodation sharing (Pieriegud, 2016). Changes in business models in which DTP play a key role are an expression of the existence of the economics of intermediation, whereby the platform acts as an intermediary between users who want to buy and sell or exchange certain goods (Brousseau and Penard, 2007).

It is worth adding that the innovative changes within the modern business model, based on DTP, serve primarily to ensure that the quality and timeliness of service provision is at the highest possible level so that various customer expectations are met and, at the same time, the platforms make satisfactory, increasingly higher profits. Such a model is aimed at the autonomy of customers so that they can influence the final shape of a given product or service thus generating value for the platform or organisations that create it. Another important factor is the personalisation of the what is offered to customers (platforms provide a basis for configuring and selecting products and services, and not only for using ready-made packages – the *curated computing* model), algorithmisation and automation of sales of products and services (based on various algorithms, a number of choices concerning the shape of these products and services are made automatically, which makes it easier for customers to purchase goods) and to enable customers within the framework of particular platforms to access the widest possible content and not only selected works or book files (*video on demand* services) (Filiciak, 2012).

### **3. Participation of digital technology platforms in the changes of modern business models in the context of increasing the level of competitiveness of enterprises - results of own research**

#### **3.1. Research using the CATI method**

Our own research was conducted between February the 18<sup>th</sup> and 28<sup>th</sup> 2019 using the method of standardised questionnaire interviews (i.e., containing questions of a strictly defined sequence and unchanging wording, usually closed). CATI (i.e., computer-assisted telephone interviews) was used in this respect. Their implementation was based on a survey questionnaire consisting of 23 questions. The CATI method has a high degree of standardisation and is an element of the quantitative paradigm, with its main advantages being that its results can be generalised to the whole population (Gerring, 2001).

The sample was random and the interviews were conducted with representatives of the management staff who had knowledge of the functioning and use of digital technology platforms by enterprises. Drawing was based on the lists of beneficiaries of the Operational Programme Innovative Economy implemented by the Polish Agency for Enterprise Development. Companies that received funding under this programme for the implementation and development of digital technology platforms were selected for the sample. The final sample consisted of  $N = 320$  records, of which it was assumed that effective interviews would be conducted with the number of entities  $N = 120$ . The randomisation algorithm built into the telephone survey software gave each record in the database an equal chance of being included in the sample. Throughout the course of the survey, telephone contact was made with each of the enterprises. 120 interviews were completed, 49 enterprises refused to participate in the survey, two enterprises declared that they did not implement any platforms and it was not possible to complete the interviews with the remaining enterprises within the assumed survey deadlines. During the CATI survey, respondents were asked a question about the impact of DTP on creating and developing modern business models. This data is included in Table 1.

**Table 1.** The impact of digital technology platforms on innovative business models

<b>Question 12. Do you agree with the statement that digital technology platforms enable the creation and development of innovative business models?</b>		
	Frequency	Percentage
I strongly agree	63	52.1
I rather agree	45	37.2
I neither agree nor disagree	12	9.9
I rather disagree	1	0.8
Total	121	100.0

89.3% of the respondents (i.e., the vast majority) stated that digital technology platforms have an impact on the creation and development of business models. This is confirmed by the analyses carried out in this respect in the literature on the subject (as mentioned above).

Another question addresses the issues of the benefits that are generated by enterprises using DTP. The analysis of respondents' answers to this question is included in Table 2; however, it should be added that the respondents could indicate answers from 1 – the most significant benefit – to 7, the least significant benefit (Table 2 includes the first three answers).

**Table 2.** Benefits of using digital technology platforms by enterprises

<b>Benefits</b>	<b>Answer I</b>		<b>Answer II</b>		<b>Answer III</b>	
	<b>Frequency</b>	<b>Percentage</b>	<b>Frequency</b>	<b>Percentage</b>	<b>Frequency</b>	<b>Percentage</b>
profit increase	56	46.3	15	12.4	15	12.5
increase in the level of competitiveness	19	15.7	27	22.3	13	10.8
extension of the product range	13	10.7	12	9.9	15	12.5
increasing market share	3	2.5	9	7.4	10	8.3
increase in the level of innovation	6	5.0	2	1.7	9	7.5
increase in the number of customers	2	1.7	9	7.4	4	3.3
improving customer service and increasing the level of consumer satisfaction	3	2.5	5	4.1	5	4.2
increasing the number of markets in which the company operates	2	1.7	6	5.0	4	3.3
expanding the number of business partners, including those operating exclusively in a virtual environment	1	0.8	8	6.6	12	10.0

optimisation of the implementation of various business processes, including those in the field of customer service	11	9.1	16	13.2	19	15.8
creating digital supply chains	1	0.8	6	5.0	2	1.7
increase in the overall efficiency of the company's operations	3	2.5	2	1.7	3	2.5
increasing the flexibility of operation, visible through the possibility of quick introduction to the market of new products and services	0	0.0	4	3.3	4	3.3
the ability to actively participate in the implementation of programmes initiated in a virtual environment, aimed at expanding the range or customer base	1	0.8	15	12.4	5	4.2
Total	121	100.0	121	100.0	120	100.0

When analysing the main benefits, attention should be paid to increasing the level of competitiveness of enterprises as one of the most important effects of using digital business platforms. This benefit, as the most significant, was indicated by 19 people (i.e. 15.7% of the respondents). In addition to increasing profits, this is the most important benefit for respondents. Also, in the next indications (answers II-III), the increase in the level of competitiveness was one of the most important of such benefits.

The results of CATI research show that DTP are important generators of changes which take place in contemporary business models. In this respect, the most important thing is that these platforms provide a basis for building and developing these models and are based on innovative solutions. As a result, DTP and the changes in business models resulting from the implementation of these platforms are one of the most important factors contributing to the increase in the level of competitiveness of enterprises.

### 3.2. CATREG model

In addition to CATI, our own research also used regression analysis for qualitative CATREG (categorical regression) variables, thanks to which a model for measuring attitudes towards DTP was developed. Creating a model of a phenomenon consists of a specific mathematisation of hypotheses (in the form of an equation or a system of equations, respectively) and thus presenting them in a parameterised way in the so-called 'statistical space'. Such a model presents simplified but the most essential and important links between the phenomena under consideration. For this purpose, inductive statistics tools and, most often, regression models are used.

The concept of attitude is deeply rooted in social sciences (particularly sociology) but is also widely used in economics (Soper and Walstad, 1983). Scholars agree that the attitude exhibits a three-component structure: affective (what you feel), cognitive (what you know), and behavioural (what you do) (Garcia-Santillan et al., 2012). The concept of attitude was used in the formulation of Question 13, which is an indicator of an independent variable:

'To what extent do digital technology platforms increase the quality and intensity of the relations established by the company in which you perform your professional duties with all stakeholders, including mainly suppliers, contractors, distributors or customers?'

This question allowed attitudes towards the phenomenon of digital technology platforms to be measured. It includes both evaluation elements referring to knowledge as well as those concerning the evaluation of this phenomenon ("increase in quality and intensity"). Interrelationships relating to the overall assessment of the

impact of digital technology platforms on the increase in quality and intensity of business and other assessment elements can be seen, including the cognitive (Questions 5 and 12 for the affective elements and question 9 for the affective-cognitive elements) as well as behavioural (Questions 1, 4, 8, 10, 11 and 14). The influence of socio-demographic variables concerning the company was also examined (Questions 22 and 23), and the probable influence of so-called 'latent variables' concerning the surveyed person (Questions 16, 17, 18, 19 and 20). Individual indicators can also be classified in another important approach – aspects of the company's operation (the list of variables taken into account is presented in Table 3). It was assumed that a company can be transformed by digital technology platforms in the human dimension (assessment of the phenomenon, the scope of its use, expectations etc.) in the cybersecurity dimension (new IT challenges, related to hardware and software), in the economic dimension (related to the account of actual and potential profits and losses) and in the social dimension (changes in the structure of the company and its layout as well as the type and intensity of relations with the environment).

**Table 3.** Classification of indicators of the attitudes of entrepreneurs towards the phenomenon of digital technology platforms

Survey question	The dimension of the company's operations	Comments
Question 1. Does your company use digital technology platforms (i.e., tools that allow you to connect trading partners and create the basis for intensifying contacts and transactions between them)?	Human factor	Variable measurement level: ordinal
Question 4. Please specify what type of digital technology platforms are or will be used (in the case of implementation plans) in your company. (Please tick all possible answers)	Structural factor	Variable measurement level: nominal (multi-answer question) transformed into a quotient variable – counting the number of indications
Question 5. What is the attitude of the staff members in your company with regard to the implementation and use of digital technology platforms?	Human factor	Variable measurement level: ordinal
Question 8. Please indicate whether, in connection with the implementation of digital technology platforms in the company where you perform your professional duties, if there were the following negative cybersecurity events and threats, directly resulting from the use of these platforms.	Cybersecurity factor	Variable measurement level: nominal (multi-answer question) transformed into a quotient variable – counting the number of indications
Question 10. In what areas of operation of your enterprise are digital technology platforms being used or will be used (in the case of implementation plans)? (Please tick all possible answers)	Structural factor	Variable measurement level: nominal (multi-answer question) transformed into a quotient variable – counting the number of indications
Question 11. Please specify what basic benefits are generated by using digital technology platforms in your company.	Economic factor	Variable measurement level: nominal (not subject to factor analysis, for example)
Question 12. Do you agree with the statement that digital technology platforms enable the creation and development of innovative business models?	Structural factor	Variable measurement level: ordinal
Question 14. Has the implementation of digital technology platforms in the company (in which you perform your professional duties) forced or will force you to introduce specific changes in its organisational structure?	Structural factor	Variable measurement level: ordinal
Question 22. Please specify in which type of enterprise, taking into account the size of employment, you perform your professional duties.	Structural (sociodemographic) factor	Measurement level of the variable: interval



Question 23. In what industry does your company operate?	Structural (sociodemographic) factor	Variable measurement level: nominal (not subject to factor analysis, for example)
Question 16. Please state your gender.	The human factor (potential latent variable affecting ratings)	Variable measurement level: nominal (not subject to factor analysis, for example)
Question 17. Please state your age.	The human factor (potential latent variable affecting ratings)	Measurement level of the variable: interval
Question 18. Please specify your level of education.	The human factor (potential latent variable affecting ratings)	Measurement level of the variable: interval
Question 19. Specify your seniority in the company where you currently perform your professional duties.	The human factor (potential latent variable affecting ratings)	Measurement level of the variable: interval
Question 20. Please specify how long the company in which you perform your professional duties has been operating in the market.	The human factor (potential latent variable affecting ratings)	Measurement level of the variable: interval
Question 21. Please specify the type of position you hold in the company where you currently perform your professional duties.	The human factor (potential latent variable affecting ratings)	Variable measurement level: nominal (not subject to factor analysis, for example)

In the case of the issues raised in the article, the key factor is the structural factor related to Question 12 and the economic factor related to the benefits of using DTP (Question 11).

The model was built with the use of the above-mentioned variables, indicating which variables and how strongly they affect the independent variable. **Regression for qualitative CATREG variables was used for the analysis. The analytical technique revealed correlates of assessments on the degree of the impact of digital technology platforms on the functioning of the company.**

Optimal scaling belongs to the family of regression methods. It is a method consisting of predicting the value of a selected variable on the basis of values assumed by other variables also indicated by the researcher. It is important that the optimal scaling enables the inclusion (in the analyses) of variables that are at each measurement level: nominal, ordinal, interval and quotient. This is a key advantage of this method and prevents the inclusion of nominal variables in the analyses (thus it is impossible to find out what role they play). This method can be considered a kind of 'first choice' in social sciences as the variables are generally measured here on a qualitative level. The purpose of using this method is to quantify the relationship between multiple independent variables and one dependent variable. It is a "regression for qualitative variables" and its essence is that the combined effect of the variables is investigated (interaction means the "product" of individual variables) (Kooij, 2007). The concept of optimal scaling comes from various sources – correspondence analysis (Greenacre, 1984) and multidimensional scaling (MDS) (Kruskal, 1964, Guttman, 1968), and is considered to be the successor to these methods. It is also statistically more correct and rigorous (Mider, 2017).

Optimal scaling is a technique that provides multi-dimensional data exploration: the number of predictors allowed is two hundred, although only one independent (predicted) variable can be predicted. It is reasonable, however, to limit the number of variables. There should be at least ten – or preferably twenty – units of analysis for each variable; otherwise, you may experience instability in the regression line. This means that in this analysis, where the set is  $N = 120$ , a maximum of twelve independent variables can be used and no more than six optimally. This is important in the context of the number of sixteen variables identified above (Table 3). This means that at least four of them should be eliminated *a priori*. The choice was made for these variables, which, in various variable systems tested many times, showed the lowest level of interaction with other independent and dependent variables.

Interpretations of the regression model for categorical variables are analogous to those of the regular regression model, although there are more indicators that are more sophisticated.

The following numerical results are subject to interpretation:

- 1) **Multiple R**, also called the multiple correlation coefficient. It is the positive square root of R-squared (Multiple Determination Coefficient). It describes the collective relationship between a dependent variable and independent variables. It takes values between 0 and 1 and is an indicator of the model fit.
- 2) Factor **R-squared** is a multiple R raised to the second power. It illustrates the total variability of the dependent variable explained by the collective interaction of the independent variables. It takes values from 0 to 1, can be expressed as a percentage and is a comparable value.
- 3) **Adjusted R-squared** is computed from R-squared taking into account the number of factors in the regression model: the more factors there are, the lower the adjusted R-squared.
- 4) A pair of variables – **regression and residual** show the variability explained by the regression model and the amount of unexplained variation (residual). These values are subject to visual evaluation. The larger the first value and the smaller the second, the more the selected set of independent variables explains the variability of the dependent variable.
- 5) **Significance of the regression model** it is interpreted in the same way as in other statistical tests. In social research, the risk of making a Type 1 error of 5% ( $p \leq 0.05$ ) is accepted.
- 6) **Beta coefficient ( $\beta$ )** is the so-called ‘standardised regression coefficient’ (independent of the range of the variable, calculated from the slope coefficient (also called regression coefficient) which enables the comparison of individual predictors in the regression model ranging from -1 to +1. Such a scale means that values oscillating around zero mean little or no relation between the predictor and the dependent variable.
- 7) An important parameter describing individual predictors is significance (interpreted as in p. 5).
- 8) **The F statistic** is the total goodness of the fit and shows the size of the explained variance. When creating a model, the variables that have the lowest values of this statistic are sequentially eliminated.
- 9) The correlation matrix – which consists of zero-order correlations, partial and semi-partial correlations – contains less relevant information. **Zero-order correlations** are isolated correlations between the independent and dependent variable. In turn **partial correlations** take into account the correlation of a given predictor as well as the dependent variable with other variables in the model. While **semi-partial correlations** take into account the interaction of a given independent variable with other variables in the model, they do not take into account the correlation of the dependent variable with other predictors. They take values from -1 to +1.
- 10) **Significance** is the importance of individual variables in the model expressed as part of unity (the maximum value is 1). The higher the importance assigned to a given predictor, the greater the role it plays in the model. The value of this parameter can be expressed as a percentage.
- 11) **Tolerance** is a measure of the collinearity of variables. This is the inverse of  $R^2$  (tolerance =  $1 - R^2$ ). It takes values from 0 to 1. The closer the predictor tolerance is to unity, the less it is collinear with other variables in the model. Co-linearities should be avoided – the closer the coefficient is to zero, the more redundant a given variable is and the more useless information it carries. The variables in the model should be strongly correlated with the dependent variable and weakly correlated with each other. The data validation phase is important for building the model and then the issue of outlier observations must be resolved. The CATREG regression model is very sensitive to outlier data.

A model using CATREG is usually constructed in the following iterative steps:

- 1) Including a set of variables in the model that, in the opinion of the researcher, affect the dependent variable (this set is already established at the level of preparing the tool for empirical research).
- 2) Manipulating the order of variables to achieve the highest result (it is iterated repeatedly and is a mechanical activity).
- 3) Model building and evaluation.
- 4) Reduction in the number of variables by the weakest predictor.

- 5) Creation of a reduced model.
- 6) Comparisons of the previous and the next (reduced) model.
- 7) Repeating Points 4 to 6 until the most satisfactory numerical result is obtained.

The procedure as above is a top-down (descending) method which usually gives satisfactory substantive results. The calculation results (the best, final model) for the top-down optimal scaling are presented below in Table 4 and Table 5.

**Table 4.** Summary of the overall coefficients of the top-down optimal scaling model (descending)

<b>Multiple R</b>	0.668
<b>R-squared</b>	0.446
<b>Adjusted R-squared</b>	0.218

**Table 5.** ANOVA variance analysis for the optimal scaling model obtained by the top-down (descending) method

	<b>Sum of squares</b>	<b>Degrees of freedom (df)</b>	<b>Average square</b>	<b>F</b>	<b>Relevance</b>
Regression	53.971	35	1.542	1.955	$p \leq 0.01$
Residual	67.029	85	0.789		
Total	121.000	120			

The model was created by nine variables included in Table 6 (the order of importance of individual variables constituting the model).

**Table 6.** Variables used to build a model of attitudes towards digital technology platforms

Question 11. Please specify what basic benefits are generated by using digital technology platforms in your company.	Economic factor
Question 23. In what industry does your company operate?	Structural (sociodemographic) factor
Question 14. Has the implementation of digital technology platforms in the company (in which you perform your professional duties) forced or will force you to introduce specific changes in its organisational structure?	Structural factor
Question 19. Specify your seniority in the company where you currently perform your professional duties.	The human factor (potential latent variable affecting ratings)
Question 4. Please specify what type of digital technology platforms are or will be used (in the case of implementation plans) in your company. (Please tick all possible answers)	Structural factor
Question 12. Do you agree with the statement that digital technology platforms enable the creation and development of innovative business models?	Structural factor
Question 10. In what areas of operation of your enterprise are digital technology platforms being used or will be used (in the case of implementation plans)? (Please tick all possible answers)	Structural factor
Question 21. Please specify the type of position you hold in the company where you currently perform your professional duties.	The human factor (potential latent variable affecting ratings)
Question 18. Please specify your level of education.	The human factor (potential latent variable affecting ratings)

In the obtained model, there were five variables belonging to the structural factor, three (although with lower explanatory power) variables belonging to the human factor and one variable being the economic factor (however, the strongest of all variables).

**Table 7.** Components of the optimal scaling model obtained by the top-down (descending) method

Model component name (predictor)	Beta coefficient	Degrees of freedom (df)	F	Relevance	Zero correlation
Question 11.	0.477	12	19.774	0.001	0.361
Question 23.	0.399	11	12.976	0.001	0.233
Question 14.	-0.295	3	3.881	0.012	-0.162
Question 19.	0.235	2	3.527	0.034	0.150
Question 4.	0.202	1	1.941	0.167	0.130
Question 12.	0.209	2	1.675	0.193	0.116
Question 10.	0.153	1	1.919	0.170	0.135
Question 21.	0.187	2	3.443	0.036	0.100
Question 18.	-0.114	1	0.981	0.325	-0.066
	Partial correlation	Semi-partial correlation	Significance	Post-transformation tolerance	Tolerance before transformation
Question 11.	0.522	0.455	0.386	0.911	0.914
Question 23.	0.449	0.373	0.208	0.877	0.965
Question 14.	-0.351	-0.279	0.107	0.890	0.866
Question 19.	0.290	0.225	0.079	0.917	0.828
Question 4.	0.245	0.188	0.059	0.865	0.847
Question 12.	0.265	0.204	0.055	0.955	0.914
Question 10.	0.197	0.150	0.046	0.954	0.918
Question 21.	0.236	0.181	0.042	0.936	0.828
Question 18.	-0.146	-0.110	0.017	0.934	0.931

When analysing the data in Table 7, it should be noted that the most important factor influencing attitudes towards DTP is the economic factor (0.386, which means that it explains 38.6% of the variability of the independent variable) and the socio-demographic factor (0.208). In the case of Question 12, the significance is at a level of 0.055, which means that the attitudes in the surveyed enterprises are only, to a small extent, conditioned by the factor related to the creation and development of innovative business models as a result of using digital technology platforms.

The fit of the optimal scaling model expressed by multiple R was 0.668, which is considered to be a moderate (significant) dependence but almost lies on the border of the so-called ‘significant correlation’, whose space extends from 0.7. The total variability of the dependent variable, explained by the total interaction of independent variables, was as much as 0.218. This means that the model explains as much as 21.8% volatility of attitudes towards digital technology platforms in enterprises. This is a significant value despite the fact that the model consists of a large number of coefficients. A significant but acceptable number of factors in the model (9) reduces the original (R-squared) value of the coefficient. It is worth noting that the analysis consisting of an attempt to subtract individual coefficients from the model in order to reduce their number increases the forces of explaining the model. Thus, the nine variables interact (at least in a mathematical sense) together, forming an inseparable whole. The model is statistically significant on a more than satisfactory level (i.e.,  $p \leq 0.01$ ). Visual assessment of the sum of squares for regression and residuals in ANOVA shows that the regression model explains more than half (53%) of the variability, which thus makes it valid. It is worth noting that the analogous method of creating the model became the basis for the highly rated habilitation thesis by Mider (2017). In that work, the adjustment of the optimal scaling model expressed with multiple R was much less than in this one (it was 0.413). The model should, therefore, be considered valuable as it explains the correlations of positive ratings of digital technology platforms.

**Figure 1.** Components of the optimal scaling model obtained by the top-down method – graphic interpretation taking into account the proportion of importance of individual factors in the model

Benefits of Digital Technology Platforms (Q11)	Industry (Q23)	Changes in organizational structure (P14)	Work experience (Q19)	
		Types of platforms used (Q4)	Platform operation areas (Q10)	Type of position held (Q21)
		Enabling the creation and development of innovative business models (Q12)		
		Education level (Q18)		

The model covers three groups of factors: economic, structural and human. Positive attitudes towards DTP are mainly explained by **the number of benefits generated in the enterprise by digital technology platforms** (38.6% model fit). The technological factor has long been referred to as the strategic weapon of the enterprise because its importance results from its deliberate application to increase the added value as a result of changes in production and control processes (Porter over Millar, 1985, Wiseman, 1985). Positive attitudes towards DTP are also largely constituted by factors of a structural nature – primarily the industry in which the enterprise operates and the intensity of changes in the internal structure of the enterprise – in total it is as much as 47.5% (i.e., almost half of the model components). It is worth emphasising that the importance of the structural factor has long been widely recognised. Douglas North, a Nobel Prize winner in Economics, argued that development is owed more to organisational progress than to technical progress (Acemoglu, 2009). In turn, the human factor (i.e., *strictly* sociopsychological and demographic factors of the respondent) plays a minor role (in the sense of explanatory power) and is represented by characteristics such as job tenure, position and education (13.8%).

### 3.3. Alternative model proposal

An alternative model was constructed using the ascending (i.e., the "bottom-up" method) by adding successive variables by trial and error. Attempts were made to base correlation with the ascending method on assumptions of an epistemological nature. The main factor was sought both among the 'hard' elements, relating to measurable econographic features of the enterprise, and 'soft' ones (i.e., those relating to the characteristics of the respondent in his/her professional role – education, experience and other socio-psycho-demographic features). The selected groups of factors showed moderately high values in terms of the F statistic, correlation and importance, but were statistically insignificant (high risk of making a Type 1 error).

The model can be based on synthetic indicators (i.e., indexes or scales). In this case, synthetic values obtained from two or more direct indicators (questionnaire questions) would become independent variables. The direct advantage of this approach is the reduction of the number of independent variables, which makes it possible to reduce the distance between the R-squared coefficient and the adjusted R-squared. As a result, a model explaining the greater part of the variation of the dependent variable can potentially be obtained. The undoubted advantage of such an approach may be obtaining transparency by introducing order and structuring individual factors into groups.

Data was synthesised on the basis of simple, arbitrary summation followed by averaging of sets of indicators. From the point of view of methodology, these are the so-called 'reflective indicators' (i.e., not related to a common cause but, according to the researcher's assumptions, classified into a more general category).

The following five synthetic indexes were distinguished: cybersecurity (represented by one index), economic (one index, related to benefits, Question 11), human (eight sub-indexes), structural (four indexes, including one referring to Question 12) and structural and demographic (two sub-indexes). An attempt to make the model using

Question 13 as the dependent variable and such indexes as independent variables generated the results presented in Tables 8 and 9.

**Table 8.** Summary of the overall coefficients of the top-down optimal scaling model (descending)

<b>Multiple R</b>	0.361
<b>R-squared</b>	0.131
<b>Adjusted R-squared</b>	0.052

**Table 9.** ANOVA variance analysis for the optimal scaling model obtained by the top-down (descending) method

	<b>Sum of squares</b>	<b>Degrees of freedom (df)</b>	<b>Average square</b>	<b>F</b>	<b>Relevance</b>
Regression	15.805	10	1.580	1.653	$p \leq 0.1$
Residual	105.195	110	0.956		
Total	121.000	120			

In social sciences, the results of calculations in the field of inductive statistics which show a probability value (p) above 0.05 are considered statistically insignificant. Sometimes, a breakthrough is made in this rule and test results are quoted – which, although they exceed 0.05, are no higher than 0.1. There is a high (10%) risk of making a Type 1 error but, at least, such a result should be noted in the margin.

The model based on synthetic indexes explains the variability in Question 13 **to a much lesser extent than the model developed first**. The most important factor explaining more than a quarter (25.4%) of the variability of the independent variable is the structural (sociodemographic) factor, which covers the size and industry of the enterprise. This is the premise for further exploration in this regard (see Table 10).

**Table 10.** Components of the optimal scaling model obtained by the top-down (descending) method

<b>Model component name (predictor)</b>	<b>Beta coefficient</b>	<b>Degrees of freedom (df)</b>	<b>F</b>	<b>Relevance</b>	<b>Zero correlation</b>
Index - Structural (sociodemographic) factor	0.261	0.201	1	10.682	0.197
Index - Structural factor	0.147	0.163	3	0.816	0.488
Index - Human factor	0.141	0.163	2	0.749	0.475
Index - Economic factor	0.070	0.207	3	0.114	0.952
Index - Cybersecurity factor	-0.138	0.159	1	0.756	0.386
	<b>Partial correlation</b>	<b>Semi-partial correlation</b>	<b>Significance</b>	<b>Post-transformation tolerance</b>	<b>Tolerance before transformation</b>
Index - Structural (sociodemographic) factor	0.274	0.262	0.254	0.547	0.944
Index - Structural factor	0.140	0.154	0.145	0.157	0.975
Index - Human factor	0.145	0.148	0.139	0.157	0.972
Index - Economic factor	0.105	0.072	0.067	0.056	0.932
Index - Cybersecurity factor	-0.078	-0.141	-0.133	0.083	0.928

The CATREG model described above was supplemented with intergroup comparisons in order to find the specific ‘characteristics’ of the use of digital platforms from the perspective of various groups of respondents (multidimensional characteristics of the studied population). In this respect, for Questions 11 and 12, they are contrasted with Question 2 (If in Question 1 you indicated 'definitely yes' or 'rather yes', please specify how long have digital technology platforms been used in the enterprise in which you currently perform your professional duties.) and 22 (Please specify in which type of enterprise, given the size of the workforce, you perform your professional duties.). The analyses regarding Questions 2 and 11 are presented in Table 11.



**Table 11.** Time of application of digital technology platforms vs. benefits of DTP

Question 11. Benefits generated by the use of digital technology platforms in the enterprise:	Question 2. Please specify how long digital technology platforms have been used in the company where you currently perform your professional duties.			
	up to 3 years		over 3 years	
	ranking sum	ranking place	ranking sum	ranking place
profit increase	100.0	1	100.0	1
increase in the level of competitiveness	72.3	2	82.6	2
extension of the product range	61.7	4	56.0	4
increasing market share	29.6	8	48.6	5
increase in the level of innovation	37.4	5	36.2	7
increase in the number of customers	14.0	10	37.9	6
improving customer service and increasing the level of consumer satisfaction	10.0	12	34.8	8
increasing the number of markets in which the company operates	30.8	7	24.8	11
expanding the number of business partners, including those operating exclusively in a virtual environment	34.3	6	30.5	9
optimisation of the implementation of various business processes, including those in the field of customer service	71.7	3	67.0	3
creating digital supply chains	5.3	14	14.2	12
increase in the overall efficiency of the company's operations	16.2	9	28.4	10
increasing the flexibility of operation, visible through the possibility of quick introduction to the market of new products and services	8.1	13	13.8	13
the ability to actively participate in the implementation of programmes initiated in a virtual environment, aimed at expanding the range or customer base	13.7	11	14.2	12

The ranking of benefits offered by the use of digital technology platforms to both groups of respondents is almost identical. The observed differences relate to an increase in market shares, an increase in the number of customers and an increase in the overall efficiency of the company's operation (in their case, the trend is as follows – the longer CPT is used in an enterprise, the greater the benefits of the above-mentioned types are recorded). Therefore, they do not apply to increasing the level of competitiveness (72.3% of responses in the case of enterprises using DTP for up to 3 years and 82.6% in relation to a longer period of using these platforms).

Another aspect concerns the relationship between this time and the impact of DTP on creating and developing innovative business models (see Table 12).

**Table 12.** Time using digital technology platforms vs. development of innovative business models

Question 12. Do you agree with the statement that digital technology platforms enable the creation and development of innovative business models?	Question 2. Please specify how long digital technology platforms have been used in the company where you currently perform your professional duties.			
	up to 3 years		over 3 years	
	N	%	N	%
I strongly agree	25	43.1	37	59.7
I agree	29	50.0	16	25.8
I neither agree nor disagree	4	6.9	8	12.9
I disagree	0	0.0	1	1.6
I strongly disagree	0	0.0	0	0.0
Mann-Whitney's Intergroup Comparison Test	no.			
Test of significance of relationships between Pearson chi-square variables and Cramer's V contingency coefficient	no.			

There are no statistically significant differences between the studied groups in this respect. Both almost 100% agree that digital technology platforms enable the creation and development of innovative business models. It is worth noting that the force of positive conviction to the statement is higher for enterprises of higher seniority level (over three years).

Another issue raised during the study concerns the benefits of using DTP and takes the different types of enterprises studied into consideration. The data on this issue is presented in Table 13.

**Table 13.** Enterprise size vs. benefits obtained on the basis of DTP

Question 11. Benefits generated by the use of digital technology platforms in the enterprise:	Size of the enterprise			
	micro	small	medium	large
	ranking sum (ranking place)	ranking sum (ranking place)	ranking sum (ranking place)	ranking sum (ranking place)
profit increase	75.9 (2)	100.0 (1)	100.0 (1)	100.0 (1)
increase in the level of competitiveness	100.0 (1)	74.8 (2)	70.9 (2)	73.6 (3)
extension of the product range	70.7 (3)	48.9 (4)	51.5 (4)	66.7 (4)
increasing market share	41.4 (6)	45.8 (5)	33.5 (6)	35.8 (6)
increase in the level of innovation	43.1 (5)	30.5 (9)	37.4 (5)	35.8 (6)
increase in the number of customers	70.7 (3)	38.9 (6)	13.7 (11)	14.4 (9)
improving customer service and increasing the level of consumer satisfaction	44.8 (4)	36.6 (7)	17.6 (10)	8.0 (12)
increasing the number of markets in which the company operates	8.6 (9)	31.3 (8)	28.6 (8)	28.9 (7)
expanding the number of business partners, including those operating exclusively in a virtual environment	-	29.8 (10)	33.0 (7)	37.8 (5)
optimisation of the implementation of various business processes, including those in the field of customer service	12.1 (8)	74.0 (3)	63.9 (3)	87.6 (2)
creating digital supply chains	-	16.8 (11)	12.8 (13)	3.0 (13)
increase in the overall efficiency of the company's operations	29.3 (7)	30.5 (9)	13.2 (12)	22.4 (8)
increasing the flexibility of operation, visible through the possibility of quick introduction to the market of new products and services	8.6 (9)	15.3 (12)	7.5 (14)	11.4 (11)
the ability to actively participate in the implementation of programmes initiated in a virtual environment, aimed at expanding the product range or customer base	-	8.4 (13)	20.7 (9)	12.9 (10)

For all businesses, regardless of employment, the most important benefits generated by the use of digital platforms are increased profits and increased competitiveness. The latter benefit was indicated by 100.0% of representatives of micro-enterprises as well as 74.8% in the case of small enterprises, 70.9% of medium-sized enterprises and 73.6% of large enterprises.

Table 14 presents data on the impact of DTP on the creation of innovative business models and takes the size of the enterprises into account.

**Table 14.** Company size vs. creating innovative business models

Question 12. Do you agree with the statement that digital technology platforms enable the creation and development of innovative business models?	Size of the enterprise							
	micro		small		medium		large	
	N	%	N	%	N	%	N	%
I strongly agree	10	83.3	18	64.3	15	36.6	19	48.7
I rather agree	1	8.3	5	17.9	24	58.5	15	38.5
I neither agree nor disagree	1	8.3	5	17.9	1	2.4	5	12.8
I rather disagree	0	0.0	0	0.0	1	2.4	0	0.0
I strongly disagree	0	0.0	0	0.0	0	0.0	0	0.0
H Kruskal-Wallis intergroup comparison test	ni.							
Test of significance of relationships between Pearson chi-square variables and Cramer's V contingency coefficient	ni.							

All enterprises, regardless of the size of their employment, show almost 100% similarity when it is found that digital technology platforms enable the creation and development of innovative business models.

## Conclusion

In the summary of the article, it should be pointed out that the results of our own research clearly prove that the use of digital technology platforms creates the basis for building and developing innovative business models. In this respect, the opinions of the respondents are consistent and neither the duration of the DTP application nor the size of the enterprise matter in this respect. It should be emphasised that digital technology platforms determine the increase in the level of competitiveness of enterprises and this benefit is one of the most important, as indicated by the representatives of the surveyed enterprises. In this aspect, no significant differences were noticed depending on the time of using DTP or the size of the enterprise. Any changes in modern business models – based on digital technology platforms – should, therefore, be considered as a factor leading to increasing the competitiveness of enterprises. Consequently, it must be stated that both hypotheses set out in the introduction have been confirmed. Digital technology platforms significantly influence changes in modern business models, promoting the implementation of innovative solutions within them and, at the same time, constitute an important and new factor of competitiveness of enterprises in the digital economy.

The research carried out for the purpose of the article was innovative. They were based on a variety of methods and techniques, integrating such different research paradigms as CATI and CATREG. The results obtained during the research are a significant step forward in relation to the findings that have been made so far in the scientific literature. It has been shown that digital technology platforms are not only one of the most important, but even a key factor enabling the development of innovative business models. It has been proven that such platforms are the basic source of competitive advantage in the modern market. Admittedly, the importance of, for example, human resources for organizational success in business should not be underestimated. The fact is, however, that due to the widespread digitization and technologization, DTP already determines the competitive position of many companies to the greatest extent and allows the promotion of modern business models.

## Research Limitations

It should be emphasized that a certain limitation of the conducted research is the purposeful sample of enterprises that applied for and received funding under the In-novative Economy Operational Program for investments in the implementation and development of DTPs, which may cause the management of the surveyed companies to have a positive attitude towards this phenomenon. Therefore, in order to confirm the obtained results, further research should be carried out also covering those companies that did not receive or did not apply for such funding. It

should also be said that the results obtained concern the attitudes of managers of Polish companies and due to cultural, social and business conditions they should not be applied indiscriminately in other countries. The study concerned the attitudes of company management towards DTP and their impact on the shaping of production and consumption patterns. The results of the study of the strength of the impact of DTP on consumption patterns among platform users in the context of sustainable development could be interesting, differentiating the results according to the type of digital platform.

It is necessary to also distinguish those limitations related to the CATREG optimal scaling. One of such limitation is related to the permissible number of predictors—dependent variables, which amounts to 200 (in the case of CATI survey results, this condition is irrelevant, as the number of predictors rarely exceeds 100). At the same time, each variable should have a minimum of ten and, preferably, twenty units of analysis. Optimal scaling is therefore not advisable in the case of small sample sizes. Failure to take this condition into account results in unstable regression lines. Another limitation is the inherent defect of all regression methods, which provide information on the existence or absence of relations between variables but do not provide any knowledge about the cause-and-effect relationship of such relations. An important reservation also concerns the fact that depending on the type and number of variables included in the model, different result values are obtained, and it is difficult to decide which of the constructed models is best. The choice is made by the researcher, taking into account the structure of the obtained results.

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**Krzysztof BARTCZAK**

<https://orcid.org/0000-0001-7406-1509>

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## DIGITAL PLATFORMS AND ENTREPRENEURSHIP IN TOURISM SECTOR\*

Alfonso Marino <sup>1</sup>, Paolo Pariso <sup>2</sup>, Michele Picariello <sup>3</sup>

<sup>1,2,3</sup> Università degli Studi della Campania "L. Vanvitelli" – Engineering Dept, Via Roma n. 29, Aversa (CE), Italy

E-mails:<sup>1</sup> [alfonso.marino@unicampania.it](mailto:alfonso.marino@unicampania.it); <sup>2</sup> [paolo.pariso@unicampania.it](mailto:paolo.pariso@unicampania.it); <sup>3</sup> [michele.picariello@unicampania.it](mailto:michele.picariello@unicampania.it)

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**Abstract.** The current level and abilities of digital platforms are developing new practices of connections, communication, comprising the tourism sector in its different declinations. In its different declinations, the common model is the digitalization of tourism. The article proposals, analyses of the digital platform models related to the tourism sector. The digital platforms can characterize the new sector' phase. Despite this, the sector highlight deeply differences in terms of analysis and knowledge both at theoretical and operative level. The present study of a systematic literature review supported by multiple correspondence analysis highlight three different trajectories related to digital tourism platforms. The paper to provide a better understanding of platform competition research that contributes to our understanding of how platforms compete to produce and capture value in the tourist sector.

**Keywords:** digital platforms; tourism; systematic literature review; conceptual structure map

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**JEL Classifications:** G20, L2, L26

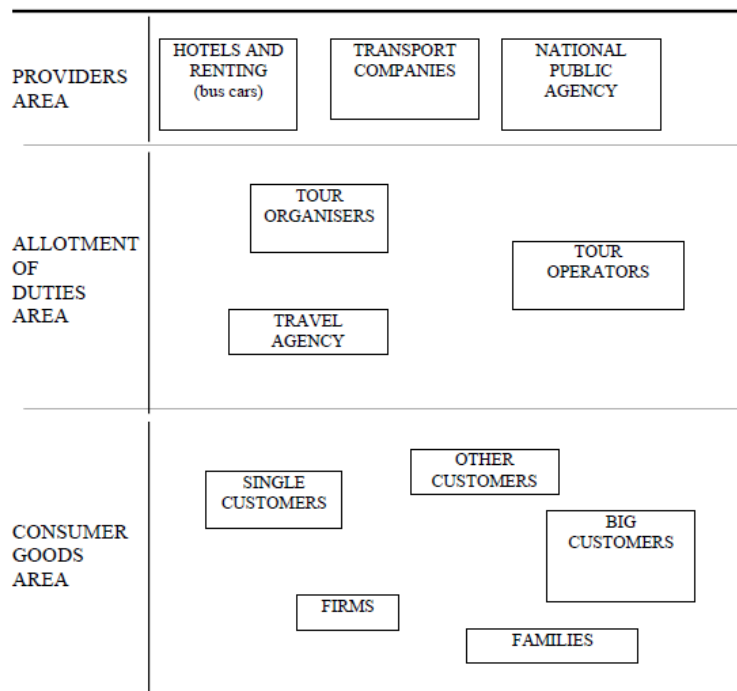
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## 1. Introduction

The tourism sector has been brutally affected by COVID-19 and the sector are leaving a negative both economic and social performance. Tourism businesses and workers are struggling against the economic crisis caused by the pandemic while many governments are applying specific measures for tourism. These measures are essential, but its positive effects will be in the long run time, in fact, the tourism sector, faces an economic crisis never known before. The decisions and actions are supported by digital platforms. It is interesting to note that in relation to accommodation, the peer-to-peer solution is a strategic pattern to support the sector. It is strategic for the tourism sector, invest in information management and to create a business value (Messeni et al 2020) of big data analytics, supported by digital global platforms. At this stage of organizational life is strategic to learn how to implement ICT. Tourism is a high-budget factor for the European States (European Commission, 2021).

The importance of the digitalization in tourism sector has underlined as part of the enactment of the digital economy program by European Commission and single States. The interaction between supply and demand using the digital platform, may contribute to create a renewed desire to travel. In order to evaluate the digital platforms the sector will be divided into three macro areas, see figure 1.



**Figure 1.** The Tourist sector

*Source:* our elaboration on WTO 2020

Providers' area, allotment of duties area, consumer goods area, is useful for collecting the systematic literature review and understanding the trajectories first within the individual macro-areas and then, if they converge.

## **2. Theoretical background**

The Systematic Literature Review (SLR) is well - known for other types of literature review primarily by a comprehensive literature search and specification of research questions that should be addressed (Keele, 2007). The SLR supported by multiple correspondence analysis (MCA) in order to estimate the strategic categories emerging from SLR and related to a specific area. The SLR, referring to the tourism sector, is significant in this phase to contribute both to theory and to operators in terms of knowledge and future decisions (Marino et al 2021). The digital tourist platforms are changing the perception of sector. The wide possibility to extend use and manage of ICT in the tourism sector underline the importance of artificial intelligence and robotics that are changing organizational routine (Marino et al 2021a), typologies of consumption, production and service delivery (Marino et al 2021c), management of tourism destinations. Following this research steam, the relationship between digital platforms and entrepreneurship considered strategic to improve technological and organizational variables (Nassar et al, 2021).

Furthermore, from other conceptual research emerged that to implement digital platforms in the sector, requires working in alignment, coordination, and co-creation. Implementing digital platform governance means to change the information system at all three-macro areas of the tourism sector as displays in figure 1. ICTs (Marino et al 2021b), transforms this wave of research, shifting attention in this sector to the use of digital platforms, their sharing and related elements of competition, both globally and within the same region with a high tourist vocation. The macro areas proposed in Figure 1 are still present to the attention of theoretical and operational studies concerning the tourism sector in terms of ICT tools and its declinations. This approach it is useful for accumulating knowledge in the context of the implementation of digital technologies within organizations. In order to develop the study, the methodology will help select and process the collected data.

## **3. Methodology**

A SLR is a specific type of literature reviews characterized by:

- A specification of research questions that should be addressed;
- A comprehensive and unbiased search for the relevant literature;
- An explicit definition of inclusion and exclusion criteria;

We conducted our SLR in several stages:

- Formulating the research questions
- Extracting and filtering papers
- Defining evaluation and comparison criteria
- Presenting and discussing the obtained results

The remainder of this section describes the details of each stage

### **3.1 Formulating the research questions**

The specification of research questions (RQs) is the most important part of any SLR as they guide authors throughout the review process. The RQs in our SLR formulated as follows:

RQ1: What are the areas and goals targeted by digital tourism platforms these last years?

RQ2: What are the formats used for the representation of digital tourism platforms?

RQ3: Do the proposed digital tourism platforms comply with the implementation mechanism specified by the UNWTO?

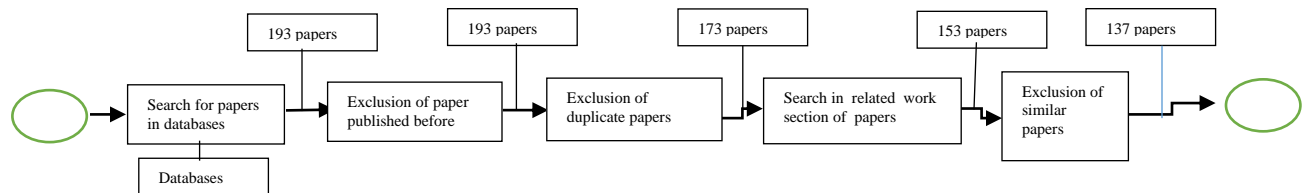
RQ4: How is digital tourism platforms demonstrated and evaluated?

### 3.2 Formulating the research questions

The extraction and filter of papers supported by multiple correspondence analysis (MCA) in order to create a conceptual structure map (Pagès, 2014). The software of the data analysis is the Statistical Package for the Social Sciences (SPSS) version 26.0. The final search string structured as follows: Search string = (“Tourism” OR “Digital Platforms” AND “Applic\*” OR “Delsol\*” OR “Standa\*” OR “Custom\*” OR “System”). We use several databases and search tools like Web of Science, Scopus, Science Direct, Google Scholar, IEEE Digital Library. Our SLR targets all digital tourism platforms published over the time of December 2019 – February 2021 in journals, conference/workshop proceedings, and book chapters. For this, we filtered the obtained papers according to the following exclusion criteria:

- Papers published before the considered period;
- Papers that are not published in journals, conference/workshop proceedings, and book chapters such as master and doctoral theses;
- Papers that do not propose a digital tourism platform in the three macro areas considered;
- Papers written in a language other than English;
- Papers that describe the same digital tourism platforms in the same way.

Filtering has greatly reduced the number of papers. In fact, after the paper collection, we obtained 193 papers. However, we have kept the papers that propose a digital tourism platform, whether it is a primary or secondary contribution. Accordingly, a set of 137 papers (Annex) retained for an in-depth examination in our SLR. Figure 2, displays the main steps of paper extraction and filtering process.



**Figure 2.** Process of paper extraction and filtering

*Source:* our elaboration

### 3.3 Defining evaluation and comparison criteria

In order to evaluate and compare the digital tourism platforms, we have defined the following criteria:

- Publication type: journal, conference/workshop proceeding, book chapter.
- Aim: indicates the reason for which the topic was proposed or the problem that it solves.
- Category: we defined two categories. The first is a particular domain of tourism: providers, allotment of duties, consumer goods. The second that aims to improve the performance: e.g., cost, security, compliance, quality. The extensions of the second category are independent of a specific domain but used in any domain.
- Digital platforms related to software: specifies the version of the software.
- Digital tourism platform name: indicates whether a name assigned to the proposed solution.
- Main domain: Designates the main domain targeted by a platform knowing.
- Demonstration: indicates whether a platform demonstrated through an operational example.

- Digital platform modality: mentions whether technologies has been implemented either by integrating it into an existing tool or by developing a new tool.
- Evaluation: specifies for each tool whether evaluated and which method used for the evaluation.
- Conformity: determines whether a platform complies with the ISO standard.

We define for each digital tourism platform the publication type ('J' for the journal, 'C' for conference or workshop and 'Ch' for chapter), the main purpose of the platform as well as the category ('Imp' for improvement and 'SD' for specific- domain).

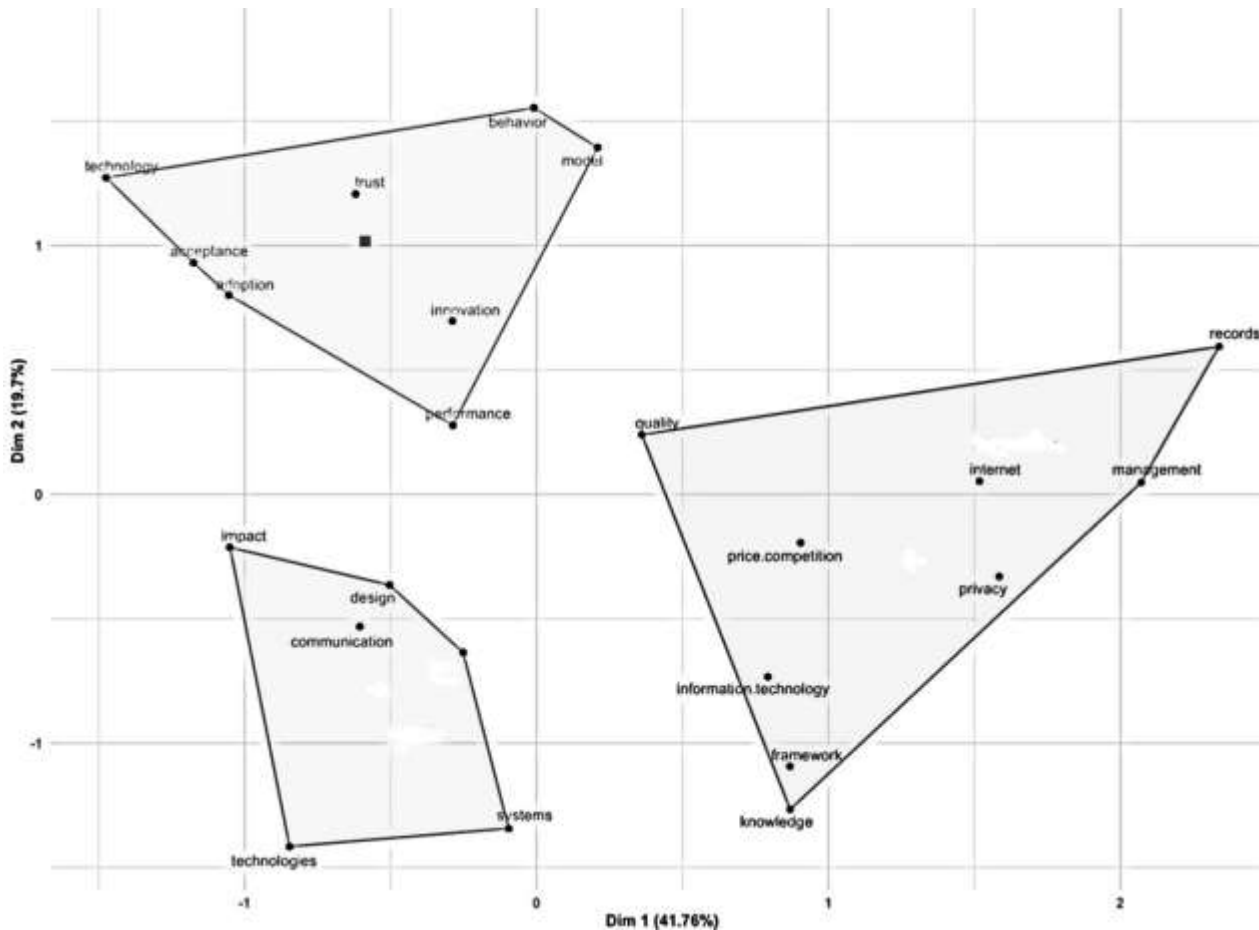
#### 4. Results

It is possible to note, that the majority of 137 publications type is in Journals, 120 (Table 1). We can explain this by the fact that tourism: providers, allotment of duties, consumer goods and digital platforms are consistent enough in terms of operative and theory contribution submitted to journals (Tables 2;3). In line with this, the distribution by category balanced between improvement and specific domain. Furthermore, tourism and digital platforms compared according to their name, main domain, demonstration, implementation, and evaluation. It is interesting to note that few documents 15/137 indicate the name of digital platforms, in terms of brand and tools. This is possible, considering the indirect advertising that can result. Furthermore, more than 50% of paper, have indicated domain. The domain relates to specific applications and big data communication. The papers that have indicate the domain also contain the demonstration, more than 50%. The digital platforms relate to the destination, while in a few papers there is not an evaluation approach. In addition, also in terms of theory and model, interesting information emerging related to both key factors: providers, allotment of duties, consumer goods, destination, and bottlenecks. The demonstration, implementation and evaluation, within destination are, also strictly linked to, SLR considered. These reasons highlight that all variables considered in functional properties in studies considered. The ICTs is among the most targeted areas (Marino et al., 2021).

In addition, digital platform is highly regulated by the private sector with a low level of standard e.g., ISO. However, 23/137, papers, make the comparison of digital tourism platform to their conformity and related it with ISO standard, recommendations, reused, customized, extend. It is possible to observe, that recommendation and customization are present only in 23 documents. Despite these difficulties, SLR helps to understand it: only 33/137 studied and with the results of individual works, they compared with those of other platform typologies. Furthermore all protocols use the recommended tools, although, case studies in different contexts are little explored and as a result, absentee comparisons. After to have elaborated the SLR, and extract the categories, is possible to match it with the support of the MCA analysis. The matching is related the three-macro areas considered. The Figure 3, highlight related to three macro areas, the categories present in SLR analyzed. Starting from Figure 3 is possible to identify three clusters:

- i) providers' area (at the top left),
- ii) allotment of duties (on the lower left)
- iii) Consumer goods area (on the lower right).





**Figure 3.** MCA analysis elaborating categories of SRL

*Source:* our elaboration

## 5. Discussion

The general consideration is related to different topics each to other linked, but only within the same area. There are not correspondences between the diversity of platforms used, the specificities of connected sites, and if there are or not, lack of systems integration that make difficult to adopt the platform. The absence in the literature of this comparison between the three areas makes it more difficult for researchers and operators to accumulate knowledge of the sector. There is also an economic point of view lack related to digital platforms and investment to sustain it. This lack is present in all three considered areas. The specific consideration is that in providers' area, the decision to use digital tourist platforms depends how platforms can affect customers' behavior. Model and technology is strictly linked to customers' behavior in provides area. The least studied categories between technology and performance are acceptance and adoption. The third, there is not a correspondence for trust and innovation. These two categories are weakness related to the others and among them. The least studied are the National Public Agency, as reported in Figure 1. Analyzing allotment of duties, in which no category exceeds zero for both axes, impactful displays the correspondence with system and in addition to missing there is a design. At the same time between impact and technology, there are no correspondences. The communication in allotment of duties has no correspondence with the other categories, may be interesting to study, how to improve the communication channels of digital platform development that meet information from customers and destinations.

This topic studied as a single category in this area. The tour organizers as reported in Figure 1, are the least studied. Analyzing consumer goods area with the highest number of categories on the lower right, displays four corners: quality, records, management and knowledge.

The relationship between them concern management that is sharing between records and knowledge. The correspondence analysis linked to consumer goods area displays also the highest number of categories without correspondences. The least studied is price competition and internet, that is the technical dimension, while, information technologies, and privacy have been studied but not always in relation to others categories. The framework, sector structure also but with more correspondences with knowledge. The categories least studied in this are the families. Starting from these assumptions may be interesting verify in providers' area, if these behaviors are reinforced by trust in the digital service. In SLR and related MCA this correspondence is not verified. Furthermore, if digital technology is convenient for the firms, and easy to use to the customers, should be affect trust topic. The trust is a strategic variable to create value in the tourism sector. Furthermore, research experiences related to the trust and digital economy can supported to develop of this topic in the tourism sector. In the area of allotment of duties, there is a contribution lack linked to the role of intermediaries. Furthermore, the overcome of this lack can contribute to the knowledge of this intermediate area that affected by the quality of service. The digital tourism platforms in this area can support a better data access, as well as accessibility, availability, and compatibility of destinations and its tools. Although most of the literature focuses on digital platforms by customers, tourist professionals may also be reluctant or favorable to its adoption. Can be interesting to develop this topic in allotment duty area.

## 6. Conclusion

The topic is part of a future research agenda as complex and inter sectorial systems of information and organization, can improve the firm performance, individuals and groups decisions within tourism sector. Following this research agenda, the studies should make more effort on the topic, by integrating it into a theory and model in order to prove its feasibility. Based on these indications, the topic has yet discussed and deepened, bringing to a synthesis the different experiences gained in the field by both operators and researchers.

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## Annex

**Table 1.** Comparison of digital tourism platform and their publication type, aim, and category

Digital Tourism platform	Publication Type	Aim	Category
1. Almeida-Santana et al. 2020	J	The Authors, identify, main digital platforms inter-organizational research opportunities modeled through an evaluation approach	ICT
2. Kayumovich 2020	J	The Author, identify, the main opportunities for the application of automation in tourism care contexts	SD
3. Hunt, et al. 2019	J	The Authors, identify, the main phases of implementation of the technologies in e tourism contexts	SD
4. Alves et al 2020	Ch	The Authors develop a planning tourism promotion programs with information technologies	ICT
5. Talon-Ballesterio et al 2019	J	The Authors study the information and communication technologies applied in tourism contexts	SD
6. Wu 2020	C	The Author study applied information and communication technologies and economic dynamics in tourism contexts	SD
7. Pencarelli, 2020	J	The Author develop information technologies applications applied to the tourism environment	SD
8. Fereidouni, et al., 2019	C	Authors highlight difficulties in implementing digital tourism platform	SD
9. Lopez-Cordova 2020	Ch	The Author highlight the difficulties in implementing digital tourism platform in relation to value creation	ICT
10. Poux, et al. 2020	J	The Authors highlight the economic dynamics of the digital tourism platform	Adp
11. Pradhan et al 2019	C	The Authors highlight the evolution of skills and related gaps in the use of digital tourism platform	Imp
12. Ketter, 2020	J	The Authors highlight the evolution of skills and related gaps of digital tourism contexts	SD
13. Balula, et al., 2019	J	The Authors highlight the interventions necessary to use digital tourism platform	SD
14. Ardito et al., 2019	C	The Authors highlight the interventions necessary in the implementation of digital tourism platform for the creation of value	Adp
15. Remoaldo et al. 2020	J	The Authors measured the benefits of tourist services using information technology	ICT
16. Minca et al., 2019	J	The Authors measure the benefits of digital tourist platforms and related technologies	Adp
17. Ziyadin et al., 2019	J	The Authors measure the benefits of information technology in tourism contexts	SD
18. Cassia et al., 2020	J	The Authors identify factors determining the success and failure of digital tourism	Imp
19. Sharafutdinov et al 2020	J	The Authors identify key components determining the success and failure digital tourism platform	ICT
20. McGinnis et al 2020	J	The Authors identify key components beyond adoption digital tourism platforms	SD
21. Frolova et al 2019	J	The Authors identify models and theories related to digital tourism platforms	SD
22. Nikolskaya et al., 2019	J	The Authors identify key factors design of digital tourism platforms	SD
23. Mkwizu, 2019	J	The Authors study digital tourism to improve tourism literacy	SD
24. Styvén et al 2019	J	The Authors study digital tourism platforms to improve tourism professionalities	SD
25. Alghizzawi et al., 2019	C	The Authors study digital tourism platform evaluation	ICT
26. Bassano et al., 2019	J	The Authors study the relationship between innovation and digital tourism platform evaluation	Adp
27. Duignan et al., 2019	J	The Authors study cultural orientations and information systems success in public and private tourism areas	SD
28. Xiao 2019	J	The Authors study the development of digital tourism platforms and specific applications	Adp
29. Tarazona-Montoya et al., 2020	J	The Authors study software applications related to digital tourism platforms	Imp
30. Alghizzawi, 2019	J	The Author identify the interventions to promote digital tourism platforms	Adp
31. Moreno et al., 2020	J	The Authors study the impact of digital tourism platform in tourism contexts	SD
32. Reyes-Menendez, et al., 2019	J	The Authors study behavior change in digital tourism platforms	Adp
33. Kazandzhieva, et al., 2019	J	The Authors study tourism and quality service in digital tourism	SD
34. Casillo et al., 2019	J	The Authors study innovation technologies in tourism sector	SD
35. Nusair 2020	J	The Author study technologic change and implications for tourism sector	ICT
36. Hsieh et al., 2019	J	The Authors identify key factors from digital tourism	ICT
37. Treiblmaier et al., 2019	Ch	The Authors study the complexity of digital tourism platforms	Imp
38. Bu et al., 2020	C	The Authors study the complexity of digital tourism platforms	SD
39. Wali et al., 2019	J	The Authors study barriers and facilitators to the implementation of digital tourism platforms	SD
40. Casais et al., 2020	J	The Authors study behavioral intervention technologies	ICT
41. Pearce et al., 2020	J	The Authors study digital tourism platforms identifying key factors to improve outcome and resources	SD
42. Plantin et al., 2019	J	The Authors study digital tourism platforms identifying key factors to improve services and resources	SD
43. Rotta et al., 2019	J	The Authors study digital tourism platforms in tourism contexts	SD
44. Khudoyberdievich 2020	J	The Author measure digital tourism platforms in tourism contexts	SD
45. Bourliataux-Lajoie et al., 2019	J	The Authors measure digital tourism platforms related to projects	Imp
46. Lazar 2019	J	The Author measure digital tourism platforms related to service outcomes	Adp
47. Dewi 2020	Ch	The Author highlight the global diffusion of technologies in tourism sector	ICT

48.	Diniz et al., 2019	J	The Authors identify digital tourism platforms assessment factors	Adp
49.	Magano et al., 2020	J	The Authors study innovation technologies and its application on digital tourism platforms	SD
50.	Kontogianni et al., 2020	J	The Authors, identify, main e health inter-organizational research opportunities modeled through an evaluation approach	Adp
51.	Mohan et al 2019	J	The Authors, identify, the main opportunities for the application of automation in digital tourism platforms contexts	SD
52.	Ricart et al., 2020	J	The Authors, identify, the main phases of implementation of the technologies in e digital tourism platforms contexts	SD
53.	Benckendorff, et al., 2019	Ch	The Authors develop a planning digital tourism platforms promotion programs with information technologies	ICT
54.	Bissell 2020	J	The Author study the information and communication technologies applied in digital tourism platforms contexts	SD
55.	Suherlan et al 2019	C	The Author study applied information and communication technologies and economic dynamics in digital tourism platforms contexts	SD
56.	Guerriero et al., 2019	J	The Authors develop information technologies applications applied to the digital tourism platforms environment	SD
57.	Cardelwood et al., 2019	C	Authors highlight difficulties in implementing digital tourism platforms	Imp
58.	Popkova et al., 2020	Ch	The Author highlight the difficulties in implementing digital tourism platforms in relation to value creation	Adp
59.	Dexeus 2019	J	The Author highlight the economic dynamics of the digital tourism	ICT
60.	Azhar et al., 2019	C	The Authors highlight the evolution of skills and related gaps in the digital tourism platforms	Adp
61.	Gaberli 2019	J	The Author highlight the evolution of skills and related gaps of the digital tourism platforms	SD
62.	Robertson et al., 2020	J	The Authors highlight the interventions necessary linked to the digital tourism platforms in tourism areas	SD
63.	Grubor et al., 2019	C	The Authors highlight the interventions necessary in the implementation of digital tourism platforms for to create value	Imp
64.	Urquhart 2019	J	The Author measured the benefits of tourism areas using information technology	ICT
65.	Eferin et al., 2019	J	The Authors measure the benefits of destination programs and related technologies	SD
66.	Mulyana et al., 2020	J	The Authors measure the benefits of information technology in destination contexts	SD
67.	Gil et al., 2019	J	The Authors identify factors determining the success and failure of destination interventions	SD
68.	Pelet et al., 2019	J	The Author identify key components determining the success and failure of destination interventions	Imp
69.	Pecený et al., 2019	J	The Authors identify key components beyond adoption of digital tourism platforms	Adp
70.	Yarchi et al., 2019	J	The Authors identify models and theories related to digital tourism	ICT
71.	Nilashi et al., 2019	J	The Authors identify key factors design and implementation of digital tourism platforms	ICT
72.	Saura et al., 2020	J	The Authors study the relationship between digital tourism platforms and destination	SD
73.	Ye et al., 2020	J	The Authors study digital tourism platforms to improve tourism professionalities	Adp
74.	Malik et al., 2019	C	The Authors study digital tourism platforms evaluation	ICT
75.	Li et al 2020	J	The Authors study the relationship between destination and digital tourism platforms evaluation	ICT
76.	Antony et al., 2019	J	The Authors study cultural orientations and information systems success in public and private tourism areas	SD
77.	Schnauber-Stockmann, et al 2020	J	The Authors study the development of digital tourism platforms applications	Imp
78.	Nam et al., 2019	J	The Authors study software applications related to digital tourism	ICT
79.	Salerno 2019	J	The Author identify the interventions to promote digital tourism	ICT
80.	Aithal et al., 2019	J	The Authors study the impact of digital tourism platforms in destination contexts	SD
81.	Henver et al., 2019	J	The Authors study behavior change in the destination	Imp
82.	Sang et al., 2019	J	The Authors study digital tourism platforms and quality in tourism services	SD
83.	Champion et al., 2020	J	The Authors study innovation technologies and digital tourism platforms context	SD
84.	Arenas et al., 2019	J	The Authors study technologic change and implications for destinations	Adp
85.	Chan et al., 2020	J	The Authors identify key factors from digital tourism platforms implementation	Imp
86.	Nyurenberger et al., 2019	Ch	The Authors study the complexity of digital tourism platforms Implementation	Adp
87.	Pesonen et al., 2019	C	The Authors study the complexity of the digital tourism platforms	SD
88.	Stors 2020	J	The Author study barriers and facilitators to the implementation of digital tourism platforms services	SD
89.	Muhammedrisaevna et al., 2020	J	The Authors study behavioral intervention technologies	ICT
90.	Xu et al 2020	J	The Authors study digital tourism platforms identifying key factors to improve outcome and resources	SD
91.	Veloso et al., 2019	J	The Authors study digital tourism platforms identifying key factors to improve services and resources	SD
92.	Ballina et al., 2019	J	The Authors study digital tourism platforms contexts	SD
93.	Kumar et al., 2020	J	The Authors measure digital tourism platforms implementation in destination	SD
94.	Adeola et al., 2020	J	The Authors measure digital tourism platforms related to projects	ICT
95.	Patwary et al., 2020	J	The Authors measure digital tourism platforms related to service outcomes	Adp
96.	Komminos et al., 2019	Ch	The Authors highlight the global diffusion of digital tourism platforms	Imp
97.	Mishara et al., 2020	J	The Authors identify destination assessment factors	Adp
98.	Elkins 2019	J	The Author study innovation technologies and its application in tourism contexts	SD
99.	Lee et al., 2019	J	The Authors, identify, main tourism area inter-organizational research opportunities modeled through an evaluation approach	Adp
100.	Baronian 2020		The Author, identify, the main opportunities for the application of automation in destinations	SD

	J		
101. Mandic et al., 2019	J	The Authors, identify, the main phases of implementation of the technologies in tourism contexts	SD
102. Aloisi 2019	Ch	The Author develop a planning destination promotion programs with information technologies	ICT
103. Vera et al., 2019	J	The Authors study the information and communication technologies applied in tourism contexts	SD
104. Baber et al., 2019	C	The Author study applied information and communication technologies and economic dynamics in tourism areas	SD
105. Sigalat-Signes et al., 2020	J	The Authors develop information technologies applications applied to the tourism environment	SD
106. Rzevski 2019	C	Author highlight difficulties in implementing digital tourism platforms	Imp
107. Neidhardt et al., 2020	Ch	The Author highlight the difficulties in implementing digital tourism platforms in relation to value creation	Adp
108. Ramos et al., 2020	J	The Authors highlight the economic dynamics of the implementation of the digital tourism platforms	Adp
109. Polukhina et al., 2019	C	The Authors highlight the evolution of skills and related gaps in the implementation of the digital tourism platforms	Imp
110. Ortega et al., 2020	J	The Authors highlight the evolution of skills and related gaps in the implementation of the digital tourism platforms	SD
111. Cavalheiro et al., 2020	J	The Author highlight the interventions necessary in the implementation of the digital tourism platforms	SD
112. Tsokota et al., 2019	C	The Authors highlight the interventions necessary in the implementation of the digital tourism platforms for the creation of value	Imp
113. Trunfio et al., 2019	J	The Authors measured the benefits of destination using information technology	ICT
114. Gomez – Oliva et al., 2019	J	The Authors measure the benefits of the digital tourism platforms programs and related technologies	ICT
115. Stankov et al., 2019	J	The Authors measure the benefits of information technology in digital tourism platforms contexts	SD
116. Hanafiah et al 2019	J	The Authors identify factors determining the success and failure of the digital tourism platforms interventions	Imp
117. Spencer 2019	J	The Author identify key components determining the success and failure of the digital tourism platforms interventions	Imp
118. Hossain et al., 2019	J	The Authors identify key components beyond adoption of the digital tourism platforms	Adp
119. Zach et al., 2020	J	The Authors identify models and theories related to digital tourism platforms implementation	Imp
120. Lo et al., 2019	J	The Authors identify key factors design and implementation of the digital tourism platforms	Imp
121. Lam et al., 2020	J	The Authors study digital tourism platforms to improve tourism' areas	Adp
122. Karya et al., 2019	J	The Authors study digital tourism platforms to improve tourism sector	Imp
123. Fatimah et al., 2019	C	The Authors study digital tourism platforms evaluation	Adp
124. Baser et al., 2019	J	The Authors study the relationship between innovation and digital tourism platforms evaluation	Imp
125. Law et al., 2019	J	The Authors study cultural orientations and information systems success in public and private areas	SD
126. Pongiantopoulou et al., 2019	J	The Authors study the development of digital tourism platforms applications	App
127. Rallan et al., 2020	J	The Authors study software applications related to digital tourism platforms	Adp
128. Khatri 2019	J	The Author identify the interventions to promote digital tourism platforms	Adp
129. Aslam 2020	J	The Authors study the impact of e Health in health care contexts	SD
130. Ankomah et al., 2019	J	The Authors study behavior change in the digital tourism platforms	App
131. Myat et al., 2019	J	The Authors study e Health and quality in health care	SD
132. Morales Urrutia et al., 2019	J	The Authors study innovation technologies and tourism context	SD
133. Koutsi et al., 2019	J	The Authors study technologic change and implications for digital tourism platforms	Imp
134. Gaffar et al., 2019	J	The Authors identify key factors from digital tourism platforms	Adp
135. Hassan et al., 2020	Ch	The Authors study the complexity of the digital tourism platforms	Adp
136. Shrestha et al., 2020	C	The Authors study the complexity of the digital tourism platforms	SD
137. Rondovic et al., 2019	J	The Authors study barriers and facilitators to the adoption of the digital tourism platforms	SD

Legend: 'J' for the journal, 'C' for conference or workshop and 'Ch' for chapter. 'Imp' for improvement and 'SD' for specific- domain, Adp for Acknowledge of digital platforms

**Table 2.** Comparison of digital tourism platform to their Authors, digital platform name, domain, demonstration, adoption, and evaluation

Authors	Digital Tourism Platforms	Domain	Demonstration	Adoption	Evaluation
Almeida-Santana et al. 2020	NA	NA	NA	Theory and Model	Cwa
Kayumovich 2020	Yes	NA	NA	Destination	Cwa
Hunt, et al. 2019	Yes	NA	NA	Destination	Cwa
Alves et al 2020	NA	NA	NA	Theory and Model	Cwa



Talon-Ballester et al 2019	Yes	NA	NA	Destination	Cwa
Wu 2020	NA	NA	NA	Theory and Model	Cwa
Pencarelli, 2020	Yes	Blockchain	Yes	Destination	Cwa
Fereidouni, et al., 2019	NA	NA	NA	Theory and Model	Cwa
Lopez-Cordova 2020	NA	NA	NA	Theory and Model	Cwa
Poux, et al. 2020	NA	NA	NA	Theory and Model	Cwa
Pradhan et al 2019	NA	NA	NA	Theory and Model	NA
Ketter, 2020	Yes	NA	Yes	Destination	Cwa
Balula, et al., 2019	NA	NA	NA	Theory and Model	NA
Ardito et al., 2019	NA	NA	NA	Theory and Model	Cwa
Remoaldo et al, 2020	Yes	NA	Yes	Destination	Cwa
Minca et al., 2019	NA	NA	NA	Theory and Model	NA
Ziyadin et al., 2019	Yes	SW	Yes	Destination	Cwa
Cassia et al., 2020	NA	NA	NA	Theory and Model	Cwa
Sharafutdinov et al 2020	Yes	SW	Yes	Destination	Cwa
McGinnis et al 2020	NA	NA	NA	Theory and Model	Cwa
Frolova et al 2019	NA	NA	NA	Theory and Model	Cwa
Nikolskaya et al., 2019	Yes	SW	Yes	Destination	NA
Mkwizu, 2019	NA	NA	NA	Theory and Model	Cwa
Styvén et al 2019	Yes	SW	Yes	Destination	Cwa
Alghizzawi et al., 2019	Yes	SW	Yes	Destination	Cwa
Bassano et al., 2019	NA	NA	NA	Theory and Model	Cwa
Duignan et al., 2019	NA	NA	NA	Theory and Model	Cwa
Xiao 2019	Yes	SW	Yes	Destination	NA
Tarazona-Montoya et al., 2020	Yes	SW	Yes	Destination	Cwa
Alghizzawi, 2019	NA	NA	NA	Theory and Model	Cwa
Moreno et al., 2020	NA	NA	NA	Theory and Model	Cwa
Reyes-Menendez, et al., 2019	NA	SW	Yes	Destination	Cwa
Kazandzhieva, et al., 2019	NA	NA	NA	Theory and Model	Cwa
Casillo et al., 2019	Yes	Big Data	Yes	Destination	Cwa
Nusair 2020	NA	NA	NA	Theory and Model	NA
Hsieh et al., 2019	NA	Big Data	Yes	Destination	Cwa
Treiblmaier et al., 2019	NA	NA	NA	Theory and Model	Cwa
Bu et al., 2020	Yes	SW	Yes	Destination	Cwa
Wali et al., 2019	NA	NA	NA	Theory and Model	Cwa
Casais et al., 2020	NA	NA	NA	Theory and Model	Cwa
Pearce et al., 2020	Yes	Big Data	Yes	Destination	Cwa
Plantin et al., 2019	NA	NA	NA	Theory and Model	Cwa
Rotta et al., 2019	Yes	Big Data	Yes	Destination	NA
Khudoyberdievich 2020	NA	Big Data	Yes	Destination	Cwa
Bourliataux-Lajoie et al., 2019	NA	Big Data	Yes	Destination	Cwa
Lazar 2019	NA	NA	NA	Theory and Model	Cwa
Dewi 2020	NA	NA	NA	Theory and Model	Cwa
Diniz et al., 2019	Yes	NA	Yes	Destination	Cwa
Magano et al., 2020	Yes	SW	Yes	Destination	Cwa
Kontogianni et al., 2020	NA	NA	NA	Theory and Model	Cwa
Mohan et al 2019	Yes	Big Data	Yes	Destination	Cwa
Ricart et al., 2020	Yes	Big Data	Yes	Destination	Cwa
Benckendorff, et al., 2019	NA	NA	NA	Theory and Model	Cwa
Bissell 2020	Yes	Yes	Yes	Destination	Cwa
Suherlan et al 2019	NA	NA	NA	Theory and Model	Cwa
Guerriero et al., 2019	Yes	Blockchain	Yes	Destination	Cwa
Cardelwood et al., 2019	NA	NA	NA	Theory and Model	Cwa
Popkova et al., 2020	NA	NA	NA	Theory and Model	Cwa
Dexous 2019	NA	NA	NA	Theory and Model	Cwa
Azhar et al., 2019	NA	NA	NA	Theory and Model	NA
Gaberli 2019	Yes	SW	Yes	Destination	Cwa
Robertson et al., 2020	NA	NA	NA	Theory and Model	NA
Grubor et al., 2019	NA	NA	NA	Theory and Model	Cwa
Urquhart 2019	Yes	SW	Yes	Destination	Cwa
Eferin et al., 2019	NA	NA	NA	Theory and Model	NA
Mulyana et al., 2020	Yes	Big Data	Yes	Destination	Cwa
Gil et al., 2019	NA	NA	NA	Theory and Model	Cwa
Pelet et al., 2019	Yes	Big Data	Yes	Destination	Cwa
Pecený et al., 2019	NA	NA	NA	Theory and Model	Cwa
Yarchi et al., 2019	NA	NA	NA	Theory and Model	Cwa
Nilashi et al., 2019	Yes	SW	Yes	Destination	NA
Saura et al., 2020	NA	NA	NA	Theory and Model	Cwa
Ye et al., 2020	Yes	SW	Yes	Destination	Cwa
Malik et al., 2019	Yes	Big Data	Yes	Destination	Cwa

Li et al 2020	NA	NA	NA	Theory and Model	Cwa
Antony et al., 2019	NA	NA	NA	Theory and Model	Cwa
Schnauber-Stockmann, et al 2020	Yes	SW	Yes	Destination	NA
Nam et al., 2019	Yes	SW	Yes	Destination	Cwa
Salerno 2019	NA	NA	NA	Theory and Model	Cwa
Aithal et al., 2019	NA	NA	NA	Theory and Model	Cwa
Henver et al., 2019	NA	Big Data	Yes	Destination	Cwa
Sang et al., 2019	NA	NA	NA	Theory and Model	Cwa
Champion et al., 2020	Yes	Big Data	Yes	Destination	Cwa
Arenas et al., 2019	NA	NA	NA	Theory and Model	NA
Chan et al., 2020	NA	SW	Yes	Destination	Cwa
Nyurenberger et al., 2019	NA	NA	NA	Theory and Model	Cwa
Pesonen et al., 2019	Yes	SW	Yes	Destination	Cwa
Stors 2020	NA	NA	NA	Theory and Model	Cwa
Muhammedrisaevna et al., 2020	NA	NA	NA	Theory and Model	Cwa
Xu et al 2020	Yes	Big Data	Yes	Destination	Cwa
Veloso et al., 2019	NA	NA	NA	Theory and Model	Cwa
Ballina et al., 2019	Yes	SW	Yes	Destination	NA
Kumar et al., 2020	NA	SW	Yes	Destination	Cwa
Adeola et al., 2020	NA	Big Data	Yes	Destination	Cwa
Patwary et al., 2020	NA	NA	NA	Theory and Model	Cwa
Komminos et al., 2019	NA	NA	NA	Theory and Model	Cwa
Mishara et al., 2020	Yes	NA	Yes	Destination	Cwa
Elkins 2019	Yes	SW	Yes	Destination	Cwa
Lee et al., 2019	NA	NA	NA	Theory and Model	Cwa
Baronian 2020	Yes	SW	Yes	Destination	Cwa
Mandic et al., 2019	Yes	App	Yes	Destination	Cwa
Aloisi 2019	NA	NA	NA	Theory and Model	Cwa
Vera et al., 2019	Yes	Yes	Yes	Destination	Cwa
Baber et al., 2019	NA	NA	NA	Theory and Model	Cwa
Sigalat-Signes et al., 2020	Yes	Blockchain	Yes	Destination	Cwa
Rzevski 2019	NA	NA	NA	Theory and Model	Cwa
Neidhardt et al., 2020	NA	NA	NA	Theory and Model	Cwa
Ramos et al., 2020	NA	NA	NA	Theory and Model	Cwa
Polukhina et al., 2019	NA	NA	NA	Theory and Model	NA
Ortega et al., 2020	YES	SW	Yes	Destination	Cwa
Cavalheiro et al., 2020	NA	NA	NA	Theory and Model	NA
Tsokota et al., 2019	NA	NA	NA	Theory and Model	Cwa
Trunfio et al., 2019	Yes	Big Data	Yes	Destination	Cwa
Gomez – Oliva et al., 2019	NA	NA	NA	Theory and Model	NA
Stankov et al., 2019	Yes	SW	Yes	Destination	Cwa
Hanafiah et al 2019	NA	NA	NA	Theory and Model	Cwa
Spencer 2019	Yes	SW	Yes	Destination	Cwa
Hossain et al., 2019	NA	NA	NA	Theory and Model	Cwa
Zach et al., 2020	NA	NA	NA	Theory and Model	Cwa
Lo et al., 2019	Yes	SW	Yes	Destination	NA
Lam et al., 2020	NA	NA	NA	Theory and Model	Cwa
Karya et al., 2019	Yes	Big Data	Yes	Destination	Cwa
Fatimah et al., 2019	Yes	SW	Yes	Destination	Cwa
Baser et al., 2019	NA	NA	NA	Theory and Model	Cwa
Law et al., 2019	NA	NA	NA	Theory and Model	Cwa
Pongiantopoulou et al., 2019	Yes	SW	Yes	Destination	NA
Rallan et al., 2020	Yes	SW	Yes	Destination	Cwa
Khatri 2019	NA	NA	NA	Theory and Model	Cwa
Aslam 2020	NA	NA	NA	Theory and Model	Cwa
Ankomah et al., 2019	NA	Big Data	Yes	Destination	Cwa
Myat et al., 2019	NA	NA	NA	Theory and Model	Cwa
Morales Urrutia et al., 2019	Yes	Big Data	Yes	Destination	Cwa
Koutsi et al., 2019	NA	NA	NA	Theory and Model	NA
Gaffar et al., 2019	NA	SW	Yes	Destination	Cwa
Hassan et al., 2020	NA	NA	NA	Theory and Model	Cwa
Shrestha et al., 2020	Yes	SW	Yes	Destination	Cwa
Rondovic et al., 2019	NA	NA	NA	Theory and Model	Cwa

Legend: Cwa for Comparison with other approaches, NA for Not Available

**Table 3.** Comparison of digital tourism platforms to their application in providers' area, allotment of duty and consumer goods are: standard, recommendations, reused, customized, extended

Authors	Conformity	Standar	Recommendations	Reused	Customized	Extended
Almeida-Santana et al. 2020	NA	NA				
Kayumovich 2020	Yes	Yes	X		X	X
Hunt, et al. 2019	Yes	Yes	X	X	X	X
Alves et al 2020	NA	NA				
Talon-Ballesterro et al 2019	Yes	Yes	X		X	
Wu 2020	NA	NA				
Pencarelli, 2020	Yes	NA			X	X
Fereidouni, et al., 2019	NA	NA				
Lopez-Cordova 2020	NA	NA				
Poux, et al. 2020	NA	NA				
Pradhan et al 2019	NA	NA				
Ketter, 2020	Yes	Yes	X	X	X	X
Balula, et al., 2019	NA	NA				
Ardito et al., 2019	NA	NA				
Remoaldo et al, 2020	Yes	Yes	X		X	X
Minca et al., 2019	NA	NA				
Ziyadin et al., 2019	Yes	Yes	X		X	X
Cassia et al., 2020	NA	NA				
Sharafutdinov et al 2020	Yes	Yes	X	X	X	X
McGinnis et al 2020	NA	NA				
Frolova et al 2019	NA	NA				
Nikolskaya et al., 2019	Yes	Yes	X	X	X	X
Mkwizu, 2019	NA	NA				
Styvén et al 2019	Yes	Yes	X		X	X
Alghizzawi et al., 2019	Yes	Yes	X		X	X
Bassano et al., 2019	NA	NA				
Duignan et al., 2019	NA	NA				
Xiao 2019	Yes	Yes	X		X	X
Tarazona-Montoya et al., 2020	Yes	Yes	X	X	X	X
Alghizzawi, 2019	NA	NA				
Moreno et al., 2020	NA	NA				
Reyes-Menendez, et al., 2019	NA	Yes	X		X	X
Kazandzhieva, et al., 2019	NA	NA				
Casillo et al., 2019	Yes	Yes	X	X	X	X
Nusair 2020	NA	NA				
Hsieh et al., 2019	NA	Yes	X		X	X
Treiblmaier et al., 2019	NA	NA				
Bu et al., 2020	Yes	Yes	X		X	X
Wali et al., 2019	NA	NA				
Casais et al., 2020	NA	NA				
Pearce et al., 2020	Yes	Yes	X	X	X	X
Plantin et al., 2019	NA	NA				
Rotta et al., 2019	Yes	Yes	X	X	X	X
Khudoyberdievich 2020	NA	Yes	X		X	X
Bourliataux-Lajoinie et al., 2019	NA	Yes	X		X	X
Lazar 2019	NA	NA				
Dewi 2020	NA	NA				
Diniz et al., 2019	Yes	NA	X		X	X
Magano et al., 2020	Yes	Yes	X	X	X	X
Kontogianni et al., 2020	NA	NA				
Mohan et al 2019	Yes	Yes	X		X	X
Ricart et al., 2020	Yes	Yes	X	X	X	X
Benckendorff, et al., 2019	NA	NA				
Bissell 2020	Yes	Yes	X		X	
Suherlan et al 2019	NA	NA				
Guerriero et al., 2019	Yes	NA			X	X
Cardelwood et al., 2019	NA	NA				
Popkova et al., 2020	NA	NA				
Dexeus 2019	NA	NA				
Azhar et al., 2019	NA	NA				
Gaberli 2019	Yes	Yes	X	X	X	X
Robertson et al., 2020	NA	NA				
Grubor et al., 2019	NA	NA				
Urquhart 2019	Yes	Yes	X		X	X
Eferin et al., 2019	NA	NA				
Mulyana et al., 2020	Yes	Yes	X		X	X
Gil et al., 2019	NA	NA				

Pelet et al., 2019	Yes	Yes	X	X	X	X
Pecený et al., 2019	NA	NA				
Yarchi et al., 2019	NA	NA				
Nilashi et al., 2019	Yes	Yes	X	X	X	X
Saura et al., 2020	NA	NA				
Ye et al., 2020	Yes	Yes	X		X	X
Malik et al., 2019	Yes	Yes	X		X	X
Li et al 2020	NA	NA				
Antony et al., 2019	NA	NA				
Schnauber-Stockmann, et al 2020	Yes	Yes	X		X	X
Nam et al., 2019	Yes	Yes	X	X	X	X
Salerno 2019	NA	NA				
Aithal et al., 2019	NA	NA				
Henver et al., 2019	NA	Yes	X		X	X
Sang et al., 2019	NA	NA				
Champion et al., 2020	Yes	Yes	X	X	X	X
Arenas et al., 2019	NA	NA				
Chan et al., 2020	NA	Yes	X		X	X
Nyurenberger et al., 2019	NA	NA				
Pesonen et al., 2019	Yes	Yes	X		X	X
Stors 2020	NA	NA				
Muhammedrisaevna et al., 2020	NA	NA				
Xu et al 2020	Yes	Yes	X	X	X	X
Veloso et al., 2019	NA	NA				
Ballina et al., 2019	Yes	Yes	X	X	X	X
Kumar et al., 2020	NA	Yes	X		X	X
Adeola et al., 2020	NA	Yes	X		X	X
Patwary et al., 2020	NA	NA				
Komminos et al., 2019	NA	NA				
Mishara et al., 2020	Yes	NA	X		X	X
Elkins 2019	Yes	Yes	X	X	X	X
Lee et al., 2019	NA	NA				
Baronian 2020	Yes	Yes	X		X	X
Mandic et al., 2019	Yes	Yes	X	X	X	X
Aloisi 2019	NA	NA				
Vera et al., 2019	Yes	Yes	X		X	
Baber et al., 2019	NA	NA				
Sigalat-Signes et al., 2020	Yes	NA			X	X
Rzevski 2019	NA	NA				
Neidhardt et al., 2020	NA	NA				
Ramos et al., 2020	NA	NA				
Polukhina et al., 2019	NA	NA				
Ortega et al., 2020	Yes	Yes	X	X	X	X
Cavalheiro et al., 2020	NA	NA				
Tsokota et al., 2019	NA	NA				
Trunfio et al., 2019	Yes	Yes	X		X	X
Gomez – Oliva et al., 2019	NA	NA				
Stankov et al., 2019	Yes	Yes	X		X	X
Hanafiah et al 2019	NA	NA				
Spencer 2019	Yes	Yes	X	X	X	X
Hossain et al., 2019	NA	NA				
Zach et al., 2020	NA	NA				
Lo et al., 2019	Yes	Yes	X	X	X	X
Lam et al., 2020	NA	NA				
Karya et al., 2019	Yes	Yes	X		X	X
Fatimah et al., 2019	Yes	Yes	X		X	X
Baser et al., 2019	NA	NA				
Law et al., 2019	NA	NA				
Pongiantopoulou et al., 2019	Yes	Yes	X		X	X
Rallan et al., 2020	Yes	Yes	X	X	X	X
Khatri 2019	NA	NA				
Aslam 2020	NA	NA				
Ankomah et al., 2019	NA	Yes	X		X	X
Myat et al., 2019	NA	NA				
Morales Urrutia et al., 2019	Yes	Yes	X	X	X	X
Koutsi et al., 2019	NA	NA				
Gaffar et al., 2019	NA	Yes	X		X	X
Hassan et al., 2020	NA	NA				
Shrestha et al., 2020	Yes	Yes	X		X	X
Rondovic et al., 2019	NA	NA				

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**Alfonso MARINO**, professor circular economy, (Università della Campania – Luigi Vanvitelli, Italy) degree in business economics with specific competencies in sustainability and circular economy.

ORCID ID: <https://orcid.org/0000-0003-1722-0539>

**Paolo PARISO**, PhD in business economics, (Università della Campania – Luigi Vanvitelli, Italy) degree in business economics, with specific competences in SMEs.

ORCID ID: <https://orcid.org/0000-0003-1066-4102>

**Michele PICARIELLO**, Research fellow, (Università della Campania – Luigi Vanvitelli, Italy) degree in Engineering, with specific competences in innovation technology.

ORCID ID: <https://orcid.org/0000-0002-2481-1559>

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## DEVELOPMENT TRENDS AND CHALLENGES OF STUDENTS' ACADEMIC MOBILITY IN HIGHER EDUCATION

Agnė Juškevičienė<sup>1</sup>, Kristina Samašonok<sup>2</sup>, Adomas Vincas Rakšnys<sup>3</sup>, Lina Žirnelė<sup>4</sup>, Vilma Gegužienė<sup>5</sup>

<sup>1,2,3,4,5</sup> Vilnius University of Applied Sciences, Saltoniškių Str. 58, Vilnius, Lithuania

E-mails: <sup>1\*</sup>[a.juskeviciene@vvf.viko.lt](mailto:a.juskeviciene@vvf.viko.lt) (Corresponding authors); <sup>2</sup>[k.samasonok@vvf.viko.lt](mailto:k.samasonok@vvf.viko.lt); <sup>3</sup>[a.raksnys@mtf.viko.lt](mailto:a.raksnys@mtf.viko.lt); <sup>4</sup>[l.zirnele@vvf.viko.lt](mailto:l.zirnele@vvf.viko.lt); <sup>5</sup>[v.geguziene@vvf.viko.lt](mailto:v.geguziene@vvf.viko.lt)

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**Abstract.** The article presents the evaluation of students' international academic mobility in higher education in the context of the scientific literature, where the barriers to the development of academic mobility are singled out, the more effective management tools of academic mobility and their effectiveness are discussed. *The aim of the research:* after identifying the problematic areas of the implementation of international academic mobility in higher education, to anticipate the possibilities of its development. *Analytical descriptive, quantitative and statistical* research methods were applied. Using the quantitative research strategy, the experience of participation of Lithuanian higher education students (n = 349) in the Erasmus+ mobility programme was clarified, the reasons for non-participation in international academic mobility programmes were revealed and the factors determining higher student mobility indicators were singled out. The results of the study revealed the need to improve the system for the promotion and implementation of international academic mobility in higher education, as the results of the study showed that only a small number of research participants took part in the Erasmus+ programme. Despite the fact that participation in academic mobility programmes provides experience in communication and cooperation with representatives of other cultures, professional foreign language development, independence skills are developed, however, according to the research participants, fear, self-confidence due to insufficient professional knowledge and skills, lack of foreign language knowledge, intimidating selection procedures and interviews, and fears of possible difficulties in adapting when moving to another country, as well as reluctance to break up with family or close friends and insufficient financial support (scholarship), are among the reasons for not participating in Erasmus+ mobility. When assessing the possibilities of developing international academic mobility in higher education, the highest average scores show that higher scholarships and paid internships, as well as opportunities for groups of students to go to the same higher education institution or company in another country and places offered (educational institutions, internship places), the diversity of of places for academic exchanges and the high level of quality of professional training (education, studies and internships), according to the research participants, would encourage students to participate more actively in international academic mobility programmes. The results of the study will have practical implications for anticipating possible more effective tools for managing academic mobility in higher education.

**Keywords:** international academic mobility; Erasmus+ mobility programme; internships; higher education; students

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**JEL Classifications:** A2, E02



## 1. Introduction

In the context of internationalization, technological and socio-cultural changes, the international mobility of students in higher education is receiving increasing attention (Lopez-Duarte, et. al., 2021; Khanal and Gaulee, 2019; Castro, et.al., 2016; Bista, 2019; Dias, et al., 2021; Kirloskar and Inamdar, 2021; Cibák et al., 2021; Hou and Du, 2022). The results of international student exchange programmes such as Erasmus, their improvement opportunities, efficiency and effectiveness of existing processes and projects, as well as potential challenges, changes for the participants in different geographic fields are analysed (Do and Pham, 2016; Lopez-Duarte, et. al., 2021; Souto-Otero et. al., 2013; Wells, 2014; Wulz and Rainer, 2015). While this phenomenon is not new, historians say that at least one out of ten students in universities in the Middle Ages came from another country (Teichler, 2007), in the current conditions, the mobility of international students is intensified by the integration of educational political and legal systems, knowledge economy, various formats of global supranational institutions, strategic changes in university policy, the agreements and commitments they entail, declaration multiculturalism, opportunities provided by modern technologies (Knight, 2012; Lopez-Duarte, et. al., 2021; Joyce, et. al., 2007). In Europe, for example, these phenomena are linked to the Bologna process, The European Higher Education Area (EHEA), Definition of a European Credit Transfer & Accumulation System (ECTS), unification of higher education quality management systems and standards (Joyce, et. al., 2007). In retrospect, the establishment of the Erasmus exchange programme in 1987, which was based on student mobility, aimed at strengthening young people's career prospects, promoting socio-cultural adaptability and gaining international experience, is a significant catalyst for these processes (Papatsiba, 2005). Erasmus programme involves more than 4,000 higher education institutions from more than 30 countries (Souto-Otero et. al., 2013). The most popular countries which dominate in the context of international student selection are the Anglo-Saxon USA, UK, Australia, Canada and China (Bista, 2019). It should be noted that since 1950, globally, the number of students studying abroad has grown to more than 2 million by 2012 (Wells, 2014), other authors, e.g. Knight (2012), based on data from Chen and Barnett and OECD, state that the number of students increased from approximately 238,000 in 1960 to as many as 3.3 million in 2008. Although the data and methodologies of counting differ, they undoubtedly confirm the growing interest of students, the intensification of student mobility processes and the relevance of the analysed topic and problems in the face of constant political, legal, socio-cultural, institutional, structural and procedural changes. Student mobility is most often driven by the reputation of foreign universities, the quality of studies, the need for different cultural experiences, the financial interests of the universities themselves, recommendations from other students, external communication strategies used by higher education institutions, openness and freedom of academic thought of the institutions, high living and working standards, political reasons, e.g. post-colonial relations between states (Teichler, 2007; Wells, 2014; Wulz and Rainer, 2015).

*The scientific problem of the article* – what are the main challenges of the international mobility of students and what are the development trends of the international mobility?

*Aim of the research:* after identifying problematic areas for the implementation of international academic mobility in higher education, to identify opportunities for its development.

## 2. Theoretical background

*The concept and key challenges of student mobility.* Analysing the concepts of student mobility, it is possible to distinguish vertical mobility, where students have the opportunity to try institutions and study programmes in the same country, and when analysing international mobility in different countries, the concept of horizontal mobility is most often used. In the first case, it is called intra-national mobility, and in the second case, it is called international mobility. Given the complexity of this phenomenon, it is necessary to mention various double-triple diploma programmes, when students spend part of their study time in their home country and another part abroad, various international workshops (Teichler, 2007; Wells, 2014; Knight, 2012). Current research also notes the

concept of virtual international mobility of students, particularly in relation to the global situation of COVID-19 (Lopez-Duarte, et. al., 2021; Joyce, et. al., 2007). The article analyses a phenomenon related to the mobility of international student credits (ECTS), which is limited in time (Wulz and Rainer, 2015; Papatsiba, 2005). As with any social phenomenon, the mobility of international students is inseparable from specific challenges. The concepts of challenges, pull factors / barriers are most often used in academic discourse to describe this phenomenon. In this article, the concept of challenges is used to distinguish both the factors that may limit students' participation in international mobility programmes and the factors-problems that arise during participation in these programmes, as these problems later become challenges for new students due to the feedback they provide (Wells, 2014; Souto-Otero et. al., 2013). Other authors, e.g. Khanal and Gaulee (2019) focus their research on the challenges of international mobility of students before and in the later stages, pre-departure and post-departure. The article attempts to systematize these challenges by distinguishing the fundamental categories that are formed based on various empirical studies.

*Socio-cultural challenges.* When examining barriers to the development of academic mobility, special attention is paid to socio-cultural factors. Many researchers associate a person's reluctance to participate in exchange programmes and go to a higher education institution abroad for academic purposes with a person's lack of motivation and personal reasons, as well as unfavourable conditions for exchange. First of all, it is possible to distinguish students' reluctance and fear of separation from relatives, lack of motivation to participate. On the other hand, research data predominate, where geographical proximity is also considered an important factor influencing students' self-determination regarding their mobility (Mok, et al., 2021). Students are not offered a suitable period, e.g. the study period is considered too long or too short. Although student mobility periods vary, students usually have to spend a semester or even a year at a foreign higher education institution, which can negatively affect their social relationships, e.g. with their partner, other family members. This phenomenon is also inseparable from the various responsibilities of students to take care of older parents or children, who play a significant role in the context of student mobility. When discussing the influence of close contact and circumstances on a person's decision to participate in international academic mobility programmes, some researchers (Mok, et al., 2021) emphasize the importance of social contacts with an acquaintance or family living in the host country. According to researchers, such social ties with the countries to which they intend to study encourage student mobility. Also student mobility is often restricted by limited knowledge of a foreign language, a limited number of programmes in the English language, fear of losing one's job, complex socialization and integration processes, lack of mentoring, identity and value compatibility issues or the so-called "culture shock" phenomenon, family attitudes towards student mobility, and even the social status of the family, social segregation. It is also important to mention the challenges of intercultural communication, considering the different styles and forms of communication. On the other hand, security is of great importance in a person's life. This is confirmed by the findings of the researchers' work, which shows that, for example, the security of the country of destination is important for motivating students to study in a foreign institution. For example, Hill and Sughnani (2021), based on a study, notes that three-quarters of respondents identified national security as one of the most important factors in deciding to participate in an international academic mobility programme. The international mobility of students is also often criticized for the brain drain phenomenon, which can lead to a lack of cultural support, and for a positive perception of these processes in society, which is inseparable from ensuring student mobility. Frequently arriving international students are seen as a threat to the country's economy and jobs, they face racism, student psychological problems, e.g. depression due to increased workload (Bryla and Ciabiada, 2014; Teichler, 2007; Papatsiba, 2005; Do and Pham, 2016; Souto-Otero, et. al., 2013; Lopez-Duarte, et. al., 2021; Khanal and Gaulee, 2019; Wulz and Rainer, 2015; Bista, 2019).

*Legal - procedural challenges.* The legal instruments set out the basic principles and modalities for implementing international academic mobility programmes. Unfortunately, it is not always possible to ensure the smooth implementation of academic exchanges in a higher education institution. The mobility of international students

can be limited by various laws, strict legal requirements (e.g. migration rules), and the complex process of filling in and submitting documents, competition between students for mobility positions. Some universities are generally unable to offer extensive mobility opportunities for their students, they lack information on international mobility programmes. It can be difficult to choose the right programme, students are not given the opportunity to apply for the desired institution of higher education. Despite various international agreements, university procedures and policies differ, e.g. the length and structure of the academic period, the timetable system (e.g. in some universities in Japan the spring semester runs from April to August), different assessment, examination procedures, and teaching methods, institutions face the challenge of limited student counselling about involvement in international exchange programmes, complex checks. Students are not sure whether their acquired knowledge, completed programmes, diploma, subject credits abroad will be recognized in the home country as well. The challenges of international student mobility can also be linked to the attractiveness of the host country itself, e.g. peripheral status in the Southeast Asian region (Bryla and Ciabiada, 2014; Knight, 2012; Do and Pham, 2016; Souto-Otero et. al., 2013; Lopez-Duarte, et. al., 2021; Wulz and Rainer, 2015). It is important to note that student mobility is also closely linked to the political situation in countries or regions of the world. According to Altbach and Wit (2018), students' mobility is influenced by Brexit, and, at the same time, the strengthening of anti-migrant policies. Such processes also change the map of openness of higher education to different groups of students. For example, due to the Brexit process, the increased problem of obtaining visas, even according to Altbach and Wit (2018), the unfavourable atmosphere for foreigners and other problems reduce the number of international students in the UK. At the same time, processes such as Brexit have an impact on the mobility of students from other European countries (Lincényi and Laczko, 2020).

*Financial reasons.* Students avoid participating in international mobility programmes due to limited university financial support, small scholarships, competition for scholarships, various fees, different levels of economic development of the states, ensuring the functions of the welfare state, economic cycle, especially when students come from less developed countries and face high financial costs, accommodation problems, students question the financial benefits of international mobility, and in many countries, it is forbidden to combine studies with financial - career goals and work during studies. It is natural that the limited financial support of a higher education institution, the different economic level of development of the countries and the related possible financial difficulties may be one of the reasons limiting a person's access to a higher education institution abroad for academic purposes. The location of the higher education institutions themselves, the physical environment and its attractiveness are also considered to be a certain limitation. Some higher education institutions participating in international mobility programmes require detailed financial statements (sometimes even from family members, such as bank records for one year) (Bryla and Ciabiada, 2014; Papatsiba, 2005; Souto-Otero et. al., 2013; Wulz and Rainer, 2015). Lee (2013) emphasizes that cost issues, including not only living but also social costs such as security, are considered to be one of the key factors influencing students' final decision to participate in an international mobility programme.

*Technological and ecological environment reasons.* Living in the conditions of rapid social, economic and technological changes, technology-based studies, which include virtual learning and other forms of learning based on information and communication technologies, become an inevitability in the context of modernization of higher education and study quality improvement (Volungevičienė and Teresevičienė, 2008). According to researchers, the implementation of technological learning solutions not only ensures more flexible organization of activities in the study process, improves access to higher education for those who want to study according to the opportunities and needs of students, but also gives higher education institutions a competitive advantage and uniqueness over other higher education institutions. encouraging an increase in academic exchange flows. To ensure the efficiency of international student mobility processes, it is necessary to invest in the digitization of educational processes, the development and integration of various virtual systems. The lack of technological competence and infrastructure can be seen as a specific challenge (Fakunle and Ajani, 2021). The lack of

competence can cause underuse of contemporary higher education websites, learning platforms, assessment and examination systems etc.. This is particularly important because international students in higher education institutions often face staff passivity, lack of attention and information that could be offset by well-functioning technological systems (Joyce, et. al., 2007; Bista, 2019; Turnea et al., 2020).

The use of virtual systems to promote student mobility is also supported by Sidhu, et. al. (2021). It should be noted that virtual student mobility may also become an opportunity for international study, although this cannot completely replace student mobility programmes related to physical travel. However, Sidhu, et. al. (2020) argues that higher education institutions should include more blended mobility programmes. On the other hand, the change in forms of student mobility is driven by economic and cultural reasons, the national political climate, and global geopolitical realities (Kirkoskar and Inamdar, 2021). William Lo and Chan (2020), Hou and Du (2022) place great emphasis on the political and economic forces among the countries participating in student mobility programmes and unequivocally determine the successful implementation of these processes. For example, Wit and Altbach (2021) even link the implementation of student mobility to various global phenomena, including climate change issues, noting that it is important for programmes such as Erasmus+ to contribute to reducing carbon emissions. more active virtual exchanges and joint international online learning are encouraged. At the same time, it is noted that these are just some of the key challenges for the next decade. Continuing to delve into the causes of student mobility, there is certainly considerable attention paid to ecological environment factors when, according to Mok, et. al. (2021), the environmental and climatic conditions in the destination country are one of the main reasons for deciding on student mobility.

Summarizing the above, it can be seen that the implementation of academic mobility is of particular importance in the context of globalization. Based on the results of the discussed research, it can be stated that the implementation of international academic mobility not only supports and ensures the attractiveness of higher education institutions in the international environment, but also improves the compliance of future international competencies and qualifications with the labour market. However, there are many barriers to the development and implementation of academic mobility, such as language and cultural differences, lack of information, non-recognition of foreign qualifications, differences in living standards, migrant status, visa problems and lack of funding. All this complicates the implementation of academic student mobility and does not ensure the development of its effectiveness in higher education. Therefore, the development of academic mobility in higher education institutions should be based not only on the knowledge provided in the field of study, but also on innovative approaches and tools through virtual systems and based on social cohesion.

### 3. The research methodology

*Organization and sample of the study.* The sample of the study was convenient, so the students of the selected Lithuanian higher education institution (n = 349) participated in it, of which 204 (58.6%) were female and 140 (40.2%) male, and 4 (1, 1%) did not indicate gender in the study. The highest number of respondents is first-year (n = 178 (51.1%)) and third-year (n = 107 (30.7%)) students, while the lowest number of respondents is second-year (n = 52 (14.9%)). and fourth-year (n = 11 (3.2 %)) students. At the request of the higher education institution where the study was conducted, its name is not published.

A mixed method of distributing the questionnaires was used: a written survey and an online survey. The most effective way to collect data was to send questionnaires directly to survey participants. A total of 307 questionnaires were distributed, filled in immediately and returned to the person who conducted the survey. Of the returned questionnaires, 6 questionnaires were invalid, incomplete or incompletely filled in (e.g. the same numbers in all columns of the questionnaire were marked, etc.) and were not included in the further data analysis. Also, 48 students responded to the online questionnaire. For further data analysis, 349 questionnaires were used, which are considered suitable for statistical analysis. The ethical principle of free choice to participate in the

survey was observed during the research. The study was conducted anonymously, the results were processed and summarized, and data confidentiality was ensured.

*Research methods.* The analytical descriptive method was used to analyse the questions of implementation of internationalization development in higher education. *Quantitative research method.* A questionnaire was created in order to find out how the international academic mobility of students is promoted by providing opportunities to study in foreign higher education institutions and to reveal the challenges and opportunities for the development of academic exchanges in higher education. The questionnaire was constructed on the basis of theoretical insights, criteria selected in the scientific literature, based on which students' mobility for academic purposes was studied, factors determining participation in exchange programmes, and reasons limiting students' international academic mobility. The validity and reliability of the questionnaire were determined by calculating the Cronbach's alpha values for each group of statements in the questionnaire. The results of the statistical analysis show that the group of statements in the questionnaire on the benefits of Erasmus + mobility programs for students preparing for a professional career has a sufficiently high internal compatibility rate (Cronbach's alpha) ranging from 0.841 to 0.851, except for the statement with a negative value of Cronbach's alpha = 0.774; therefore, this statement is analysed as a separate variable.

After checking the internal consistency of the statement group on the possibilities of *Exchange possibilities development in higher education*, the Cronbach's alpha = 0.8639 was calculated and ranged from 0.8479 to 0.8702. In defining the main reasons for non-participation in the Erasmus + mobility programme, the aim is to test several constructs in this regard. For this purpose, the analysis of principal component factors using a Varimax rotation was performed. The results show that the data are suitable for factor analysis: KMO = 0.793 (possible KMO not less than 0.6), and Bartlett specificity test  $p < 0.001$ . The results of the factor analysis show that the statements in the question consist of three factors (see Table 1). Factor weights in each factor range from 0.41 to 0.791. The calculated internal degree of agreement (Cronbach alpha) for each factor and the number of statements are presented in Table 1. Based on the fact that internal consistency should be between 0 and 1, and a Cronbach's alpha of 0.60 is considered suitable for research (Pakalniškienė, 2012), the Cronbach's alpha calculated in this study indicates that the groups of statements in the question should be considered compatible.

**Table 1.** Reasons for not participating in the Erasmus + mobility programme: internal compatibility of factors

Factors	Number of statements	Cronbach alpha
External causes in high school	9	0.627
Personal reasons	8	0.806
Environmental factors	7	0.65

*Statistical research method.* Statistical analysis methods were used to process the data collected during the study: calculations of percentage frequencies and statistical averages. Statistical analysis of the data was performed using the data package of SPSS software version 17.

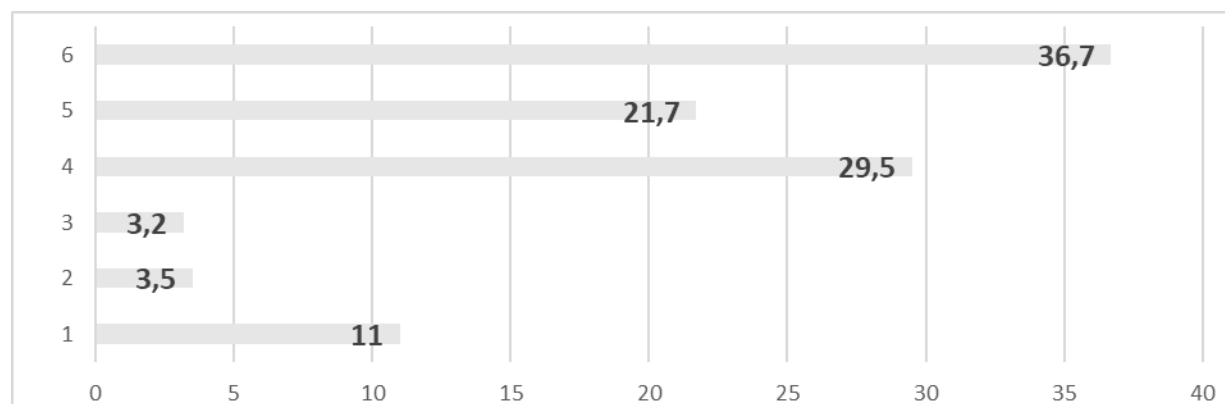
#### 4. The research results and their analysis

With the rapid processes of globalization, the demand for higher education and the need to acquire it are obvious. The prevailing trend - increasing demand for higher education, the need for higher education - encourages academic mobility of students. Thus, as higher education becomes more and more international, the importance of opportunities for students to deepen their knowledge and broaden their horizons by choosing to study at a foreign higher education institution is obvious. However, are students taking advantage of the opportunity to participate in international academic mobility programmes?



Analysing the respondents' participating in the Erasmus+ mobility programme experience (see Figure 1), the analysis of the data showed that only 11% of students who participated in the survey have participated in the Erasmus+ programme while preparing for professional activities and have taken the opportunity to go to another higher education institution or having an internship in a foreign country and gain knowledge, experience and skills there. The stronger passiveness of students to participate in the international academic mobility programme is also evidenced by the fact that only a small percentage of survey participants (3.5%) were selected but could not leave or did not take part in the competition due to the global pandemic (3.2%).

The results of the survey also showed that almost a third (29.5%) of the respondents did not go to other foreign higher education institutions to study, but are plan to participate in the Erasmus + programme in the future, and 21.7%. the students who participated in the study have thought many times (4 times and more) about participating in an international academic mobility programme, but did not take action for objective or subjective reasons. Thus, the latter results do not reject the possibility that facilitating the academic mobility of students and improving the framework for the promotion and implementation of international academic mobility is likely to increase student mobility rates. The need for action is also reflected in the fact that more than a third (36.7%) of survey participants did not plan and are not planning to participate in the Erasmus+ mobility programme in the future (see Picture 1).



**Picture 1.** Experience of participating in Erasmus + mobility programme: students' assessment (n=349; %)

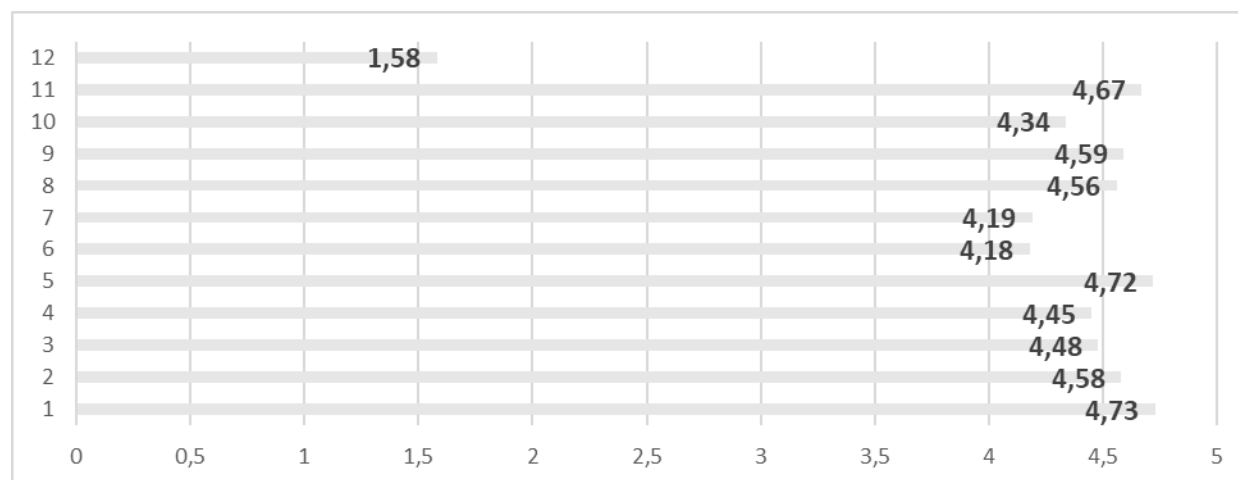
*Remark:*

- |   |   |
|---|---|
| 1. I have already participated in the Erasmus+ mobility programme                             | 4. I am planning to participate in the Erasmus+ mobility programme  |
| 2. I took part in the competition, was selected but could not go due to the Covid-19 pandemic | 5. Yes, many times (4 times or more) I have thought about participating in the Erasmus+ mobility programme, but I have not taken action |
| 3. I have participated in the competition, but was not selected                               | 6. I did not and am not planning to participate in the Erasmus+ mobility programme  |

International academic mobility is probably most often associated with students' academic, professional progress and personal change in terms of knowledge, skills, values and attitudes (Juknytė-Petrekienė and Pukelis, 2007). Undoubtedly, young people's academic mobility in preparation for their careers is very important. International mobility enriches students' learning through international experience, develops intercultural competences and general abilities that allow them to compete more successfully in the national and international labour market. On the other hand, integrated part-time studies at a foreign university or an internship in a foreign company provide students with the opportunity to gain subject, linguistic and cultural international experience; students develop communication skills and have further international professional activities perspectives (Knight, 2004).



This is further illustrated by the results of this study, which show that students are positive about the benefits of participating in the Erasmus+ mobility programme (see Picture 2). The highest average values of the estimates showed that, according to the participants of the research, participation in mobility programmes enhances the experience of learning about the new cultural environment ( $M = 4.73$ ) and students have the opportunity to improve their spoken foreign language after moving to another foreign university ( $M = 4.72$ ). On the other hand, by participating in academic mobility programmes, students have the opportunity to change their environment, travel and see the world ( $M = 4.67$ ), acquire independence skills ( $M = 4.59$ ) and develop intercultural competencies, attitudes and values ( $M = 4.58$ ). The positive average of the exchange programmes ( $M = 1.58$ ) adds to the positive evaluation of the exchange programmes, indicating that the majority of respondents do not agree that students do not benefit from participating in the Erasmus+ mobility programme. As the results of the study show, participants of the research least associate the benefits of students' participation in mobility programmes with the increasing employment opportunities and prospects in the national and intercultural labour market ( $M = 4.18$ ) and greater career opportunities in the national and international environment ( $M = 4.19$ ); these variables are based on the lowest estimates of the maximum possible 5.



**Picture 2.** Evaluation of the benefits for a student to participate in the Erasmus+ mobility programme (n = 349; M-average value, max = 5)

*Remark:*

1. The experience of recognition of a new cultural environment is strengthened (knowledge of mentality, life and human relations of other countries, etc.)
2. Intercultural competences, attitudes and values are formed (cultural awareness, cultural knowledge, skills, etc.)
3. Students' understanding of the economic and social culture of other countries is expanded
4. Students' tolerance of other cultures is developed
5. The student improves spoken foreign language skills
6. Employment opportunities / perspectives of students in the national and intercultural labor market are increasing
7. Students have greater career opportunities in the national and international environment
8. Students get acquainted with studies and practice organized differently than in Lithuania (teaching / learning and assessment methods, etc.)
9. Students gain more independence skills
10. The student breaks away from everyday life and has a good time
11. The student travels, changes the environment, sees the world
12. The student does not receive any benefit

Summarizing the results, the answers showed that the general personal abilities and socio-cultural skills acquired through participation in international academic mobility programmes are of great importance to the respondents. Participants in the research indicated that participation in academic mobility programmes provides experience in communication and cooperation with representatives of other cultures, improves professional foreign language

skills, develops independence skills in adapting to a new environment and flexibility in relation to other socio-cultural living conditions. On the other hand, the survey shows that respondents associate the potential benefits of international academic mobility to a lesser extent with a competitive advantage in the national and international labour market, greater employment and career opportunities nationally and internationally. Thus, according to students, participation in international academic mobility programmes is less related to the knowledge and skills acquired for a future professional career. It should be noted that the indicators reflecting the benefits of international academic mobility are in line with and confirm the aspects identified in the scientific literature, such as: experience gained, personal development that includes tolerance of other cultures, independence and communication skills in a foreign language, and so on.

Despite the fact that ongoing globalization processes act as a catalyst for academic mobility, barriers to international mobility exist. Researchers who have identified barriers to the development of academic mobility identify the cost of living and cost of studies, language, cultural or religious differences, lack of information, differences in living standards, restrictions of acknowledgement of the qualification gained, restrictions on possibility to work while studying, re-recognition of newly acquired qualifications, etc. (Knight, 2004).

The analysis of the reasons why the participants did not take the opportunity to go to a higher education institution abroad for academic purposes was based on the evaluations of the respondents who did not participate in the Erasmus+ exchange programme. After factor analysis, three groups of reasons were identified: personal, related to higher education institution, and environmental factors.

The results of the statistical analysis show (see Table 2) that non-participation in the Erasmus+ exchange programme is mainly due to personal reasons; the highest average scores found in the group of personal reasons range from 2.01 to 1.62 out of 3. The study found that fear, lack of self-confidence due to insufficient professional knowledge and skills ( $M = 2.01$ ) and lack of foreign language skills ( $M = 1.98$ ) are among the reasons for not participating in the Erasmus+ mobility programme. On the other hand, the personal reasons why students have not yet participated in an international academic mobility programme are intimidating selection procedures and interviews ( $M = 1.98$ ) and fears of possible difficulties in adapting when moving to another country ( $M = 1.98$ ). Therefore, one of the ways to solve this problem is to start partnership with foreign higher education institutions and companies, disseminate information about the implemented study programmes, higher education institution and study conditions by involving mobile students, organizing virtual or physical meetings with foreign higher education teachers before the student goes to a foreign higher education institution or company for an internship. It is likely that the development of cooperation networks would not only help to adapt more successfully to new conditions in another country and to the requirements of the institution, but would also increase the mobility of students internationally.

Slightly lower average estimates suggest that environmental factors are less associated by research participants with reasons that may influence their decision not to participate in an international academic mobility programme; in this group of statements, average scores range from 1.83 to 1.24 (see Table 2). According to the statistical analysis of the data, the reluctance to separate with family members ( $M = 1.83$ ) or close friends ( $M = 1.8$ ) is one of the reasons why the students have not participated in the international academic mobility programme so far. A similar situation arose when assessing the inadequate (too long / too short) proposed period of the mobility ( $M = 1.65$ ) and fear of losing one's job ( $M = 1.6$ ), which from the respondents' point of view, is one of the reasons for not participating in the academic mobility programme.

Analysing the reasons why students do not participate in the international academic mobility programme, the lowest average scores, ranging from 1.8 to 1.13, indicate (see Table 2) that the research participants associate these reasons with higher education institution the least. According to the respondents, insufficient financial support (scholarship) ( $M = 1.8$ ), as well as lack of help from the sending institution, when the student has to find a place to study abroad independently ( $M = 1.65$ ), are one of the reasons why the study participants have not yet

participated in the Erasmus+ mobility programme. On the other hand, the analysed research data show that the possibility to participate in the Erasmus+ programme competition is limited by poor academic results ( $M = 1.63$ ).

**Table 2.** Personal reasons related to higher education institution and environmental factors determining students; non-participation in the international academic mobility programme (n = 349; M-average values, max = 3)

Personal reasons	M
I don't know what to start from.	1.82
Intimidating selection procedures (application, selection interview).	1.98
Documentation procedures are intimidating.	1.78
Organizational issues (buying tickets, accommodation, etc.)	1.89
The potential difficulties of adaptation when moving to another country are frightening.	1.98
Fear, lack of self-confidence due to poor foreign language skills.	1.98
Fear, self-confidence due to lack of professional knowledge and skills.	2.01
I am not interested in the Erasmus+ mobility programme.	1.62
<b>Environmental factors</b>	
Poor feedback from students who participated in the Erasmus+ mobility programme.	1.35
Reluctance to break up with family members.	1.83
Reluctance to break up with close friends.	1.8
Lack of support from the family.	1.24
Fear of losing one's job.	1.6
Inappropriate (too long) proposed mobility period (e.g. 5 months for studies, 3 months for internships)	1.65
Inappropriate (too short) proposed mobility period (e.g. 5 months for studies, 3 months for internships)	1.65
<b>External causes in the high education institution</b>	
I knew nothing about such a possibility.	1.21
I participated in the competition but was not selected.	1.13
Information about Erasmus+ is not provided in the higher education institution website.	1.44
I asked, but did not receive information from study consultants about the Erasmus+ programme.	1.15
I found out about the Erasmus+ exchange programme too late.	1.3
Lack of help from the sending institution (I have to find a place to study abroad myself, etc.)	1.65
Insufficient financial support (scholarship) for participation in the Erasmus + mobility programme.	1.8
I'm afraid to get worse grades when I leave and lose the scholarship I get from higher education institution.	1.35
I cannot participate in Erasmus+ competition due to low academic performance.	1.63

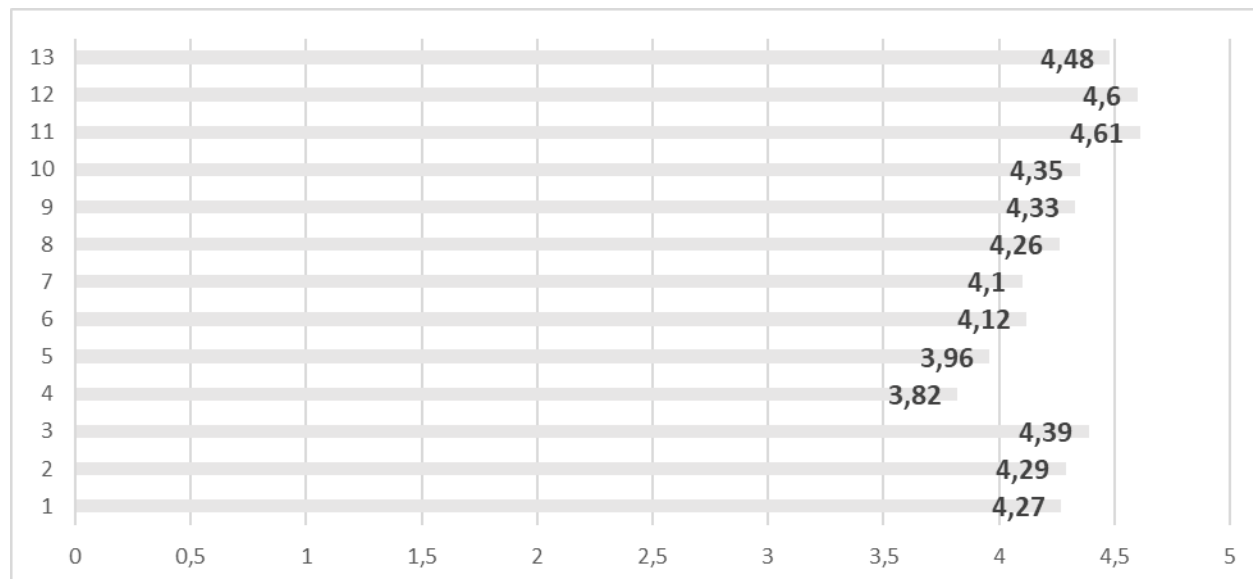
Summarizing the data, we can see a clear trend in the assessment of factors related to personal reasons, such as a person's fear of insufficient professional knowledge and skills and poor assessment of his / her foreign language skills, as well as possible difficulties in adapting to another culture, which, according to the research participants, has an impact on not participating in the international academic mobility programme. On the other hand, according to the research, the reasons why respondents did not participate in the Erasmus+ mobility programme so far are related to the environmental factors: they do not want to be separated from family and close friends, and the reasons for not participating in the academic mobility programme are least related to higher education institution including insufficient financial support and lack of assistance from the sending institution in finding a place to study abroad, etc. Undoubtedly, the reasons mentioned may reduce students; willingness and intention to participate in an international academic mobility programme.

With the growing need for higher education, initiating international academic mobility in the higher education sector is becoming one of the priority areas. Therefore, in addition to the use of already proven means, there is a need to find more effective ways for managing academic mobility in the face of ever-changing global conditions and the challenges of a changing external environment. Analysing the opportunities for the development of students' international academic mobility, the research suggests the idea that higher rates of student mobility would be determined by sufficient implementation of publicity of academic exchanges and promotion of students, as well as greater availability of study exchanges.

Examining students' opinions on the possibilities of developing international academic mobility (see Picture 3) identifies the importance of higher scholarships ( $M = 4.6$ ) and paid internships ( $M = 4.61$ ), which, according to

students, are one of the main measures promoting the academic mobility of students. Thus, a material incentive to create a comfortable study environment that meets a person's needs can be one of the factors and the main motives for academic mobility. Also, opportunities for groups of students to go to the same higher education institution or company in another country ( $M = 4.48$ ) and the variety of places offered for academic exchange (educational institutions, internships) ( $M = 4.39$ ), according to the research participants, encourage students to become more involved in international academic mobility programmes. Based on this, it is expedient to expand the network of cooperation with foreign higher education institutions and companies, to create international networks that are essential for acquiring most recent knowledge, to form and initiate an environment for cooperation between higher education institutions in creating a common higher education area. On the other hand, the aspects of the quality of the higher education system and the high economic development of the country are identified as one of the essential in order to increase the academic mobility of students. According to the participants of the research, students have the opportunity to choose higher education institutions in economically strong countries with a high level of development ( $M = 4.26$ ) and countries with a high level of professional training (education, studies and internships) ( $M = 4.35$ ) would encourage students to participate more actively in international academic mobility programmes. The latter results are in line with Želvis' (2006) idea, which emphasizes that students willing to study abroad tend to choose economically developed countries which achievements in higher education are universally recognized. It is also identified as one of the key ways to promote international academic mobility, enabling students to participate more actively in academic exchange programmes - opportunities for students to travel to countries in an attractive geographical area ( $M = 4.33$ ). The lower averages of the estimates indicate that, according to the respondents, increasing the attractiveness of higher education institutions participating in academic mobility programmes in other countries ( $M = 4.29$ ) and providing more detailed information on opportunities to participate in exchange programmes ( $M = 4.27$ ) would increase participation in international academic exchange programs less. Slightly lower, but also significant data show that, according to the study participants, meetings with students participating in academic exchange programmes, sharing good practices ( $M = 4.12$ ) and disseminating students' experiences on social media ( $M = 4.1$ ) would encourage students to be more active in participating in international academic mobility programmes. Recent results show the effectiveness of disseminating information about academic mobility programmes in a variety of ways and channels. According to the research participants, students who have participated in exchange programmes by passing on their academic experience to other students during events organized at the higher education institution would help to form a positive attitude towards academic international exchange.

Whereas the virtual implementation of international academic exchanges and the development of short-term mobility (academic exchanges) are not marked with high average scores as one of the means to increase internationalization in higher education (see Picture 3). According to the participants of the study, opportunities to participate in short-term exchanges (5 days abroad, the rest of the time - online) ( $M = 3.96$ ) or the opportunity to participate in a virtual academic mobility without leaving the country ( $M = 3.82$ ) are less effective ways of encouraging students to participate more actively in academic mobility programmes. Recent findings suggest that there is still a widespread perception of traditional international mobility, with greater recognition of studies conducted in a physical academic setting. However, in the context of ongoing globalization, the implementation of virtual international academic mobility, based on communication and collaboration and technology, will make it inevitable for higher education institutions to respond to changes in the world in the near future. It is likely that the implementation of virtual mobility in the near future will not only enrich but also change physical mobility by responding to students' needs and by managing and creating a virtual learning environment, selecting ways and means to organize and implement technology-based studies and facilitating international academic mobility programmes for students who, for various subjective or objective reasons, are unable to leave their country, job or family. Thus, the organization of technology-based studies is an inevitable and one of the priority areas for the organization and implementation of virtual mobility in the near future. On the other hand, virtual mobility directly determines the quality of studies, the internationality of studies, the supply and diversity of studies and the modernization of higher education (Volungevičienė, Teresevičienė, 2008).



**Picture 3.** Opportunities to promote students' participation in international academic mobility programmes (n = 349; M-average values, max = 5)

*Remark:*

1. More information on opportunities to participate in the Erasmus+ study exchange programme.
2. Enhancing the attractiveness of higher education institutions in other countries participating in Erasmus+ mobility programme.
3. Variety of Erasmus+ exchange places offered (educational institutions, companies etc.)
4. Opportunity to participate in a virtual Erasmus+ mobility programme without leaving the country to study at a higher education institution in another country
5. Possibility to participate in short-term exchanges (5 days abroad, other time online)
6. Meetings with Erasmus+ students, sharing good practices (e.g. Erasmus+ Days)

7. Public dissemination on social media of the experiences of students participating in Erasmus+ mobility programme.
8. Possibility to travel to countries with a high level of economic development.
9. Possibility to travel to countries in an attractive geographical area (warm climate, seaside, etc.).
10. Possibility to go to countries with a high level of quality of higher education (education, studies and internships).
11. Paid internship place.
12. Higher Erasmus+ scholarships.
13. Opportunity for groups of students to go to the same higher education institution / company in another country.

Summarizing the results of the research, the factors significant for increasing the active participation of students in academic mobility programmes were identified: higher financial support (scholarships, paid internships), as well as an attractive geographical and cultural aspect, higher level of economic development of the country. In addition, the importance of the quality of higher education (professional training) is perceived, which, according to students, would increase the rates of academic mobility and the more active involvement of students in participating in mobility programmes. Also, increasing the international attractiveness of studies, foreign higher education institutions and disseminating information about the variety of exchange places offered are identified as one of the ways to encourage students to become more actively involved in academic international mobility.

However, the limitation of this study should be mentioned, which is defined by the fact that the sample consisted of the majority of students who did not participate in international academic mobility programmes. Therefore, in order to further explore the possibilities of promoting academic mobility of students, in the future it would be



appropriate to expand the sample to include students with exchange experience and explore how academic mobility changes students' behaviour, knowledge, understanding, values and skills. The insights provided by students on how to increase their participation in mobility programs would provide an opportunity to improve the situation.

## Conclusions

1. The implementation of international academic mobility supports and ensures the attractiveness of higher education institutions in the international environment, however, there are many barriers to the development and implementation of academic mobility, such as language and cultural differences, lack of information, non-recognition of foreign qualifications, differences in living standards, migrant status, visa problems and lack of funding.

2. The situation of the implementation of international academic mobility in higher education has been clarified by the statement study:

2.1. As the results of the research show, although almost a third of respondents plan to participate in the Erasmus+ programme in the future or have planned to do so but did not take action for objective or subjective reasons, more than a third of respondents did not and do not intend to participate in the Erasmus+ mobility programme. have participated in an Erasmus + program, participated in a competition, failed to pass or been selected but were unable to leave for objective reasons. Recent results have highlighted the need to improve the framework for promoting and implementing international academic mobility in higher education.

2.2. The highest averages of the estimates indicate that fear, lack of self-confidence due to lack of professional knowledge and skills, lack of foreign language skills, intimidating selection procedures and interviews, and fear of possible adjustment difficulties when moving to another country, as well as reluctance to separate with close friends and insufficient financial support (scholarship) are the reasons for not participating in the Erasmus+ mobility programme.

3. Based on the results of the research, the possibilities for the development of international academic mobility in higher education are foreseen:

3.1. According to the participants of the study, higher scholarships and paid internships, as well as opportunities for groups of students to go to the same higher education institution or company in another country would encourage students to participate more actively in international academic mobility programmes.

3.2. Despite the fact that the implementation of virtual international academic mobility for higher education institutions will become inevitable in the near future in order to respond to changes in the world, the analysis of data shows that virtual international academic exchanges and short-term mobility (academic exchanges) are less effective encouraging students to participate more actively in academic mobility programmes.

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**Agnė JUŠKEVIČIENĖ**, Doctor of Social Sciences (Educology), Docent of the Faculty of Business Management of Vilnius University of Applied Sciences, Didlaukio Str., 49, Vilnius, e-mail: administracija[eta]vvf.viko.lt.; research interest areas: inclusive, multicultural education in higher and general education school, acquisition and development of general and subject competencies, formation of identity in adolescence.

ORCID ID: <https://orcid.org/0000-0001-9732-8616>

**Kristina SAMASONOK**, Doctor of Social Sciences (Educology), Docent of the Faculty of Business Management of Vilnius University of Applied Sciences, Didlaukio Str., 49, Vilnius, e-mail: administracija[eta]vvf.viko.lt.; research interest areas: social exclusion risk for adolescence adaptation, institutional development and adaptive behaviour modelling, the first year students' adaptation to the study process, motivation factors for choosing studies, developing students' creative thinking in a higher school.

ORCID ID: <https://orcid.org/0000-0002-8985-6942>

**Adomas Vincas RAKŠNYS**, Doctor of Social Sciences (Management), Associate Professor of the Faculty of Business Management of Vilnius University of Applied Sciences, Didlaukio Str., 49, Vilnius, e-mail: administracija[eta]vvf.viko.lt.; research interest areas: organizational culture, public governance, risk management.

ORCID ID: <https://orcid.org/0000-0002-2128-6314>

**Lina ŽIRNELĖ**, Master of philology at Vilnius university. Lecturer, Erasmus coordinator and the Head of Advertising and Communication Department at of the Faculty of Business Management of Vilnius University of Applied Sciences, Didlaukio Str., 49, Vilnius, e-mail: administracija[eta]vvf.viko.lt. Research interest areas: intercultural communication, creativity, CSR, internationalization.

ORCID ID: <https://orcid.org/0000-0002-4100-7319>

**Vilma GEGUŽIENĖ**, Lecturer of the Faculty of Business Management of Vilnius University of Applied Sciences, Didlaukio Str., 49, Vilnius, e-mail: administracija[eta]vvf.viko.lt.; research interest areas: sociology of education, research methodology, public speaking theory and practice, development of creative thinking in higher education.

ORCID ID: <https://orcid.org/0000-0002-9568-020X>

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## TASK-TECHNOLOGY FIT PERSPECTIVE OF THE USE OF M-COMMERCE BY RETAIL BUSINESSES

Mateus Vicente Justino <sup>1</sup>, Robertson K. Tengeh <sup>2</sup>, Michael Twum-Darko <sup>3</sup>

<sup>1,2,3</sup> Faculty of Business and Management Sciences, Cape Peninsula University of Technology, South Africa

E-mails:<sup>1</sup> [mvjmateus22@gmail.com](mailto:mvjmateus22@gmail.com); <sup>2</sup> [tengehr@cput.ac.za](mailto:tengehr@cput.ac.za); <sup>3</sup> [darkom@cput.ac.za](mailto:darkom@cput.ac.za)

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**Abstract.** Mobile commerce (m-commerce) has gradually increased in popularity among small and medium-sized retail businesses in developing countries in recent years. As a result, scholars and retail practitioners have been eager to understand better the factors that influence this new mobile channel usage. The article examines the primary determinants of retail personnel's use of m-commerce in Angola through the theoretical lens of Task-Technology Fit (TTF). This study followed a cross-sectional design and adopted the positivist research paradigm. As such, a structured questionnaire was used to collect data from retail business personnel and actual users of m-commerce (n = 229). Structural Equation Modeling (SEM) analysis was performed on the data collected using the Analysis of Moment Structures (AMOS) software. The findings indicated a strong correlation between the four dimensions of task characteristics (i.e., time criticality, mobility, non-routineness, and interdependence) and the task-technology fit dimensions. Additionally, it was determined that there is a strong correlation between the functionalities of m-commerce systems (i.e., Mobile Notification, Mobile Information Exchange, Mobile Information Search, and Mobile Data Processing) and the TTF dimensions. In comparison, the study discovered a minimal correlation between task-technology fit as correspondence and m-commerce use. As a result, some directions for future research were provided.

**Keywords:** Mobile commerce (m-commerce); Retailer; Retailing; Small and Medium Enterprises (SMEs); Mobile Commerce Application; Task-Technology Fit (TTF); Angola; Luanda

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### 1. Introduction

Mobile commerce (m-commerce) is an innovation that enables businesses to sell products or services via mobile technologies (Liang & Wei, 2004:7; Gitau & Nzuki, 2014:88), that is, using a wireless business model. The use of this innovation in the retail sector has caught the attention of scholars and retail practitioners (Chen, 2017:5793; Kamble, Gunasekaran, Parekh & Joshi, 2019:154; Verhoef, Kannan & Inman, 2015:179; Franque et al., 2022). However, despite the growth of m-commerce in many economies (Zhao, 2016; Chen, 2017; Chau & Deng, 2018, Finotto Christine & Procidano, 2020:1), there is still considerable debate about the determinants of

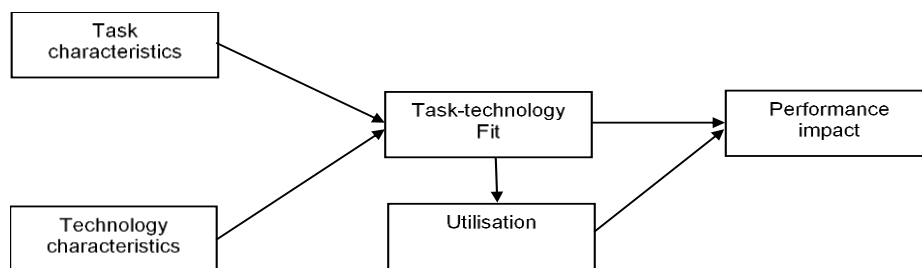
retailers' m-commerce use. Although the Coronavirus pandemic affected retailers' current adoption and use of m-commerce (Finotto et al., 2020:1; Gamser & Chenevix, 2020; Goddard, 2020:4; Wang et al., 2021), there have been several theoretical interpretations of the determinants of new technology adoption and use. Some of these models/frameworks include the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), Technology Acceptance Model (TAM) (Davis, 1989), Task-Technology Fit (TTF) model (Goodhue & Thompson, 1995), Innovation Diffusion Theory (IDT) (Rogers, 1995), the Information System Success (ISS) model (DeLone & McLean, 1992) and Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis & Davis, 2003). Furthermore, these theoretical models/frameworks also support a distinct set of determinants for evaluating the adoption or use of technological innovation, highlighting the importance of examining the determinants of m-commerce by retailers using the Task-Technology Fit (TTF) model. Although, TTF is applied to evaluate consumers' innovation adoption or use because of its coherent structure (Klopping & McKinney, 2004; Wang et al., 2021; Zhang et al. 2021; Franque et al. 2022), TTF has been one of the earlier models used to explore and test the use of new technologies in organisations (Lee, Cheng & Cheng, 2007; Yen, Wu, Cheng & Huang, 2010; Yuan, Archer, Connelly & Zheng, 2010; Shih & Chen, 2013). It is predicated on the premise that the absence of technological functions capable of meeting a business' task requirements indicates a mismatch between technology and business-related tasks. That is, the technology will have no beneficial effect on task performance and will be unfit for business use (Goodhue & Thompson, 1995:213; Dishaw & Strong, 1999:11; Gebauer, Shaw & Gribbins, 2010:260; Yuan et al., 2010:125; Vongjaturapat, 2018:40; Zhang et al., 2021).

This paper assumes that retail businesses' use of m-commerce may necessitate a variety of tasks that must be performed on m-commerce systems that also require a combination of m-commerce system functionalities to accomplish those tasks. As such, this study applied the TTF model to understand and determine (a) the task characteristics that play a role in the use of m-commerce by retailers; (b) the functionalities of m-commerce systems that are critical for the use of m-commerce by retailers; and (c) the fit conceptualization that will adequately link retail task characteristics and functionalities of m-commerce systems.

## 2. Overview of theoretical underpinning

### 2.1 Introduction

Bauböck (2008:59) argues that from a political science perspective, empirical research can be guided by theory, and theory can be improved by empirical research. As such, this study applied TTF as a theoretical lens to understand the phenomenon and not just rely on hypothetical arguments. Goodhue and Thompson (1995:213) proposed the TTF as a subset or reduced model of the Technology-to-Performance Chain (TPC) theory. As illustrated by Figure 1, there are five constructs in the TTF model: 1) task characteristics and 2) technology characteristics, which influence 3) task-technology fit, which in turn predicts 4) utilisation, and 5) the two last constructs predict performance (Goodhue & Thompson, 1995:216; Dishaw & Strong, 1999:11; Gebauer *et al.*, 2010:260).



**Figure 1.** Task-technology fit model

Source: Goodhue and Thompson (1995)

## **2.2 Functionalities of m-commerce systems**

Given the work of Yuan et al. (2010:125) which examined the fit of mobile task and mobile work support functions, classification of the functionalities of mobile work support, such as mobile job dispatching, notification, navigation for travel guidance and location tracking, was necessary found to be suitable. Furthermore, in other mobile systems research, the technology characteristics construct was particularly termed a personal digital assistant (PDA) m-commerce systems (Lee et al., 2007:98) or tool functionality (Shih & Chen, 2013:1017). Therefore, the study drew on the functionalities of m-commerce systems because of the functions that mobile devices can support and provide for the execution of particular task characteristics. Mobile functionalities have been analysed as a notification (Gebauer & Shaw, 2004:22; Zheng, 2007:54; Yuan et al., 2010:125; Gebauer et al., 2010), navigation (Yuan et al., 2010:125), mobile transaction/data processing, communication (i.e., for mail, discussions, information exchange), online/information access (Gebauer & Shaw, 2004:22; Gebauer et al., 2010:363; Lembach & Lane, 2011), mobile information searching, mobile office, (Zheng, 2007:54; Lembach & Lane, 2011) mobile job dispatching, location tracking (Zheng, 2007:54; Yuan et al., 2010:125).

## **2.3 Task characteristics**

In general, the task characteristics of TTF as a theoretical lens have been the time a task would be required to perform; for example, time criticality (Gebauer et al., 2010:261; Yuan et al., 2010:125; Gatara & Cohen, 2014:333), or time-dependency (Junglas, 2003). Task characteristics are further analysed by their degree of difficulty, whether they are highly predictable, complex, analytic, and full of uncertainty or exceptions. Such task characteristics include task non-routineness (Daft & Macintosh, 1981:207; Gebauer et al., 2010:261) and task complexity (Zheng, 2007). The attributes of tasks could be analysed in relation to this study as task interdependence, meaning the degree to which workers depend upon each other to accomplish their tasks (Goodhue & Thompson, 1995:222, Zheng, 2007; Gebauer et al., 2010:261). Given the work of Yuan et al. (2010:125) and Gatara & Cohen (2014:333) and in the context of this study, mobile work would rely on mobility characteristics and location/information dependency characteristics as dimensions of tasks that need to be carried out in different location and of those that need travelling or equipment location-related information.

## **2.4 Conceptualisation of task-technology fit**

There are distinct types of fit that have been institutionalised in TTF as a theoretical lens. The task-technology fit constructs operationalised by Goodhue and Thompson (1995:218) denote the interplay between the technology and task. In other words, the dimensions of the task-technology fit construct reflect the net result of the interactions between the two constructs (task characteristics and technology characteristics) (Goodhue & Thompson, 1995:218). Other fits available for assessing the success of technology include the six approaches of fit, i.e., "fit as moderation, fit as mediation, fit as matching, fit as Gestalt, fit as a profile and fit as covariation", proposed by Venkatraman (1989:423). These institutionalisations of fit are widely used in strategic management but can also be applied to evaluate the fit between task and technology (Strong, Dishaw & Bandy, 2006; Gatara & Cohen, 2014; Gatara, 2016). For example, fit as moderator has been conceptualized as computed interaction in TTF research (Dishaw & Strong, 1999:14; and Strong, Dishaw & Bandy, 2006:99).

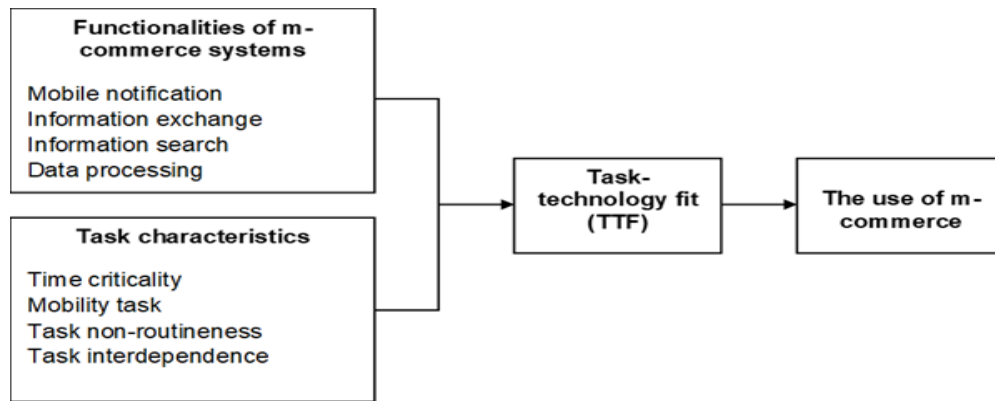


## 2.5 The “use” construct

The “use” construct in TTF theory reflects the individual’s behaviour towards the deployment of the technology in completing tasks (Goodhue & Thompson, 1995). In their evaluation, Goodhue & Thompson (1995) argue that the use of technology should be accessible by the degree of workers’ dependence on it and that, according to Dishaw & Strong (1999) and Gebauer (2008), the use is determined by the frequency of use or according to Teo & Men (2008) and McGill & Klobas (2009) the intensity of use or how much time a user spends using it. Furthermore, the use of technology, from the work of Goodhue & Thompson (1995:8) and Goodhue (1997), can be institutionalised as a binary condition of 0-1, i.e., the choice of a particular individual or organisation to use specific technology for performing a task (thus, 1), or not to use it (thus, 0).

## 3. Research Approach

Given the discussions on the TTF as underpinning theory for this study, Figure 2 represents the extended TTF model with relevant dimensions to explore and explain the determinants of the use of m-commerce by retail personnel. Each construct of the proposed model and its interactions are discussed below.



**Figure 2.** Proposed TTF model for retail’s personnel use of m-commerce

**Retail-related task characteristics:** According to the reviewed literature, four task characteristics are believed to drive the retail activities associated with m-commerce (see Figure 2). These tasks are defined in Table 1. We believe that retail employees will be required to perform time-sensitive tasks that must be completed quickly to provide timely services or minimize risks or obstacles in a complex and wireless environment. The use of mobile commerce necessitates mobility tasks, that is, tasks that do not confine retail workers to their usual geographical boundaries (Basole, 2004; Gebauer et al., 2010:263) in order to deliver services that require workers to leave the business premises. Retailers will also be required to perform non-routine tasks. That is, tasks that vary in processing complexity and are likely to be unstructured, novel or unknown and relate to information searching, the interactive transmission of data, data interpretation, data editing, and document production (Stair, Reynolds & Chesney, 2008). Furthermore, the use of m-commerce by retailers involves high interdependent tasks, thus, matching the order processing unit with the stock keeper and service delivery units. In general, task interdependence requires frequent coordination and being regulated into procedures.

*Support for task characteristics and task-technology fit:* Goodhue and Thompson (1995) proposed the task construct as antecedents of the task-technology fit. Thus, task characteristics have been incorporated into several studies to ensure that they are appropriate for innovation and affect task-technology fit (Goodhue & Thompson, 1995; Gebauer & Shaw, 2004; Lee et al., 2007; Yen et al., 2010:913). Additionally, Lee et al. (2007:107) argue that personal digital assistant technology does not provide the same level of assistance for all types of tasks because the level of assistance varies. We anticipate that the impact of task characteristics on task-technology fit dimensions will vary. Therefore, it is hypothesised that:

**HP1a:** The task characteristics have direct effects on perceived task-technology fit.

**HP1b:** Different task characteristics may fit in with functionalities of m-commerce systems in different dimensions of task-technology fit.

***The functionalities of m-commerce systems:*** The functions depicted in Figure 2 should be available for the use of m-commerce by retailers. In general, m-commerce systems should enable retail employees to notify clients about an order they placed to ensure delivery or alert business stakeholders to an emergency or critical situation. Additionally, retail employees may require m-commerce systems to exchange information (in a reciprocal manner) among themselves and with other stakeholders such as customers. They may rely on information exchange functions to establish clarity regarding assignments, orders, addresses, and progress (Lee, Lee & Kim, 2004:149; Zheng 2007:94; Gebauer et al., 2010:264). Retailers require mobile commerce systems that facilitate information/data search. The system should include processing functions that enable customers to perform shopping tasks (Wang et al., 2021:1), i.e. to enter and process data via mobile devices and allow retail employees to capture, interpret, and process transaction data.

*Support for functionalities of m-commerce systems and task-technology fit:* The proposed model shows a path from the functionalities of m-commerce systems to the task-technology fit. Many other studies have suggested such a path (Dishaw & Strong, 1999:13; Yen *et al.*, 2010:913; Prabowo et al., 2018:307). Due to the different functionalities of m-commerce systems, it is presumed that the strength of their relationship with task-technology fit may vary (Lee et al., 2007:107; Teo & Men, 2008). A tool's functionality is likely to be more compatible with certain task-technology fit dimensions than others (Lee et al., 2007:107). Therefore, it is hypothesised that:

**HP2a:** The functionalities of m-commerce systems directly affect perceived task-technology fit.

**HP2b:** Different functionalities of m-commerce systems may fit with task characteristics in different dimensions of task-technology fit.

Table 1 provides a short description of the functionalities of the technologies, task characteristics and the task-technology fit and use of m-commerce.

**Table 1.** Explanation of model dimensions

Dimension	Definitions
<b>Functionalities of m-commerce systems</b>	
Mobile notification	is deployed to notify other stakeholders without expecting a direct response (Gebauer et al., 2010:263).
Mobile information exchange	involves reaching and being reached by others immediately via mobile technology to clarify things, such as assignments, orders, addresses and progress.
Mobile information search	used to search for products, customers, suppliers or other business partners' related information on the business' mobile Information Systems (intranet wireless connection (database) or online when needed (Yuan et al., 2010:127).
Mobile data processing	used to process tasks-related transactions such as sales, inventory management and shipment or delivery, and manage schedules, provide reports on transactions (Gebauer et al., 2010; Lembach & Lane, 2011) and for "data editing, data manipulation, data storage and document production" (Stair et al., 2008).
<b>Task characteristics</b>	
Task non-routineness	reflects the extent to which a task is complex, multifaceted, predictable and reflects non-repetitive procedures in its execution (Gebauer et al., 2010:261).
Mobility task	reflects the extent to which the task forces workers to travel and use the m-commerce systems to perform tasks away from their business premises, off-site (Yuan et al., 2010:129; Gatara & Cohen, 2014:326).
Task interdependence	reflects the degree to which the task requires the worker to interact with co-workers to achieve the goals (Gebauer et al., 2010:265).
Time criticality	the attributes that require a task to be performed with urgency, such as the short time required to complete the task (Gebauer et al., 2010:261).
Task-technology fit	The correspondence between the dimensions of task and functionalities of the technology (Goodhue & Thompson, 1995:218).
The use of m-commerce	reflect the extent to which the mobile system is used to support the firm-related technological processes.

Source: authors

**Task-technology fit:** Due to the nature of this study, Goodhue and Thompson's (1995) concept of fit as correspondence was used, i.e., user evaluation of task-technology fit. From a business standpoint, task-technology fit dimensions such as data quality, ease of use/training, data locatability, production timeliness, authorisation to access data, system reliability, data compatibility, and relationship with the user have been analyzed (Goodhue & Thompson, 1995:229; Lee et al. 2007:106).

Support for task-technology fit and the use of m-commerce: Utilization is predicated on the task-technology fit construct. This construct should be able to forecast how the business system will be used (Goodhue & Thompson, 1995; Dishaw & Strong, 1999:17; Gebauer & Shaw, 2004; Lee et al., 2007; Vongjaturapat, 2018:39). Thus, a good task-technology fit is expected to positively affect usage (Yen et al., 2010:912). Therefore, it is hypothesised that:

**HP3:** The perception of task-technology fit will directly affect the use of m-commerce by the retail personnel.

#### 4. Research methodology

The study followed a cross-sectional design and adopted the positivist research paradigm. As such, a structured questionnaire was used to collect data from the personnel of online retail businesses (see Appendix A). The indicators used for the structured questionnaire were adapted from pre-tested survey instruments used in prior studies (Goodhue & Thompson, 1995; Lee et al., 2004; Lee et al., 2007; Teo & Men, 2008; Yuan et al., 2010; Lembach & Lane, 2011; and Gatara & Cohen, 2014). Businesses were initially contacted via email and/or telephone and then on-site following meetings to distribute and collect questionnaires in Luanda province. The majority of these online businesses were micro and small, operated from the owner's home, and heavily reliant on instant messaging and social networking messaging platforms to conduct mobile transactions. Thus, 42 m-commerce businesses participated in the study, 263 questionnaires were distributed to m-commerce businesses' personnel, and 240 returned. The collected data was screened for inaccuracies and completeness. Thus, 11 cases were eliminated based on the non-random and large number of missing value principles (more than 10% of all cases) (Gallagher, Ting, & Palmer, 2008:262), leaving 229 suitable for analysis (Bartlett, Kotrlik & Higgins, 2001). For the analysis of the primary data, the descriptive analysis approach and Structural Equation Modeling (SEM) analysis were performed using the Statistical Package for the Social Sciences (SPSS) and the Analysis of Moment Structures (AMOS) software.

Outliers were detected by converting the data to standardised (z) scores and employing univariate detection. The data was screened for outliers using standardised (z) scores and univariate detection. However, potential outliers were retained if their z scores did not exceed 4, the threshold for a large sample's z score (Gallagher et al., 2008:261). Additionally, the model's collinearity was evaluated. However, no independent variable had a tolerance of less than 0.20, nor did any have a Variance Inflation Factor (VIF) greater than 5. (Cohen, Manion & Morrison, 2007:598). As a result, collinearity was not a concern.

##### *Fit indices and measurement models assessment*

Having performed the data screening, the regression analysis for the Confirmatory Factor analysis (CFA) was conducted. Table 2 indicates the results of the Goodness-of-Fit (GOF) indices for the measurement models. The results of the measurement models show acceptable fit indices ( $X^2/df$  1.570, P .000, CFI .928, GFI .788, RMSEA .050). Thus, the assessment of constructs' validity and reliability was carried out.

**Table 2.** Fit of measurement models

GOF indices	Structural Model value	Recommended value
Chi-square per degree of freedom ( $X^2/df$ )	1.570	$\leq 3$
Probability (P)	.000	$> .05$
Comparative Fit Index (CFI)	.928	$> .900$
Incremental Fit Index (IFI)	.930	$> .900$
Goodness-of-fit index (GFI)	.788	$> .900$
Tucker-Lewis Index (TLI)	.916	$> .900$
Roots Mean Square Error of Approximation (RMSEA)	.050	$< .080$

Source: authors

Table 3 shows the assessment results of constructs' validity and reliability. The composite reliability test was performed to achieve the constructs' internal consistency reliability. To determine the convergent validity, the Average Variance Extracted (AVE) was assessed (Gallagher et al., 2008:267; Hair, Ringle & Sarstedt, 2011:145). However, all constructs had achieved good internal consistency reliability and convergent validity except the

reliability factor constructs, which had an indicator (RF1) that scored below 0.70 and did not improve its construct AVE (see Table 3). As such, the indicator was excluded from the analysis.

**Table 3.** Technology Context Variables– Loadings, Composite Validity and AVE

Latent Variables	Observed Variables	Factor Loading	Composite reliability	Average Variance Extracted (AVE)
Mobile Notification	MNO1	0.953	0.951	0.831
	MNO2	0.869		
	MNO3	0.884		
	MNO4	0.937		
Mobile Information Exchange	MIE1	0.946	0.928	0.814
	MIE2	0.950		
	MIE3	0.802		
Mobile Information Search	MIS1	0.951	0.950	0.864
	MIS2	0.954		
	MIS3	0.882		
Mobile Data Processing	MDP1	0.829	0.934	0.826
	MDP2	0.933		
	MDP3	0.960		
Time Criticality	TC1	0.915	0.911	0.775
	TC2	0.841		
	TC2	0.883		
Mobility Task	MT1	0.860	0.887	0.668
	MT2	0.886		
	MT3	0.863		
	MT4	0.634		
Task Non-routineness	TN1	0.857	0.930	0.817
	TN2	0.937		
	TN3	0.915		
Task Interdependence	TI1	0.893	0.944	0.811
	TI2	0.930		
	TI3	0.896		
	TI4	0.882		
Reliability Factor	RF1	0.638	0.661	0.496
	RF2	0.765		
Quality Factor	QF1	0.735	0.758	0.515
	QF2	0.799		
	QF3	0.606		
Compatibility Factor	CF1	0.847	0.790	0.654
	CF2	0.769		
Locatability Factor	LF1	0.892	0.792	0.659
	LF2	0.758		
Product Timeliness	PT1	0.847	0.784	0.646
	PT2	0.758		
Relationship with User	RU1	0.933	0.870	0.633
	RU2	0.681		
	RU3	0.896		
	RU4	0.629		

Latent Variables	Observed Variables	Factor Loading	Composite reliability	Average Variance Extracted (AVE)
Ease of Use	EU1	0.606	0.670	0.509
	EU2	0.807		
Authorisation Factor	AF1	0.775	0.764	0.619
	AF2	0.798		
The use of m-commerce	UM1	0.866	0.903	0.701
	UM2	0.826		
	UM3	0.846		
	UM4	0.809		

Source: authors

## 5. Results

The results from the questionnaire administered to the m-commerce business personnel are presented and analysed in this section.

### 5.1 Demographic information

This section discusses respondents' gender, age group, level of education and main products their businesses retail. The results in Table 4 show there were proportionately more males (53.3%) m-commerce business personnel than females (45%). It was found that most of the respondents were relatively young, ages ranging from 25 to 35 (39%) and below 25 (34.5%). The results show that there was no respondent above 66 years.

Table 4. Respondents' demographic information

	Specificity	Sample	Valid percentage
<b>Gender</b>	Male	122	53.3
	Female	103	45.0
<b>Age group</b>	Below 25	79	34.5
	25 to 35	89	38.9
	36 to 45	43	18.8
	46 to 55	10	4.4
	56 to 65	3	1.3
<b>Education level</b>	Primary school	20	8.7
	Secondary school	72	31.4
	Post-matric school certificate	47	20.5
	Bachelor's degree	74	32.3
	Postgraduate degree	8	3.5
<b>Major product retailing</b>	Food products	76	33.2
	Clothing	42	18.3
	Shoes	58	25.3
	Furniture	14	6.1
	Music items	5	2.2
	Jewellery	6	2.6
	Other types	22	9.6

Source: authors



Most of the respondents had at least a bachelor's degree (32%) or received a secondary school education (31%). We found that food products were the main products m-commerce businesses retail (33.2%). Next to food products were shoes (25.3%) and clothing (18.3%). The other types of products (9.6%) largely found in the Angolan market were consumer electronic components, body care and hair extension, alcoholic beverage and fast food and pastry products. Despite these core products, some retailers sell a mix of the core and other products.

## 5.2 The structural model analysis

### *Effect of task characteristics on task-technology fit*

The task interdependence had significantly impacted on six out of eight dimensions of task-technology fit (see Table 5), that is, reliability factor (.334\*\*\*), quality factor (.150\*\*), locatability factor (.246\*\*\*), relationship with user (.171\*\*\*), ease of use (.197\*\*\*), and authorization factor (.335\*\*\*). Furthermore, other tasks affected three dimensions of task-technology fit each. Time criticality had significantly impacted on locatability factor (.180\*\*), production timeliness (.177\*\*), and relationship with the user (.120\*\*). Mobility task has significantly impacted on compatibility factor (.524\*\*\*), production timeliness (.411\*\*\*), and authorization factor (.442\*\*\*), while task non-routineness had significantly impacted on compatibility factor (.184\*\*), locatability factor (.220\*\*\*) and ease of use (.329\*\*\*). (see Table 5).

**Table 5.** Effects of tasks and functionalities on TTF

	TC	MT	TN	TI	MNO	MIE	MIS	MDP	R <sup>2</sup>
Reliability Factor	.038	-.123	.090	.334***	.022	.307***	.108	-.026	.211
Quality Factor	.047	-.086	.064	.150**	.069	.139*	.193***	.171***	.291
Compatibility Factor	.032	.524***	.184**	.041	.139*	.202*	.006	.138*	.309
Locatability Factor	.180**	.125	.220***	.246***	.156*	.086	.143	.093	.345
Production Timeliness	.177**	.411***	-.005	.066	.080	.109	.030	.096	.220
Relationship with User	.120**	.057	.014	.171***	.084*	.052	.061	.125**	.262
Ease of Use	.092	.152	.329***	.197***	.151**	.032	.038	.053	.380
Authorization Factor	.071	.442***	.064	.335***	-.011	.016	.097	.177**	.378
* P < 0.05; ** P < 0.01; *** P < 0.001;									
TC = Time Criticality, MT = Mobility Task, TN = Task Non-routineness, TI = Task Interdependence, MNO = Mobile Notification, MIE = Mobile Information Exchange, MIS = Mobile Information Search, MDP = Mobile Data Processing									

Source: authors

The results show that task interdependence has strongly impacted six out of eight dimensions of task technology fit. Furthermore, the results indicate that three out of four task characteristics also have a significant positive effect on at least three dimensions of task-technology fit.

### *Effect of functionalities of m-commerce systems on task-technology fit*

Furthermore, Table 5 indicates that mobile data processing had significantly impacted four out of eight dimensions of task-technology fit, such as quality factor (.171\*\*\*), authorization factor (.177\*\*), relationship with the user (.125\*\*) and compatibility factor (.138\*). Similarly, mobile notification had significantly impacted four dimensions, namely compatibility factor (.139\*), locatability factor (.156\*), Relationship with User (.084\*) and ease of use (.151\*). However, mobile information search has only significantly impacted one dimension of

task-technology fit. The results show that two out of four functionalities of m-commerce have significant positive effects on at least four dimensions of task-technology fit.

#### *Effect of task-technology fit on the use of m-commerce*

The results indicate that two out of eight dimensions of task-technology fit significantly affect the use of mobile commerce (see Table 6). That is, the fit of ease of use (322\*\*) and the fit of quality factor (.313\*). Other fits, such as reliability, compatibility, locatability factors and production timeliness had adverse and insignificant effects. Furthermore, the results show that all the dimensions of task-technology fit only account for 19.4% of the variance in the use of m-commerce.

**Table 7.** Research model goodness-of-fit indices

GOF indices	Structural Model value	Recommended value
Chi-square per degree of freedom ( $X^2/df$ )	1.599	$\leq 3$
Probability (P)	.000	$> .05$
Comparative Fit Index (CFI)	.924	$> .900$
Incremental Fit Index (IFI)	.926	$> .900$
Goodness-of-fit index (GFI)	.784	$> .900$
Tucker-Lewis Index (TLI)	.914	$> .900$
Roots Mean Square Error of Approximation (RMSEA)	.051	$< .080$

Source: authors

## 6. Discussion

Given the results above, the task characteristics that play a role in the use of m-commerce by retail personnel can be determined. Considering the four task characteristics, the task interdependence has significantly impacted most (thus, six) dimensions of task-technology fit, while the other tasks each have impacted three dimensions. This finding indicates that the more the retailer personnel recognise the fit of reliability factor, quality factor, locatability factor, relationship with user, ease of use and authorisation factor, the more they will use the m-commerce systems to perform the task interdependence, that is, to obtain information from, share information with and depend on the work of co-workers. Previous study has also indicated that the perception of ease of use is a requisite for the use of an innovation (Franque et al., 2021:21). Furthermore, we found that the eight dimensions of task-technology fit were significantly affected by at least one or more task characteristics. Thus, the direct link between task characteristics and task-technology fit is strongly supported (HP1a).

Considering the analysis of functionalities of m-commerce systems presented, mobile data processing and mobile notification had the most robust and most significant effects on the dimensions of task-technology fit. Each affected four out of eight dimensions. The two functions each had a considerable impact on the compatibility factor and relationship with the user. These results suggest that the mobile data processing and mobile notification, as well as the mobile information exchange functions, are highly used when workers perceive that the m-commerce systems are compatible, i.e., very consistent and consolidated, with their tasks. In addition, when respondents take cognizance of a convenient and user-friendly m-commerce system, they mostly deploy mobile data processing and mobile notification functions.

Furthermore, the results also show that the fit of quality factor was significantly impacted by three functions, which means that the more respondents perceive that the m-commerce systems provide data and information that are current enough or maintained at an appropriate level of detail, the more they will use its mobile data processing, mobile information search and mobile information exchange functionalities. Thus, seven dimensions

of task-technology fit were significantly affected by at least one or more functions of m-commerce systems. As such, their direct link is supported (HP2a).

Furthermore, the results show that different task characteristics fit in with the functionalities of m-commerce systems in different dimensions of task-technology fit. The time criticality task and task interdependence fit in with mobile notification in two dimensions: locatability and relationship with user. As such, the perception of fit between time criticality task, task interdependence and mobile notification will stop any negative perception of fits of locatability and relationship with user. All the antecedents account for 34.5% of the variance in locatability and 26.2% in relationship with user. In addition, task interdependence and task non-routineness fit in with mobile notification in locatability and ease of use. All the antecedents explained 38% of the variance in ease of use, which is the highest  $R^2$  score among all dependent variables.

Similarly, different functionalities do fit in with task characteristics. It was found that mobile information exchange, mobile information search and mobile data processing fit in with task interdependence in quality ( $R^2$  29.1%). And mobile notification, mobile information exchange, and mobile data processing fit in with mobility tasks and task non-routineness incompatibility ( $R^2$  30.9%). Thus, the perception of fit between the four functionalities and task Interdependent, mobility task and task non-routineness will end any negative perception of the fit of quality factor or compatibility. We found a random fit between task characteristics and functionalities of m-commerce systems in seven dimensions of task-technology fit. These results are also supported by prior study (Lee et al., 2007:107; Jeyaraj, 2022:9). The fit of production timeliness ( $R^2$  22%) was not affected by any functionality. Thus, the proposed interactions between tasks, the functionality of m-commerce systems and fit are highly supported (HP1b and HP2b).

Furthermore, the findings indicate that two out of eight dimensions of task-technology fit significantly affect the use of mobile commerce. That is, the fit of quality factor and the fit of ease of use. These results show that respondents highly rely on these two fits to use the m-commerce systems to perform tasks. However, other fits, such as reliability factor, compatibility factor, locatability factor and production timeliness had negative and not significant effects, which implies that when these fits increase, the use of m-commerce decreases. Although the structural model shows an acceptable fit index, all the dimensions of task-technology fit only account for 19.4% of the variance in the use of m-commerce. These results show weak support for the interaction between fit and the use of m-commerce. This weak support is supported by previous studies (Goodhue & Thompson, 1995:227; Dishaw & Strong, 1999:16). Hence, the use of m-commerce has the lowest  $R^2$  score among all dependent variables. Strong support for the use of m-commerce would require a positive interaction effect and a significant P-value of most of the TTF dimensions. Thus, hypothesis three (HP3) was not supported.

## Conclusions

The TTF model was expanded in this study by emphasizing the task characteristics and functionalities of m-commerce systems in order to better understand how retail personnel use m-commerce. The study identified and empirically validated four m-commerce system functionalities and four retail-related task characteristics. Additionally, the study identified a suitable conceptualization that adequately connects retail task characteristics and m-commerce system functionality. It successfully validated Goodhue and Thompson's proposal of fit as correspondence (1995). It was found that different functionalities squared with retail task characteristics at different dimensions of task-technology fit. As such, this study found strong support for most of the hypotheses suggested (HP1a, HP1b, HP2a and HP2b). In contrast, it has not found enough support for the relationship between task-technology fit and the use of m-commerce (HP3).

Our study contributes by theoretically extending and empirically evaluating the TTF model. This study led to the development of instruments to measure the mobile information exchange, which is one of the functionalities of m-

commerce systems and then validated it. Thus, marketing researchers can use these constructs in conjunction with other dimensions proposed in this study to conceptualise the TTF model. Additionally, the study shed light on the task characteristics and functionalities of m-commerce systems that can aid retailers in their m-commerce endeavours.

Given that this study was conducted in Angola, where m-commerce is one of the most recent innovations in the retail sector, it opens the door for future research to test the extended TTF model established in this study in various settings or environments. In addition to the preceding, future research should consider examining m-commerce from a unique perspective, such as through a qualitative lens or from the standpoint of brick-and-mortar retailers' intentions to use. Given that this study used fit as a measure of correspondence, future research on retailers' use of m-commerce may consider applying the extended TTF model proposed in this study but evaluating a different measure of fit. We anticipate that the retail sector will benefit from new development in the determinants of the use of m-commerce.

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**Mateus Vicente JUSTINO**

ORCID ID: <https://orcid.org/0000-0001-6468-7209>

**Robertson K. TENGEH**

ORCID ID: <https://orcid.org/0000-0003-2485-0205>

**Michael TWUM-DARKO**

ORCID ID: <https://orcid.org/0000-0002-3774-608X>.

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## BUSINESS-MAKING SUPPORTED VIA THE APPLICATION OF BIG DATA TO ACHIEVE ECONOMIC SUSTAINABILITY\*

**Gabriel Koman<sup>1\*</sup>, Dominika Tumová<sup>2</sup>, Radoslav Jankal<sup>3</sup>, Martin Mičiak<sup>4</sup>**

<sup>1,2,3,4</sup> Faculty of Management Science and Informatics, University of Žilina, University Science Park, Univerzitná 8215/1,  
010 26 Žilina, Slovak Republic

E-mails: <sup>1\*</sup> [gabriel.koman@fri.uniza.sk](mailto:gabriel.koman@fri.uniza.sk) (Corresponding author); <sup>2</sup> [dominika.tumova@uniza.sk](mailto:dominika.tumova@uniza.sk); <sup>3</sup> [radoslav.jankal@fri.uniza.sk](mailto:radoslav.jankal@fri.uniza.sk);  
<sup>4</sup> [martin.miciak@fri.uniza.sk](mailto:martin.miciak@fri.uniza.sk)

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**Abstract.** Decision-making of managers in companies is currently significantly influenced by instantly available information. This phenomenon was caused by advances in information and communication technologies (ICT) and the development of a new generation of machines and systems that create an abundance of diverse data. For managers, this data is a source of information that needs to be obtained in an appropriate manner using different technologies. Technologies that enable the acquisition of this information from available data become an essential part of each company and its management processes. Since technology is currently entering the decision-making process in a significant way, this can be seen as the digital transformation of decision-making processes in companies. The ability to capture, process and assess a very large amount of available data represents the implementation of decisions that make the company's activity more efficient and sustainable (e.g., achieving a competitive advantage, increasing sales or profits, development of new products, etc.). The article presents the results of the conducted research focused on identifying the benefits of implementing Big Data solutions in companies. The main method applied was content analysis of multiple cases followed by the categorization of data extracted. The research hypothesis was stated as follows: There are significant reasons that justify the application of Big Data in managerial decision-making to support the achievement of economic sustainability. The findings from the research (categories) support the importance of the Big Data solutions applied in the managerial decision-making for ensuring the sustainable operation of companies with the current trend of generating and processing a large variety of data.

**Keywords:** sustainable entrepreneurship; Big Data; decision-making; management; information and communication technology

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## 1. Introduction

Traditional business information systems (Zheng, et al., 2020) are not able to distribute the required information created from the data to managers in the decision-making process (Wu, et al., 2021; Zhang, et al., 2021), especially from the time perspective. This is the reason for the development of new technologies (Li, Wang, 2019) aimed at rapid and efficient processing of many diverse data types, i.e., Big Data (Katal, et al., 2013; Yan, et al., 2021). This solution for the processing of a large variety of data (Talwar, et al., 2021) is a way to expand and improve the decision-making process to ensure the sustainable entrepreneurship via decision-making in companies (Raut, et al., 2019), with data being generated in larger quantities that may contain a potentially significant informational value (Hajjaji, et al., 2020; Blštáková, et al., 2020). The aim of the article is to present the theoretical basis of the Big Data solution, and the results of the research carried out via the content analysis. The research was focused on analysing the cases of the Big Data solutions' implementation and its effect on sustainable operation of companies via the support of managerial decision-making.

Based on the results of the analysis, the benefits of the Big Data solution were identified in companies that justify the use of the Big Data solution in the decision-making process, allowing companies to ensure economic sustainability with the ever-increasing amount of data generated at present (Elkhwesky, et al., 2022).

## 2. Theoretical background

The analysis of the theoretical background consists of three subchapters. The first one describes managerial decision-making in companies. The second chapter focuses on a brief definition and description of the Big Data technology. This is followed by the setting of research questions and hypothesis.

### 2.1. Decision-making

Decision making is the most important activity of business managers (Ikram et al., 2020; Holubčík, Soviar, 2021). This activity is an extensive process consisting of partial steps leading to a decision that can help achieve sustainable operation and development of companies (Worthington, 2013). Due to the rapid development of computing technology, information from source data is becoming the key input to the decision-making process in the swiftly changing social trends, along with the managers' experience and abilities (Treurniet, Wolbers, 2021). Instantly available, trustworthy, true, and relevant information have a significant impact on the correctness of managerial decisions, especially in the current global market environment (Holubčík, et al., 2018).

The customers' requirements are also constantly changing (Owen, et al., 2016; Kubina, Lendel, 2015). This leads to the need of a continuous decision-making processes in companies (Deverell, et al., 2019). A variety of different data that may contain potentially significant information value is being generated because ICT are currently affordable both for companies and customers and various social media are still expanding (Stacho, et al., 2015; Andronie, et al., 2021; Fakunle, Ajani, 2021).

Many **techniques** are being developed and used to help companies obtain, process, and use the necessary data to support the effectiveness of their decision-making. Kamble et al. in their study focused on *a large group decision-making technique* they used to identify and evaluate *the best big-data-driven circular economy (BDDCE) practices in the auto-component industry*. The results of this study were specific factors that formed an aspect of the economic sustainability of the surveyed companies. These included, for example: *plan for reuse, recycle, recovery of material, parts, and reduction of the process waste at the design stage, or minimization of the raw material consumption* (2021).

Decision-making as a process is characterized by defining specific **indicators**, based on which it is possible to choose one of the variants of solving the analysed situation (Goodwin, Wright, 1998). Decision-making indicators are used in companies in activities such as: *goal setting, performance evaluation, monitoring, or control* (Huovila, et al., 2019). The choice of the most suitable combination of indicators is critical for the success of the whole process on the one hand, but on the other hand it is objectively demanding. Therefore, it is essential to use and improve expertise in this area, as well as to look for new methods and techniques that will help managers streamline the decision-making process (Sousa, Rocha, 2020).

Different *indicator standards* are set for different areas. For example, in the Smart City area, some standards are narrowly focused on output indicators that assess progress in implementing smart urban ICT solutions (Huovila, et al., 2019).

Following the information provided in the previous paragraphs, it can be argued that the use of formal methods or decision-making techniques can be used to improve the overall **sustainability** of the company (Zavadskas et al., 2016). In this case, the decision-making process is associated with the area of sustainability (Sulich et al., 2021). Based on this relationship, it is possible to support the efficiency, speed, and reliability of decision-making using various solutions (including Big Data), which will bring economic sustainability of the company.

The impact of decision-making on sustainability is being explored by numerous authors. Diaz et al. in their study focused on examining the implications of adopting a specific strategy for decision-making in *the sustainable product development (SPD) process* (2021).

## 2.2. Big Data as the platform for the company's decision-making process leading to sustainability

We are currently living in the Big Data era where, using Big Data technologies intended for processing large volume of data, companies can improve their decision-making and thereby ensure sustainable growth. The difference between the decisions made without this technology and with it can significantly differ (Cheng et al., 2018). The Big Data topic is not entirely new. From a historical perspective, the evolution of Big Data can be dated back to the 1960s. It was then that data centres were being built and databases were being developed to store data. A significant milestone in Big Data was the year 2005 with the development of social media and social networking. Users of social networks started generating large amounts of heterogeneous data. This data can contain significant informational value whereby its use grows in proportion to the increasing trend of data being generated daily. (Husamaldin, Saeed, 2021) Big Data represent a loosely defined term that describes large quantity of complex data sets and, at the same time, the advanced technologies for collection and storage of such large data quantities (Keen, 1991) There are many definitions of Big Data, but there is no single and exact one. Definitions differ, representing different opinions of various authors. From a broader perspective, Big Data can be considered as an element that connects and integrates the physical world, people, and cyberspace. (Favaretto et al., 2020) The term Big Data applies to the group of hardware and software tools specifically designed for solutions related to the complexity of data. (Calic, Ghasemaghaei, 2020) These tools can work simultaneously with several sets of data, which are characterized by their volume, diversity, rapidity, and veracity, and which it is complicated to manage by means of traditional data management technologies (Romero et al., 2017). Big Data can be defined as when data sets are so big that traditional technologies and tools for their extraction are no longer usable within reasonable time frame and are ineffective in terms costs (Bakshi, 2014, Rawat, Yadav, 2021). Big Data are coming from various sources, such as transaction records, boot files, social media, sensors, third parties, web applications, etc. However, Big Data are not only large quantities of data, but they are also exceptionally diverse data types, distributed with various speed and frequency (Stanimirović, Mišković, 2014, Haili et al., 2021). These data types can be generally divided into structured, semi-structured, and unstructured. Preliminary processing of unstructured data, their conversion to structured data, and their subsequent storing is very important for their further extraction. Full utilization of Big Data depends on effective management, which makes data

extraction easier (Wu et al., 2018). Three main issues related to Big Data include: quantity of collected data, speed required for data analysis, and various data formats that are collected (Mattmann et al., 2014; Favaretto et al., 2020).

Based on similarities of the definitions listed above, Big Data can be understood as very large quantity of data continuously generated from various sources, the processing of which by traditional technologies is not manageable for the company considering both time and costs. It also includes new technologies aimed at advanced collection, storage, and analysis of data. (Aghaali et al., 2022) This utilization of data by the Big Data technology is characterized by high speed, whereas diverse data are processed. The ability to process large quantities of diverse data has substantial impact on obtaining significant information, revealing business opportunities, and streamlining activities in decision-making processes of companies. It is therefore apparent that the Big Data solutions significantly contribute to the sustainability via the decision-making in the company. (Ranjan, 2019; Fidlerová, et al., 2022)

Companies are by being aware of the potential of the Big Data technology. It results in investments into the business intelligence and utilization of Big Data analyses to understanding the wider context (Muntean, 2018, Hariri et al., 2019). Innovations in the field of Big Data are not related only to the significant increase in volume, diversity, speed, and veracity of data, but they also refer to the way how these data are applied and how new innovations are distributed in the whole company (Kharrazi et al., 2016). Big Data are also defined as methods and technologies to identify hidden value from large and complex datasets. Big Data enables the company to share data faster and more complexly. This way, it is possible to establish more effective and faster processes (Arena, Pau, 2020). The information obtained via Big Data solutions positively impact the area of innovation in the company. (Meiyu, Ye, 2022)

From the perspective of decision-making, the Big Data technology represents a way how to achieve sustainability with the aim to create competitive advantage (Batista, Francisco, 2018). Strategic decision-making is a key factor for sustainability and development of the company. It does not only affect the future implementation of strategies, but also the survival of the company itself (Wu et al., 2017). For the companies to be competitive, decisions must be quick, effective, and made in alignment with strengthening sustainability. (Phuyal et al., 2020) Despite obvious awareness of managers about the issue of sustainability, problems with its integration into the decision-making process and implementation in the praxis persist (Le Roux, 2016, 7 Mishra et al., 2021).

One of the ways how to integrate sustainability into the decision-making process and how to subsequently implement this process into the company is the utilization of the Big Data technology. That means the implementation and integration of the Big Data platform into individual decision-making processes of the company, as referred to by the performed research.

### *2.3 Setting research questions and research hypothesis*

Based on researching the theoretical basis, the following research questions were set for this research project:

- Does the application of the Big Data technology influence the efficiency of business processes in a positive way?
- Does the application of the Big Data technology help companies build better relationships with their customers?
- Are the Big Data solutions currently on such a level that their implementation in companies brings effects that are positively reflected in their economic situation?
- Are there examples of implementing the Big Data technology that can be labelled as the best practice?

The questions stated above led to the formulation of the research hypothesis  $H_0$ , whose validity is tested in the research. The hypothesis  $H_1$  is stated as well, as a negation of hypothesis  $H_0$ .

**$H_0$ :** *There are significant reasons that justify the application of Big Data in managerial decision-making to support the achievement of economic sustainability.*

**$H_1$ :** *There are no significant reasons that justify the application of Big Data in managerial decision-making to support the achievement of economic sustainability.*

### 3. Research objective and methodology

The research was carried out in 2021. It was conducted in the form of *multiple case analysis*. The main purpose of the case analysis was to identify the benefits of implementing the Big Data solution to support decision-making in a company leading to its economic sustainability. Additional activities have been defined to ensure that the main objective of the analysis is met:

- to identify companies that have implemented Big Data solutions,
- to identify reasons, which led the company to the implementation of the Big Data solution,
- to identify benefits achieved by the company via the implementation of the Big Data solution in relation to the decision-making support,
- to categorize the data included in the cases based on the content and the frequency of occurrence.

The analysis was conducted as the case studies analysis in combination with the content analysis of documents, which was used as the technique for data collection for qualitative analysis and evaluation. The materials analysed described the cases of the Big Data solution implementation in particular companies, i.e., new case studies were not created, but existing cases were collected, categorized, and analysed.

According to Yin (1994), a case study can be defined as the strategy for examination of a phenomenon specified in advance in the present, within its actual context. According to Hendl (2016), it can be assumed that examination of one case can contribute to better understanding of other similar cases and help generalize conclusions from the examination performed in wider context.

Similarly to the creation of a case study (Yin, 1994; Hendl, 2016), in the analysis performed it was also important to consider whether it is sufficient to work with one case or several cases, i.e., multi-case approach. Statistical evaluation cannot be applied since the choice of studies is targeted and not random.

Thus, the choice of objects for the analysis was made by the method of intentional selection, i.e., the best available entities (companies) were chosen. The choice was targeted and subject to previously defined criteria. The replication approach was used in combination with intentional choice to achieve outputs required. Several case studies were analysed individually, with separate evaluation in relation to the performed analysis. The literary replication was used regarding the logic of the approach (Yin, 1994). The cases where similar generalized results (benefits from the implementation of the Big Data solution) could be expected were included in the analysis.

As the research performed was qualitative, the data obtained were continuously being evaluated during their analysis. Case studies contain the description of one or several cases that are subject to detailed study. Therefore, several data points were collected from each case while the relationships within the complex entities studied are described.

The source documents were collected online. These included websites, books, and other online documents with the content corresponding with the scope and aim of the analysis.



The analysis was aimed at large companies that implemented Big Data solutions for the support of decision-making, or which were able to obtain certain benefits from the implemented solution. These benefits had to have potential to be generalized in relation to the support of managerial decision-making. The target group of the analysis was formed by companies that implemented the Big Data solutions. Cases included in the target group had to meet the following criteria:

- The company had to be classified as a large company in relation to the number of employees, i.e., having more than 250 employees.
- The company had to present the implementation of a Big Data solution for processing diverse types of data.

The number of cases analysed was not exactly specified in advance. Since qualitative evaluation was selected, the following method for including new cases was used – expansion of the research sample in the qualitative research (in this case the number of the cases examined) ends when the researcher is no longer obtaining new pieces of information from the data gathered (Donato, 2014). This was met when no new generalized benefits from the implementation of Big Data solutions emerged from additional cases studied.

#### **4. Results and discussion**

Data obtained by the analysis performed were obtained from available documents, which described specific cases examined. Relevancy of such cases in relation to the analysis and the main research objective was ensured by previously defined criteria a particular case had to meet to be included. Several methods of data processing were used during the examination of individual cases to obtain necessary information via the qualitative evaluation:

- intuitive approach,
- qualitative evaluation,
- data generalization,
- data categorization,
- comparative analysis,
- holistic approach to data assessment,
- replication approach to data analysis.

As data obtained by the analysis of cases of the Big Data solutions' implementation in companies were qualitative, they were not subject to statistical analysis.

The following procedure was defined to ensure obtaining of the required information from individual cases examined in the analysis:

1. Assessment of relevancy of the examined case according to the criteria defined.
2. Description of the company including basic information about the business subject and the details about the Big Data solution implementation.
3. Description of the reasons for the implementation of the Big Data solution, i.e., reasons that led the company to implement the Big Data solution.
4. Description of the benefits from the implementation of the Big Data solution that were achieved in the company by the implementation of the Big Data solution.
5. Case evaluation containing the summary of the findings and their generalization from a particular case of the Big Data solution implementation in the company.

Each case was analysed applying the described procedure individually, whereas the data obtained from individual cases were summarized in the end. The pieces of information extracted were used for the formulation of conclusions regarding the research objective. Following companies were examined by the procedure within the analysis: Mercedes AMG, Walmart, Nokia, Aetna, and UPS.

In relation to the scope of research, the paper contains only information emerging from point 5 and the final evaluation of the analytical procedure.

#### 4.1. Evaluation of the Mercedes AMG case

Literary sources (Donato, 2014; Overby, 2014; Mercedes-AMG GmbH, 2018) were used in the analysis of the Mercedes AMG case. Product testing represents one of the most demanding activities regarding time and financial costs in the field of car development in the company Mercedes-AMG. The possibility of accelerating testing of car components significantly affects not only the reduction of costs, but also the increase of competitiveness and sustainability of the company. Due to the implementation of the Big Data solution the company was able to shorten the time of processing and evaluating large quantity of data, which significantly affects the whole process of testing. Financial and time costs can be reduced in the company already during the testing process due to the processing, comparison (of current and historical data), visualization and prediction from generated data in real time and even the smallest deviations from standards can be revealed. The company can thus quickly react to the situation by ending the process of product testing within a very short time (in the order of minutes). This helps remove downtimes as compared to the testing process before the implementation of the Big Data solution, when results could be evaluated only after the completion of testing (app. an hour). Time saving in the testing process represents a possibility to increase the number of tested products per day and to improve the quality of resulting products according to the customers' needs and requirements. The main benefit from the implementation of the Big Data solution in the Mercedes-AMG company is in the saving of time from product (engine) testing processes. Other benefits from the implementation of the Big Data solution in form of saving operating costs, increasing sales, implementing corrective measures on the grounds of predictions from several diverse data types subsequently follow. The implementation of the Big Data solution in this company was justified via the reasons identified. The summary of reasons and benefits from the implementation of the Big Data solution in the Mercedes-AMG company is included in Table 1.

To further process the data obtained via the analysis of the selected cases, the summary tables (Tables 1 to 5) have been supplemented by the author's column "Category". The information obtained was divided into ten categories: *data, quality, costs, wastage, process, product, real-time, decision-making, customer, competitiveness/prediction.*

**Table 1.** Reasons for the implementation and the benefits of the Big Data solution in the Mercedes-AMG company

Reasons to implement the Big Data solution	Benefits for the company after the implementation of the Big Data solution	Category
Need to utilize large quantity of diverse data	Processing and visualizing data in real-time	<i>Data</i>
Reduction of production operations' costs	Predicting errors Reducing operating costs	<i>Costs</i>
Streamlining the production process	Increasing the capacity of tested products	<i>Process</i>
Elimination of downtimes and wastage	Analysing data from the process of product testing in real-time Shortening the time of testing defective products Transmitting data about testing results to employees' devices (tablet, PC) Testing larger number of products during the same time than before the solution's implementation	<i>Wastage</i>
Management of product portfolio production	Quickly identifying shortcomings by means of complex analytical tools	<i>Product</i>
Identification of customer needs	Identifying customers' needs and wishes via processing diverse data from the customers and the configuration system	<i>Customer</i>

Improvement of product quality	Historically the most successful year for the company regarding product sales Increasing time for implementation of measures and incorporation of customer requirements	<i>Quality</i>
Increase of the company's competitiveness	Expanding the product portfolio with three new models	<i>Competitiveness/prediction</i>
Improvement of decision-making processes	Predicting errors Supporting innovations Supporting processes within the whole company	<i>Decision-making</i>
Obtaining data for the support of company processes in very short time	Usability of the solution in the whole company	<i>Data</i>
Streamlining the product testing process	Predicting errors Quickly revealing deviations	<i>Product</i>
Possibility of historical data correlation	Comparing the current and historical data in real-time	<i>Data</i>
Becoming a "real-time" company	Processing data in real-time Usability of the solution for the support of processes within the whole Daimler Group	<i>Real-time</i>

#### 4.2. Evaluation of the Walmart case

Literary sources (Đuricová, 2011; Mayer-Schönberg, Cukier, 2013; Van Rijmenam, 2013; Ruby, 2014; Seetharan, 2015; Walmart Inc., 2018a; Walmart Inc., 2018b) were used in the analysis of the Walmart case. The implemented Big Data solution allows the company to process and utilize large quantity of diverse data from millions of users and various data sources. The solution enables to analyse key words from millions of customers in real time. Obtaining the necessary information from available sources for the support of the company's decision-making enables to better understand consumers' behaviour, and thus to meet their needs and requirements, thereby to ensure the sustainable development of the Walmart company. At the same time, it allows the company to identify various associations from the sale, to modify the layout of products in the shop, to optimize logistic processes, etc. The benefit from utilization of information obtained from the data combined from various sources can be demonstrated on the example of the sale of strawberry cakes where the company revealed that as soon as the warning of impending tornado is announced, the sale of these cakes grows by seven times on average. Therefore, these cakes are placed directly at the cash desk in the shops before the hurricane.

Using the Big Data solution, it was also possible to increase the sale of products and support decisions about the launch of new products based on data from social networks. The company can market products in which customers are interested immediately when they discuss them. Based on available data, the company is also able to create various predictive analyses and forecasts using which it is possible to plan further operations and activities, such as pricing of products on the grounds of market situation, or to propose measures for minimizing adverse impacts of the current situation (such as to compensate the higher price by a special discount or a gift voucher). Predictive analyses are important for the company also from the perspective of stock reduction. The company can build stock of only those products for which there is high demand. In this way it is possible not only to plan the stock, but also to identify products in which customers are not interested and subsequently to monitor the level of stock within the whole Walmart chain. The summary of reasons and benefits of the implementation of the Big Data solution in the Walmart company is presented in Table 2.

**Table 2.** Reasons for the implementation and the benefits of the Big Data solution in the Walmart company

<b>Reasons to implement the Big Data solution</b>	<b>Benefits for the company after the implementation of the Big Data solution</b>	<b>Category</b>
Large quantity of data generated	Capturing, storing, and processing large quantities of diverse data from various sources	<i>Data</i>
Need to integrate a large quantity of unstructured data within one database	Creating a single database structure	<i>Quality</i>
Possibility of mutual combination of diverse data for analysing and obtaining of results	Analysing the data from various sources in a single database structure	<i>Decision-making</i>
Increasing competitiveness	Reducing the time spent with customers at the cash desk Increasing the earnings from online sales by 10-15%	<i>Competitiveness/prediction</i>
Need of better identification of the customers' needs and requirements	Using a mobile application with the function of evaluating customer needs Analysing millions of data points about customers and their friends in real-time	<i>Customers</i>
Predicting customer needs	Using a mobile application with the function of evaluating customer needs Analysing millions of data points about customers and their friends in real-time	<i>Real-time</i>
Predicting buying habits of consumers	Using a mobile application with the function of evaluating customer needs on the grounds of their position within the shop or by voice analysis of their requirements	<i>Product</i>
Monitoring the customers' behaviour	Using a mobile application with the function of evaluating customer needs on the grounds of their position within the shop or by voice analysis of their requirements Processing data from sensors in shops	<i>Customers</i>
Need to adapt products to customers' requirements	Recommending products to customers via specific applications of the Walmart company	<i>Costs</i>
Need to optimize logistic processes	Planning stock and equipment of shops based on predictive analyses	<i>Wastage</i>
Need to obtain data from consumers' mobile devices	Obtaining data about customers via mobile applications	<i>Customers</i>
Creating the tools for customers to support the buying process	Using specific applications from the Walmart company	<i>Process</i>

#### 4.3. Evaluation of the Nokia case

Literary sources (Kosuru, Tommaney, 2012; Jia, Yin, 2015) were used in the analysis of the Nokia case. Development in the field of ICT caused the creation of many database structures in the company Nokia, which were available individually according to the needs of individual departments. Original systems for the collection and processing of data were insufficient in relation to finance, time, and information value from generated data. Therefore, the company decided to implement the Hadoop solution for processing large quantity of diverse data. Due to this Big Data solution, Nokia was able to integrate data from various data sources into a single database structure available for all employees and combine data from own and other sources to obtain information value for the support of decision-making within the whole company. The company can analyse data from its customers in real time. Therefore, it can understand the buying behaviour of its consumers on individual markets and make decisions for higher satisfaction of their needs than the competition. At the same time, the company can create various predictive models from generated data on the grounds of which it can foresee future events and make decisions about possible corrective measures to mitigate possible impacts on the company from predicted events. The summary of reasons and benefits from the implementation of the Big Data solution in the Nokia company is presented in the Table 3.

**Table 3.** Reasons for the implementation and the benefits of the Big Data solution in the Nokia company

Reasons to implement the Big Data solution	Benefits for the company after the implementation of the Big Data solution	Category
Creation of a single database of data	Integrating data from all company systems into one database structure	<i>Real-time</i>
Prevention of data duplicity and access of all employees to the data	Integrating data from all company systems into one database structure Data available in real-time for all employees	<i>Customer</i>
Need to obtain higher information value from data	Analysing data from various sources in real-time	<i>Decision-making</i>
Understanding the buying behaviour of consumers on the market	Better understanding customer needs from analysing data from mobile devices in combination with other data sources	<i>Product</i>
Need to capture and process large quantity of diverse data	Quickly identifying shortcomings via of complex analytical tools	<i>Quality</i>
Need to combine data from various sources	Obtaining data from various data sources and storing them in a single database structure to obtain information value	<i>Data</i>
Automated processing of unstructured data to structured data	Automatically transferring data between data centres of the company	<i>Process</i>
Implementation of financially and time affordable solution for processing large quantities of diverse data	Up to ten times lower price in case of storing one terabyte of data as compared to the original solution of the company	<i>Costs</i>

#### 4.4. Evaluation of the Aetna case

Literary sources (Higginbotham, 2012; Aetna Inc., 2018; Steinberg, 2018) were used in the analysis of the Aetna case. The company Aetna, using modern technologies in the field of collection and processing of diverse data, was able to improve its decision-making processes and thus ensure sustainable development in relation to the business activity. By implementing the Big Data solution, the company gained a platform for obtaining, storing,

and analysing large quantity of diverse data about its customers, patients. This enabled the company to make sustainable decisions, as various predictive models enter the decision-making process, and their information value allows the company to approach patients individually. Thus, the company can make effective decision regarding costs and required medical care of the patient. The summary of reasons and benefits from the implementation of the Big Data solution in the Aetna company is presented in Table 4.

**Table 4.** Reasons for the implementation and the benefits of the Big Data solution in the Aetna company

<b>Reasons to implement the Big Data solution</b>	<b>Benefits for the company after the implementation of the Big Data solution</b>	<b>Category</b>
Processing large quantities of diverse data	Processing data from various sources (medical records, laboratory tests, biometric results, demographic data, etc.)	<i>Data</i>
Obtaining information value from available data in short time	Obtaining information from medical records, laboratory tests, demographic data, monitoring systems of the hospital etc.	<i>Decision-making</i>
Optimal transmission of information and results	Possibility of distribution of data to the doctor to ensure the prescription of suitable treatment procedure	<i>Product</i>
Removal of unsuitable treatment plans and procedures with impact on the patient	Making accurate decisions on the grounds of predictions and data analysis	<i>Process</i>
Provision of the best individual care for the patient	Possibility to create individual treatment plans (supported by predictions)	<i>Real-time</i>
Understanding and influencing behavior of patients	Processing data from various sources Prediction of risks	<i>Customer</i>
Creation of predictions from available data	Supporting predictive analyses	<i>Competitiveness/ predictions</i>
Improvement of communication between the patient, doctor, and the insurance company	Automatic transfer of data between the patient, doctor, and the insurance company	<i>Quality</i>
Improvement of health care for patients	Better prediction of occurrence of problems with impact on the health of patients Creation of individual treatment plans, continuous monitoring of the patient and adjustment of the plan Reduction of risk of disease formation by 90%	<i>Quality</i>
Reduction of costs	Making accurate decisions based on predictions and data analysis	<i>Costs</i>

#### 4.5. Evaluation of the UPS case

Literary sources (Davenport, Dyché, 2013; Bessis, Dobre, 2014; Samuels, 2017; Bidgoli, 2018; Maar, 2018; Sahoo, 2021) were used for the analysis of the UPS case. The company UPS belongs to global leaders in the field of shipment delivery. Numerous machines and pieces of equipment are used for the company activity, which generate large quantities of diverse data. By using the data, the company can make decisions to ensure the management of the whole product delivery process due to the implementation and utilization of the Big Data solution. At the same time, the company can make sustainable decisions, which allow optimizing the route of company vehicles in the field and saving the environment (Pollák, et al., 2021). This way, it is possible to accelerate the delivery process, reduce costs, meet requirements of customers, and, eventually, ensure sustainable development of the company. The summary of reasons and benefits from the implementation of the Big Data solution in the UPS company is presented in Table 5.



**Table 5.** Reasons for the implementation and the benefits of the Big Data solution in the UPS company

<b>Reasons to implement the Big Data solution</b>	<b>Benefits for the company after the implementation of the Big Data solution</b>	<b>Category</b>
Reduction of costs	Saving 10 million gallons of natural gas Saving 30 million dollars	<i>Costs</i>
Acceleration of shipment delivery time	Identification of vehicle activity (elimination of routes with left turns)	<i>Product</i>
Optimizing route of vehicles in the field	Saving 85 million miles	<i>Quality</i>
Combining data from various sources to obtain necessary information	Processing diverse data (sensors, routes, weather conditions, etc.)	<i>Data</i>
Need to monitor all packages during the whole delivery process	Monitoring daily performance of the company (monitoring shipments in real-time)	<i>Process</i>
Decision-making support	Monitoring online map of shipments with the possibility of route correction in real-time	<i>Decision-making</i>
Working with diverse data in real-time	Monitoring daily performance of the company (monitoring shipments in real-time)	<i>Real-time</i>
Understanding customer requirements	Streamlining and speeding up the delivery process Reducing costs to better meet the customer requirements	<i>Customer</i>

#### 4.6. Conclusion of the analysis of cases describing the implementation of the Big Data solution in companies

The analysis of cases of the Big Data solutions' implementation in companies can be evaluated using the data from the performed research in relation to the tasks defined to achieve the main objective.

The first task was to identify companies that implemented Big Data solutions. The following subjects were analysed: Mercedes-MG, Walmart, Nokia, Aetna, and UPS. These subjects were chosen intentionally, i.e., they represented companies that could provide the best information in relation to the implementation and utilization of the Big Data solution for the support of decision-making leading to sustainability. Chosen examined subjects can be considered relevant as they met defined selection criteria:

- all examined subjects can be classified as large companies (with more than 250 employees),
- individual examined cases describe the implementation of a solution for processing large quantities of diverse data – Big Data, i.e., solutions SAP HANA (Mercedes-AMG) and Hadoop (Walmart, Nokia, Aetna, UPS).

It can be established that examined companies implemented Big Data solutions to process large quantities of diverse data, thus the first partial objective of the analysis was fulfilled. The second partial objective was to identify reasons that led the companies to implement the Big Data solutions.

Companies had the following needs before the implementation of the Big Data solutions that justified their implementation and utilization. They were aware of availability and information potential of diverse data, which could be used for business activities and, therefore, they had the need to utilize such quantity of diverse data. However, processing of large quantities of diverse data was very demanding in relation to the time of their processing, when the results from processed data were often no longer current, so their information value was low. This means that companies were insufficiently technologically equipped for processing and obtaining valuable information from diverse data. Capturing and storing large quantities of diverse data was also financially demanding. Thus, another need that led companies to the implementation of the Big Data solution was the need to reduce costs in relation to capturing and processing large quantities of diverse data. As the examined subjects represent large companies, they generate large quantities of data from various pieces of equipment and activities. Pieces of information from these data enter the process of decision-making on the performance of business

activities. Data from the analysis performed identified the need to eliminate downtimes, which were occurring especially in the case of transfer and evaluation of data between various information systems. Another reason for the implementation of the Big Data solution is the need to increase competitiveness. Companies were aware of information value of data, for instance, from mobile devices or production equipment, based on which it would be possible to understand buying behaviour of consumers more quickly and make decisions that would lead to the improvement of company processes and satisfaction of customer needs better than the competition. Due to the availability of ICT equipment, companies had large quantities of data on customers, using which they would be able to increase their competitiveness by improving product quality, i.e., by producing goods and services meeting the requirements of customers or quality standards. Another reason for the implementation of the Big Data solution was the need to improve company processes, especially in relation to decision-making. This means that decision-making processes used reports from information obtained by analysis and evaluation of structured data without the possibility to utilize unstructured data and their combinations (regarding time demands of processing as well as the costs). Other reasons that led companies to implement Big Data solutions included the absence of quick processing and access to data. Additionally, it was not possible to capture and process data in real time. Duplicity of data occurred, which affected the load on systems and speed of data transformation to information. The absence of possibility to perform analyses of all the data was caused by the fact that there was no single database available to be used in the decision-making.

Examination of data from individual cases identified reasons that led companies to implement the Big Data solution. Therefore, the second partial objective was fulfilled too. The third partial objective in the performed analysis was to identify benefits the companies achieved from the implementation of the Big Data solution regarding the support of sustainable decision-making. It was possible to identify and generalize the benefits from the implementation and utilization of the Big Data solution for the support of decision-making leading to sustainability of the companies.

In relation to the improvement of company processes, their sustainability was supported by the decision-making based on the Big Data solutions. Using the available information from diverse data (e.g., sensors in the production), bottlenecks in individual activities of the process can be detected and improvements can be made (e.g., elimination of duplicity, identification of the need to make reviews, etc.). The Big Data solution can be used as a source of relevant information for the support of sustainability via decision-making in relation to continuous improvement or reengineering of company processes. At the same time, it is possible to improve the communication within individual activities of the process, for instance, by automation of the data sent (e.g., sending information about a tested product). The responsible worker in the process or a manager can make quicker decisions about the performance of other process activities and continuously evaluate the effectiveness of individual activities and the whole process. This means that the Big Data solution can be used to support the sustainability via decision-making within the whole company.

Advanced analytical tools are available in Big Data solutions to obtain information value from diverse large data volumes. With these tools, companies can obtain information according to their needs and the nature of the issue the manager is deciding on. Advanced analytical tools of Big Data solutions allow companies to visualize data in various graphical reports, from which managers can quickly identify the problem or the factors that affect the decision-making. At the same time, it is possible to obtain information for the needs of decision-making as the result of processing all the historical data from information systems and currently generated data in the company and its environment. Current data, usually of unstructured nature (from sensors, social media, videos etc.), allow managers to obtain necessary information for decision-making, e.g., for making decisions about the company shop layout based on the data about the position of customers within the shop. The implementation of Big Data solutions allows companies to make sustainable decisions via better understanding of consumers' buying behaviour or company processes and impacts affecting their effectiveness (e.g., shipment delivery based on the evaluation of data about traffic situation; improvement of health care for the patient using the records from the

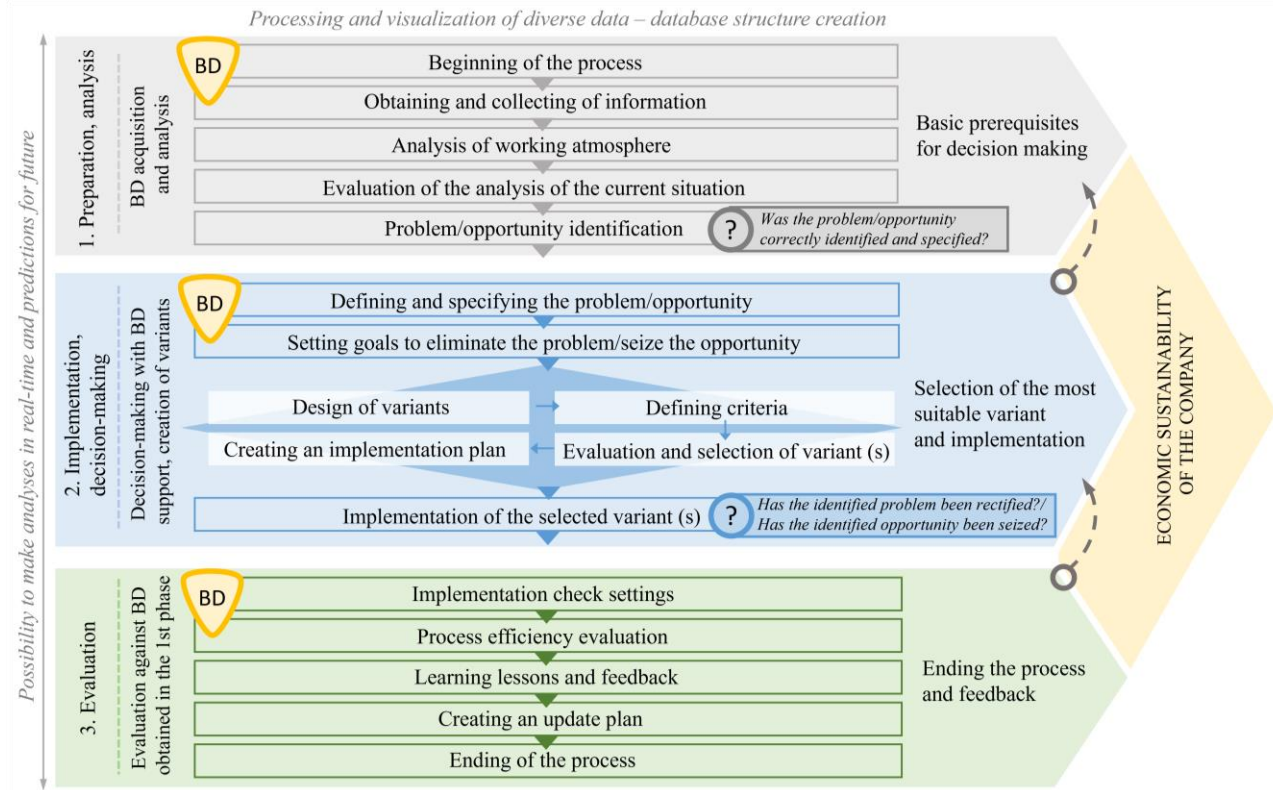
doctor, fitness equipment, biometric data etc.). In addition to information about buying behaviour, Big Data solutions enable companies to make decisions in relation to the extension of product portfolio and decisions that impact the improvement of product quality. These decisions can include the decision about the expansion of production, marketing of new product, changes of shop layout, increase of stock or transfer of stock between company branches, etc. Expansion of product portfolio can be made on the grounds of evaluation of data from customers, e.g., from social media or mobile devices in real time. Improvement of product quality can be approached in two ways – by making products according to needs and requirements of customers, or by improving processes for achieving conformity of product parameters during their production. This means that using Big Data solutions, companies can identify needs and requirements of customers more accurately and produce goods and services up to the level of individual customer connection (e.g., individual treatment program for a patient). From the perspective of product quality, in the sense of product conformity with the production procedure and with production parameters, improvement can be achieved by streamlining the production process via elimination of time losses. Saved sources can be used for funding research and development of production procedures or functions of produced goods and services.

Implementation and utilization of Big Data solutions also positively affects the increase of company sales. Making decisions aimed at ensuring the increase of sales or elimination of impacts of events in the future is supported by Big Data solutions via the possibility to create advanced predictive analyses. The companies can utilize diverse data from internal and external sources, for instance in relation to predictions of demand or predictions of risks. With predictive analyses, it is possible to increase sales via decisions related to the management of the supply chain (Kampf, et al., 2018; Pečený, et al., 2020; Zráková, et al., 2019). Utilization of Big Data solutions in the company can also result in the reduction of costs.

The fulfilment of the last partial objective of the analysis can be confirmed similarly to the previous two. The findings from the analysis of cases of implementation and utilization of Big Data solutions in companies describe their benefits as well.

Based on the evidence obtained via an in-depth analysis of the included cases from the business practice, the validity of the hypothesis stated for the research was confirmed. Thus, there are significant reasons that justify the application of Big Data in managerial decision-making to support the achievement of economic sustainability. By confirming the hypothesis's validity in combination with the partial results described above, the answers to the research questions defined were found as well.

Following eight categories resulting from the content analysis of the selected cases describing the application of the Big Data technology in the business practice, the process of implementing this technology in the managerial decision-making was designed as it is depicted below (Fig. 1).



**Figure 1.** The complex process of utilizing Big Data for the support of decision-making in the company

Source: own elaboration

The model has three layers that are separate but interconnected. The first one is the division of the whole process into three phases – labelled by numbers. In the core of the model there is a description of activities connected to the decision on the implementation of the Big Data (BD) solution itself. The last layer is created by the impact of the whole logical structure on the support of economic sustainability of a company (direction from left to right in the model).

#### 4.7. Discussion

By the implementation of the Big Data solution, companies gained the platform for processing and visualization of diverse data. They also gained a solution that integrates all available data from various sources (company information systems, social networks, Internet, mobile devices, sensors, software applications, etc.) into a single database structure, which is available within the whole company. (Mayer-Schönberg, Cukier 2013) Utilization of a Big Data solution results in automation of processes of data collection and transfer (e.g., from several branches, departments, etc.) into one database for obtaining information from all the data whenever the managerial decision-making occurs. (Romero et al., 2017; Cheng et al., 2018)

Based on the information obtained via the analysis, we can conclude that the introduction and use of the Big Data solution help companies with sustainability via enhanced managerial decision making, mainly due to (Wu et al., 2018; Sulich et al., 2021; Aghaali et al., 2022):

- the possibility to make analyses from all the data (structured and unstructured) in real time,
- predictive analyses,

- the possibility of capturing and processing diverse data from internal and external environment of the company.

From the perspective of decision-making processes within the whole company, these are supported as decisions are made based on information obtained from various sources, especially external, unstructured data. This way, the company can make decisions not only on the grounds of available company data, the information value of which can be limited due to the nature of the processes or possibilities of current information systems. (Kamble et al., 2021; Haili et al., 2021)

Visualization of available data helps in the decision-making process in the case of making quick decisions, reacting to current situation on the market or in the company. It is also possible to intuitively estimate necessary decisions of the company, branches, or individual departments using graphic reports or dashboards displaying monitored data and their changes immediately, in real time. Analysis of data in real time represents another benefit for companies after the implementation of the Big Data solution. (Deverell et al., 2019; Diaz et al., 2021)

Implementation of solution for processing large quantities of diverse data (Big Data) for the support of decision-making in the company represents a complex process. This complexity is enhanced also by the demanding nature of the Big Data platform itself regarding hardware, software, personnel, processes, and information flows. The company must be prepared for the implementation and utilization of the Big Data solution to achieve the support of decision-making because of the occurrence of possible problems, both in designing the model of decision-making with the support of Big Data and in the implementation of the solution. (Ikram et al., 2020; Andronie et al., 2021)

There are several problems that can be identified regarding the implementation of the Big Data solution in the company, which affect the significance of the designed solution for the support of sustainable decision-making: (Đuricová, 2011; Donato, 2014; Jia et al., 2015; Samuels, 2017; Muntean, 2018; Steinberg, 2018; Sousa, Rocha, 2020; Sahoo, 2021; Mishra et al., 2021; Meiyu, Ye, 2022)

1. Incorrect identification of the need to implement certain technological solution for the support of decision-making can be caused by initial enthusiasm from possibilities of new technology, but the company might not need such solution regarding its business activity, processes, etc. It is important for the company to realize whether this technological solution will bring the required benefit for it and whether it will be utilizable in the company also in the future regarding financial and time demands of the solution's implementation.
2. Incorrect understanding of data can lead to erroneous identification of data sources, i.e., the company will obtain data with information value that will not be suitable for the support of decision-making in particular areas or processes of the company.
3. Implementation of the Big Data solution with unsuitable software equipment has significant impact on the usability of the solution for the support of decision-making. Software equipment means analytical and reporting tools using which the manager will obtain and visualize information from available data. If incorrect tools are implemented or some tools are missing, we can speak about ineffective investment as the Big Data solution will not be usable for the support of decision-making.
4. Lack of qualified personnel the company can assign to the work and support of the Big Data solution. There can also be a problem that employees do not have sufficient abilities and skills to use the designed solution for the support of decision-making.
5. There can be an issue in utilizing the Big Data platform in the company for the support of decision-making when the decisions made using the obtained information will not lead to the solution of the defined problem. This issue is related to the feedback within individual parts of the decision-making process. In this case, the company must focus on the suitability of the algorithms used, credibility of data sources, and analytical tools used in the decision-making process.



Identified basic problems are meant to serve as an aid for companies in decision-making and implementation of the designed Big Data solution. Regarding the extent and complexity of the Big Data technology and the diversity of business activities of individual companies, it cannot be excluded that other problems may occur, which were not included in this paper. Thorough preparation of the company for these issues can result in mitigation of their impacts in the implementation of the Big Data solution (Wu et al., 2017; Batista, Francisco, 2018).

On the other hand, well managed implementation of the Big Data solution enables using data in real time to support sustainable decisions especially in the field of: improvement of company processes, elimination of wastage, acceleration of development of new products, and making communication more effective. (Ranjan, 2019; Hariri et al., 2019; Meiyu, 2022)

Therefore, it can be established that Big Data solutions have a significant impact on sustainability not only via the decision-making, but also in the sense defined by Muntean who says that sustainability of a company can be understood as business approach that creates long-term value for stakeholders by the means of utilizing opportunities and managing risks arising from the economic, environmental, and social development (2018; Ferenc, et al., 2017; Soviar, et al., 2018).

## Conclusions

At the time when IT dominates not only the private but especially the commercial sphere, information has crucial importance for companies, of which managers are aware. Business sustainability can be ensured only if correct decisions are made systematically. One of the criteria on which the quality of such decisions depends is the collection, processing, and, especially, correct evaluation of the pieces of information available. Application of the Big Data technology is one of the possibilities how to ensure economic sustainability of companies via the utilization of information.

**Novelty** of the research presented in this article lies in *the categorization of the factors* crucial for the implementation of the Big Data solution. This solution then supports the decision-making process in a company via which its economic sustainability can be positively affected.

Another element of the article's novelty is *the proposed model* (Fig. 1). Its originality is based on the complex approach to the utilization of Big Data for the support of decision-making in the company. The complexity is achieved by the three layers included in the model's description that can be found in the text.

**Research limitations** are listed in the following points. The main sources of research data were documents, case studies, and research publications available via the Internet. Due to the characteristics of the research, criteria were chosen to limit the selection of documents that were reviewed and analysed. Documents acceptable for analysis had to meet the following criteria:

- focus on Big Data and decision-making support,
- published by a Big Data vendor or specialist, manager, or an IT professional,
- Big Data solutions implemented in the company identical to the solution's vendor or manufacturer,
- the Big Data vendor's solution meets the basic general characteristics of Big Data (volume, variety, velocity).

Additionally, the limiting factor of the research conducted is its focus on large companies in the following sectors: *industrial production; wholesale, retail, and repair of motor vehicles; transport and storage; health and social work; telecommunications and IT.*



The reason for selecting large companies in the above-mentioned industries is mainly the demanding nature of Big Data solutions in terms of finance, technological infrastructure, and the educational level of the company's staff. The theoretical background of this article includes these points as well.

In this article, the authors have demonstrated the benefits of using this technology in various, seemingly unrelated sectors. The benefits are obvious, regardless of whether the company operates in the automotive industry, retail, technology, insurance, logistics or other industries. Specific benefits may vary, ranging from cost reduction to the understanding of consumer behaviour and optimization of business processes. However, they share a common element, which is the understanding of the information available and its utilization to predict the future. A correct prediction of the future is directly proportional to the sustainability of a company in the long run achieved via managerial decision-making.

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MINISTRY  
OF TRANSPORT  
AND CONSTRUCTION  
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**Assoc. prof. Gabriel KOMAN, PhD** is lecturer of managerial information systems and digital marketing. He focuses on the topics of Big Data, information systems, digital marketing technologies.

ORCID: <https://orcid.org/0000-0001-7562-5476>

**Dominika TUMOVÁ, PhD** is lecturer of human potential management, motivation theories and organization behaviour. She focuses on the topics of motivation, creativity, managerial decision-making, sport management.

ORCID: <https://orcid.org/0000-0003-2393-2946>

**Assoc. prof. Radoslav JANKAL, PhD** is lecturer of business ethics, strategic and quality management. He focuses on the topics of CSR, sustainability, and sustainable development.

ORCID: <https://orcid.org/0000-0001-6447-1651>

**Martin MIČIAK, PhD** is lecturer of managerial theories and project management. He focuses on the topics of human capital, sustainability, sport management.

ORCID: <https://orcid.org/0000-0002-8636-3560>

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## QUALITY ASSESSMENT OF PUBLIC SERVICES IN LATVIA

**Iveta Katelo<sup>1</sup>, Irēna Kokina<sup>2</sup>, Vitālijs Raščevskis<sup>3</sup>**

*Daugavpils University, Parādes street 1, Daugavpils, LV-5401, Latvia*

*E-mails:*<sup>1</sup> [iveta.katelo@du.lv](mailto:iveta.katelo@du.lv); <sup>2</sup> [irena.kokina@du.lv](mailto:irena.kokina@du.lv); <sup>3</sup> [wiras@inbox.lv](mailto:wiras@inbox.lv)

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**Abstract.** At present, the service sector receives growing attention taking into account its role in the socio-economic development of the society. Public services produced to meet the demands of the population occupy a special place in this sphere. Improving the quality of public services is one of the essential goals in improving the functioning of public administration in Latvia and globally. The research aimed to assess the customer service quality of administrative services provided by Latvia's public administration institutions, performing the factor and cluster analysis of the collected data. Research base: Public administration institutions (6) and their branches (17) in Latvia. The research participants are two hundred ninety-two occasionally selected customers of public administration institutions who filled in SERVQUAL questionnaires before and after their visit to an institution. The sample of customers is occasional and administratively territorial, observing the proportional representation of planning regions. The service quality assessment model – the SERVQUAL instrument (Parasuraman et al., 1988), was used for the data collection. The analysis of the research data factors and clusters was carried out. Service provision quality in all quality dimensions has been given a negative evaluation. The economic efficiency of the largest state institutions understudy is low, and so is the quality of provided services as evaluated by their customers.

**Keywords:** public administrative services; quality; service quality; efficiency; SERVQUAL model

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### 1. Introduction

One of the significant trends of the world economic development nowadays is the growing role of service sectors approved by the increase of the service production level compared to material production, the considerable growth of the range of services offered, and the number of employees in the service sectors.

This trend is undeniable in countries with a developed socio-economic system where the percentage of services in total GDP is about 70%. The share of services in GDP in Latvia as to the added value of sectors in 2019 reached 74.4% (LR Ekonomikas ministrija, 2020). At present, the service sector receives growing attention taking into account its role in the socio-economic development of the society. Public services produced to meet the demands of the population occupy a special place in this sphere. Several studies show that the quality of public service

significantly affects citizen satisfaction with these services, and citizen satisfaction with the quality of public services positively affects their trust in government (Wilantika, Wibisono, 2021). Improving the quality of public services is one of the crucial goals in improving the functioning of public administration in Latvia and globally.

The public sector includes state and local government bodies and their commercial companies, companies with state or local government capital shares of 50%, and more. The quality and efficiency of service provision are essential prerequisites for improving the process of public service provision. The evaluation of public services must become a necessary task for future actions that can positively impact the quality of services provided by public authorities (de Menezes, Pedrosa, 2022). For the gains of the quality improvement to become large enough, critical evaluation of the justification of demands and quality of services may yield a much more significant effect in alleviating the administrative load and improving state administration (VARAM, 2013). There is a need to implement administrative reforms and update public services.

Administrative reforms make a global trend in the present age. Both the developed and developing countries recognize administrative reforms as a driving force to facilitate economic growth, democracy, justice, and develop other aspects of social life (Dinh, 2014; Vasconcelos, 2021). Administrative reform in Latvia ought to make the organizational system more efficient and improve the quality of public services. In EU countries, including Latvia, the updating of the public sector is based on regularities and processes elaborated in the private sector. Application of the customer service standards accepted in the private sector in the state administration is one of the current issues of updating public administration in Latvia.

Assessing the quality of services in the Latvian public administration can reasonably contribute to improving the efficiency of public administration institutions and enhancing the quality of public life.

## 2. Theoretical background

Public service is defined as a material or direct nonmaterial favor provided by the public administration to a private individual in general benefit service, governance (individual) service, or financial service (VARAM, 2012). Examples of public services are road maintenance, street lighting, registration, certified statements, permits, taxes, social care, education, health care, and residential house management.

The public sector comprises state and local government institutions and their commercial companies, commercial companies with state or local government capital share of 50%, and more.

Administrative services are public (i.e., state and local government) services provided by public administration institutions and local governments (Koliushko, 2009). Any public service is oriented toward meeting customers' needs, which can be classified in different ways (Maslow, 1943; Škapars, 2010).

We may define quality in various ways; there is no unified, universal definition of quality (Shariff, 2012). Different authors, for instance, Berry et al. (1985), define quality as correspondence with specifications, especially customers' specifications. An organization may evaluate the quality of provided services by studying customers' opinions. Acting in this way, an organization may enhance correspondence with customers' wishes and improve the advantages of their competitiveness (Shariff, 2012).

Quality is a totality of product features that determine its capability of meeting the previously set consumer's needs. Quality may be expressed by a simplified formula (ISO):

$$Q=P-E \quad (1.1)$$

Where: Q – quality level, P – the consumer's received result, E – desirable effect.

Service quality is a complex construct that has been given much attention in the literature on marketing (e.g., Gronroos, 1984, Parasuraman et al., 1985).

The early investigation of service quality was carried out by Gronroos (1984). Gronroos stated that, for the organization to gain success, it is vitally important that it understands customers' attitudes towards the provided services. This model evaluates service quality by comparing the expected and perceived quality. Gronroos (1984) suggested three dimensions for assessing service quality: technical quality, functional quality, and image. In the mid-1980s, Berry, Parasuraman, and Zeithaml (1985) started studying the determining factors of service quality and how customers evaluate service quality based on the conception of the perceived service quality (Gronroos, 1984). Ten determining factors were discovered that characterize customers' perception of the service. One of the dominant factors is competence; it is directly related to the technical quality of the result, whereas the other is reliability, which is related to the aspect of perceived quality. The rest of determining factors are more or less about dimensions of the process of perceived quality (Gronroos, 2005).

As a result of further research, ten factors determining the quality of service were reduced to five (Gronroos, 2005): material gains, security, responsiveness, competence, and empathy.

SERVQUAL method used in the study appeared as a tool for detecting how customers perceive service quality. This tool is based on the five factors mentioned earlier. It compares customers' hopes and expectations regarding how they perform the service and their experience of the service provision (rejecting hopes of fulfilling them).

To characterize five determining factors, 22 attributes are used, and respondents are asked to indicate (on a seven-point scale from "Fully disagree" to "fully agree") what they expected from the service and how they perceived the service. Based on the difference between hopes (expectations) and the received service, it is possible to calculate the total quality indicator.

The efficiency construct may be classified as the main in economics. Efficiency is one of the significant indicators of human activity, according to economic activity results. Efficiency secures economic activity's unified qualitative and quantitative characteristics as an economic category. Shampine and Reichelt (1992) note that economic efficiency is characterized by the ratio between the number of resource entities used in the production and the quantity of the product gained. Efficiency is the ratio between the achieved result and used resources (ISO 9000: 2015).

Efficiency in the public sector may be compared to efficiency in the private sector only if their aims are identical. Even in this case, they are not fully comparable because the state sector functions in the spheres that consider economic gains and social problems, for instance, social benefits (Stoian, Ene, 2003). The efficiency of state expenses means the ratio between investments' economic and social impact. Analyzing the efficiency of the public sector, the majority of researchers refer to the economic efficiency that is taken as a construct from the private sector. According to Mihaiu and Opreana (2010), efficiency in the public sector is a sum of economic efficiency and social impact.

Factors that affect efficiency in the public sector are as follows:

- Invested resources. In the public sector, resources are much harder to detect than in the private sector, as public services overlap and resources are used from several sources. But on the whole, resources invested in the public sector come from the collected taxes.
- Action results. They are more challenging to express in numbers than investments in the public sector, as they may have both an economic and social dimension. The results of the functioning of the private sector have the value of market share; they are easy to estimate, whereas, in the public sector, the results of functioning are difficult to estimate (Mihaiu, Opreana, 2010).

However, Hall and Lobina (2005) assert that private and state organizations do not show essential differences in efficiency. According to the authors, public sector efficiency may be interpreted as the ratio between the organization's functioning (number of provided services) and costs. Still, detecting the result and costs of functioning in the public sector isn't straightforward.

Organization or enterprise efficiency is a topical management science problem. At present, the significance of this problem is growing because there is increasing competitiveness among producers. At the same time, consumers and customers set higher demands for the quality and price of products or services.

The administrative reform to be carried out in Latvia should make the organizational system more efficient and improve the quality of public services. To date, no research has been conducted in Latvia on the quality and efficiency of shared administrative services. Monitoring the quality and efficiency of public administrative services in Latvia would make a reasonable contribution to improving the quality of life in society. The study examines the current situation with the quality of public administrative services to further develop a model for assessing the quality of administrative services.

### **3. Research objective and methodology**

The research aimed to assess the customer service quality of administrative services provided by Latvia's public administration institutions.

Reaching the set aim comprises the following objectives:

1. Analysis of the theoretical aspects of explaining the notions of services, quality, service quality, and efficiency.
2. Evaluation of the quality of public administrative services.
3. Analysis of data factors and public service quality assessment clusters.

Research object: customer service quality for administrative services in public administration institutions in Latvia from 2017 to 2019.

Research base: Public administration institutions (6) and their branches (17) in Latvia – State Social Insurance Agency of the Republic of Latvia departments of Riga, Daugavpils, Valmiera, Jelgava, Ventspils, State Revenue Service of the Republic of Latvia customer service centers in Riga, Jelgava, Ventspils, Valmiera, Daugavpils, State Land Service customer service center in Daugavpils, State Employment Agency departments of Daugavpils and Ventspils, Daugavpils Regional Environmental Board, Daugavpils Court, its departments of Krāslava and Preiļi.

The research is based on a sample of public service customers in Latvia's most significant cities and towns – Riga, Daugavpils, Jelgava, Ventspils, and Valmiera. The research participants are two hundred ninety-two occasionally selected customers of public administration institutions who filled in SERVQUAL questionnaires before and after their visit to an institution. The sample of customers is occasional and administratively territorial, observing the proportional representation of planning regions.

In the present research, the quantitative data collection method was used based on SERVQUAL model. The collected data were analyzed using factor analysis and cluster analysis methods. To test the method according to the sample of scientific literature sources, survey questionnaires were prepared, wherein changes were made during the research in the formulations of questions and the scale of service evaluation for customers. The questionnaire for SERVQUAL method consisted of two parts, each entailing 22 statements about the service quality that, in the division, formed a totality of 5-dimension criteria. Customers were asked to provide an evaluation for each statement according to a 5-point scale. Part A showed the customer's expectations concerning the service quality and the importance of various quality criteria for the customer. Part B conducted the customer's

evaluation of the received service. The object of evaluation in the questionnaires was service quality as a totality of five quality dimensions wherein:

- dimension 1 - the totality of material gains (appearance and physical elements);
- dimension 2 - security (confidence, accurate performance);
- dimension 3 - responsiveness (promptness and helpfulness);
- dimension 4 - competence (attention, reliability);
- dimension 5 - empathy (convenient receiving of the service, good communication, and understanding of the customer).

SERVQUAL method was formed as a tool for detecting how customers perceive the service quality. This tool is based on the five factors mentioned above and a comparison of customers' expectations of how the service must be provided with their experience of the service provision (rejecting or conforming to their expectations) (Parasuraman et al., 1988). The total service quality indicator is calculated based on the difference between the expectations and received service. The present research aims to evaluate the customer service quality of administrative services in Latvia's public administration institutions. The study tested the appropriateness of SERVQUAL method to the process of service quality evaluation, specified the options of its application, and experimented with formulations of SERVQUAL survey questions and the evaluation scale. A research model was elaborated, and the research survey questionnaire was translated into Latvian. Before circulating the questionnaire, the authors reviewed it to ensure whether it is user-friendly and has no ambiguous or sensitive questions. The survey was tested with twenty randomly selected customers of public services. The approbation allowed to correct errors before collecting the research data. After the test survey, the questions were modified, and the evaluation scale was reduced to a 5-point level. Though the authors studied the public services provided by the state institutions, the research is independent of the observed phenomenon (Lee, Wu, 2015).

#### 4. Results and discussion

The outcomes of research produced in 2017-2018 are analyzed. Their statistical analysis has revealed the following results (see Table 1). The mean value of the evaluation of customers' expected service is 4.47. The mean value of the customers' perceived service is 3.98. The results of the expected service evaluation are provided in Table 1. Comparing the data to similar research in Egypt and Malaysia concludes that in Latvia, customers have lower expectations for service. The perceived service in Latvia is evaluated higher than in Egypt but lower than in Malaysia (see Table 1).

**Table 1.** Characteristics of evaluation of customers' expected service

Quality dimensions	Number of questionnaires		Mean	Median	Moda	Mean expected service in Egypt	Mean expected service in Malaysia
	Reliable	Lost					
Material gains	292	0	4.1575	4.2500	5.00	6.029	4.69
Security	292	0	4.7301	5.0000	5.00	6.194	5.81
Responsiveness	292	0	4.6986	5.0000	5.00	6.181	4.67
Competence	292	0	4.5325	4.7500	5.00	6.217	4.81
Empathy	292	0	4.2363	4.4000	5.00	5.836	5.73
Total	292	0	4.4721	4.5909	5.00	6.091	5.142

*Source:* the table designed by the authors, processing the survey data statistically by SPSS 22.00, 2019; Rashid (2008); Ali, Yaseen (2012)

Customers evaluated as the essential quality dimensions in Latvia's public sector services security – mean 4.73 points, responsiveness – mean 4.69 points, and competence –mean 4.53 points. Customers' received service evaluation results are provided in Table 2.

**Table 2.** Characteristics of the evaluation of customers' perceived service

Quality dimensions	Number of questionnaires		Mean	Median	Moda	Mean perceived service in Egypt	Mean perceived service in Malaysia
	Reliable	Lost					
Material gains	292	0	3.9486	4.0000	5.00	3.172	4.23
Security	292	0	4.0616	4.2000	5.00	3.521	5.26
Responsiveness	292	0	4.0728	4.0000	5.00	3.700	4.23
Competence	292	0	4.0146	4.0000	5.00	3.576	4.40
Empathy	292	0	3.8479	3.8000	5.00	3.124	5.30
Total	292	0	3.9860	4.0000	5.00	3.418	4.68

Source: the table designed by the authors, processing the survey data statistically by SPSS 22.00, 2019, Rashid (2008); Ali, Yaseen (2012)

The lowest evaluation of the service performance in Latvia's public sector institutions is given to the 5th quality dimension – empathy (mean 3.84 points) but the highest – to 3rd quality dimension – responsiveness (mean 4.07 points). Comparison to similar research data in Egypt and Malaysia concludes that the customers' evaluation of the perceived service in Latvia is medium-high. Customers in Egypt have given a similar assessment. The lowest evaluation in Malaysia was given to material gains, whereas the highest was to empathy (see Table 2).

Calculating the difference between the evaluations of customer's perceived service and expected service, the mean quality of service provision is obtained that was evaluated negatively in all quality dimensions. Quality of the dimensions of security, responsiveness, and competence was evaluated respectively by -0,668 points, -0,626, and -0,518 points. The less negative evaluation was given to the quality of the dimensions of material gains (-0,209 points) and empathy (-0,388 points). Comparing the mean rate of service provision in Latvia and Egypt concludes that it is evaluated, on average, five times lower in Egypt. Service quality has received a less negative evaluation in Malaysia than in Latvia (see Table 3).

**Table 3.** Public service mean quality in Latvia in 2017-2018 (points)

Quality dimension	Mean evaluation of expected service (E)	Mean evaluation of perceived service (P)	Mean of the service quality (P-E)	Mean of the service quality in Egypt	Mean of the service quality in Malaysia
Material gains	4.1575	3.9486	-0.2089	-2.857	-0.09
Security	4.7301	4.0616	-0.6685	-2.673	-0.11
Responsiveness	4.6986	4.0728	-0.6259	-2.481	-0.09
Competence	4.5325	4.0146	-0.5179	-2.641	-0.08
Empathy	4.2363	3.8479	-0.3884	-2.712	-0.09
Total	4.4721	3.9859	-0.4861	-2.672	-0.09

Source: the table designed by the authors, processing the survey data statistically by SPSS 22.00, 2019, Rashid (2008); Ali, Yaseen (2012)

Analysis of the customer survey outcomes in the state institutions under study reveals that customers have provided the most favorable evaluation of services offered by Daugavpils Regional Environmental Board (from 0.147 to 0.424 points). The most negative evaluation was provided by customers of State Employment Agency (from -0.278 to -0.922 points), State Social Insurance Agency (from -0,215 to -0,882 points), and State Revenue Service (from -0.217 to -0,892 points). An almost threefold higher evaluation of the service quality was given to Daugavpils Court (from -0.092 to -0.323 points) and the Office of Citizenship and Migration Affairs (from +0.068 to -0.455 points) (see Table 4). Analysis of the public service quality evaluation results according to the place of residence of the surveyed customers, it may be concluded that residents of Latgale have provided a less negative evaluation of the service quality (from -0.159 to -0.409). In other regional towns understudy and Riga, the quality



of public services was evaluated as almost two times lower. In Riga, customers evaluated public service quality between -0.144 and -0.842 points; in Valmiera – between -0.275 and -0.878, in Ventspils – between -0.444 and -0.819 points.

**Table 4.** Public service quality evaluation in Latvia in 2017-2018, in the cross-section of state institutions understudy

Quality dimension	Mean evaluation of the service quality NVA	Mean evaluation of the service quality VAA	Mean evaluation of the service quality DRVP	Mean evaluation of the service quality DT, VZD	Mean evaluation of the service quality PMLP	Mean evaluation of the service quality VID
Material gains	-0.278	-0.215	0.162	-0.318	0.068	-0.215
Security	-0.729	-0.882	0.080	-0.332	-0.345	-0.786
Responsiveness	-0.922	-0.750	0.147	-0.323	-0.455	-0.662
Competence	-0.783	-0.680	0.221	-0.224	-0.062	-0.567
Empathy	-0.511	-0.600	0.424	-0.092	-0.055	-0.472
Mean of the service quality	-0.642	-0.636	0.211	-0.254	-0.174	-0.548

*Source:* the table designed by the author, performing the statistical processing of the survey data, 2019

Researcher Tetrevova (2008) mentions efficiency as the central problem in public sector performance. Efficiency means reaching the aims of a specific system functioning, i.e., obtaining the outcome evaluated by comparing the acquired status to the desirable one. Efficiency, in general, is a ratio of the obtained result concerning its costs. According to the author, economic efficiency may be treated as a ratio between the organization's functional outcome (the number of provided services) and costs. The author has produced calculations of the economic efficiency of the state institutions under study relating the number of services offered by the organization to their expenses (see Table 5) and compared the economic efficiency of the organizations' under investigation to evaluate the quality of services provided by them.

**Table 5.** Comparison of the mean of service quality and efficiency of state institutions under study according to the data for 2017-2018

State institutions	The ratio of the number of provided services to their costs*	Mean of the delivered service quality
State Revenue Service	0.260	-0.548
State Social Insurance Agency	0.129	-0.636
State Employment Agency	0.119	-0.642
Office of Citizenship and Migration Affairs	0.094	-0.174
State Environmental Service	0.025	-0.211
Ministry of Justice	0.012	-0.254

*Source:* the table designed by the authors, performing the statistical processing of the survey data, 2020.

\*The number and costs of the provided services (maintenance costs) according to VSIA, SRS, SEA, SES, MJ, 2018

The value of efficiency of organizations with high economic efficiency is more significant or equal to 1. As shown in Table 5, the economic efficiency of larger state institutions understudy is low, the same as the service quality evaluated by customers. According to the analysis of the obtained data, it must be concluded that a linear correlation of efficiency of public administration institutions to the quality of provided services is observed. Thus, by raising the quality of provided services, the efficiency of public administration institutions would grow. The quality and efficiency of provided services are essential prerequisites for improving the process of public service provision. Implementing a model of evaluating service quality would bring a systemic control of service quality, gradually improving the public service quality and raising the economic efficiency of public administration institutions. Improving the in-person provision of administrative services in public administration institutions contributes to more efficient state governance and customer satisfaction in various age groups. From all age

groups, the most negative evaluation of service quality was given by customers of the age of retirement (from -0.169 to -0.861 points). The higher assessment was provided by respondents aged between 20-40 (from -0.33 to 0.497 points).

The analysis of the obtained outcomes according to the surveyed customers' gender reveals that less negative evaluation of the service quality was given by males (from 0.029 to -0.672 points). Females have shown a lower service quality evaluation (from -0.296 to -0.704 points). The less negative evaluation was given to the dimension of material gains.

Analysis of the survey outcomes according to the respondents' level of education reveals that customers gave the most negative evaluation of service quality with secondary professional education (from -0.121 to -0.842). Respondents provided a higher evaluation with secondary education (from -0.269 to -0.538 points). Assessment of the survey outcomes according to the respondents' employment status concluded that retired customers gave the most negative service quality evaluation (from -0.35 to -1.2). Employed respondents gave a higher evaluation (from -0.261 to -0.740) (see Table 6).

**Table 6.** Public service quality evaluation according to respondents' employment status

Quality dimension	Mean of the service quality evaluation with employed respondents	Mean of the service quality evaluation with retired respondents	Mean of the service quality evaluation with unemployed respondents
Material gains	-0.610	-0.350	0.420
Security	-0.740	-1.10	-0.992
Responsiveness	-0.604	-1.20	-0.969
Competence	-0.502	-0.942	-0.813
Empathy	-0.460	-0.620	-0.450
Mean of the service quality	-0.521	-0.855	-0.644

*Source:* the table designed by the author, performing the statistical processing of the survey data, 2019

Comparison with similar research data in other European and Asian countries concludes that the performance of Latvia's public sector is medium-low (see Table 7).

**Table 7.** Comparison of the public service quality in Latvia and other countries

Quality dimension	Mean of the public service quality evaluation in Latvia for 2017-2018	Mean of the education service quality evaluation LLKC in Latvia for 2009-2010	Mean of the post-service quality evaluation in Italy for 2000	Mean of the public service quality evaluation in Egypt for 2012	Mean of the public service quality evaluation in Malaysia for 2008
Material gains	-0.208	-0.505	1.3	-2.857	-0.09
Security	-0.668	0.367	-0.9	-2.673	-0.11
Responsiveness	-0.625	0.937	-0.2	-2.481	-0.09
Competence	-0.517	-0.069	-0.1	-2.641	-0.08
Empathy	-0.388	-0.040	0.7	-2.712	-0.09
Mean of the service quality	-0.486	0.138	0.160	-2.672	-0.09

*Source:* the table designed by the authors, performing the statistical processing of the survey data, 2019, Franceschini et al. (1998); Rashid (2008); Grünberga-Zālīte (2011); Ali, Yaseen (2012)

The research analyses the outcomes obtained as customers of public services evaluated the expected and perceived usefulness and public service quality in Latvia. It was concluded during the research that it is

impossible to use the SERVQUAL method without adjusting it to the conditions of each state institution under study.

The evaluation of service quality revealed that the performance of public service organizations in Latvia does not meet their customers' expectations. Service provision quality in all quality dimensions has been given a negative evaluation. Hence, customer satisfaction with the public service provision is also negative. The economic efficiency of the largest state institutions under study is low, and so is the quality of provided services as evaluated by their customers. A close connection between the efficiency of public administration institutions with the quality of their provided services is observed. Thus, raising the efficiency of public administration institutions may increase the quality of their provided services. Service quality and efficiency are essential preconditions for improving the process of public service provision. Improving the organization of in-person provision of administrative services in public administration institutions would enhance the efficiency of state governance and customer satisfaction.

The outcomes of this analysis make it possible to conclude that the drawbacks of public services detected in the evaluation are to be reduced. An essential measure for improving service quality is regular surveying of customers to evaluate the quality of public services provided at the given time. Assessing the quality of services offered by state institutions and implementing a model for assessing service quality would improve the quality of the services provided and, along with that, also customers' satisfaction.

### Factor analysis of the research data

Factor analysis is a mean of data reduction using correlations between data variables. If making factor analysis, it is assumed that some basic factors account for correlations or mutual relations between the observed variables (Chatfield, Collins, 1992). Factor analysis is widely used by researchers in economics, marketing, sociology, and education (Bollen, 1989; Doll et al., 1994; Li et al., 2002; Nimako et al., 2012). Statistical data analysis for the present research was produced by an approach similar to April and Pather (2008). Kaiser-Meyer-Olkin (KMO) test helps measure the suitability of data for analysis. Kaiser (1974) suggested using data with suitability values above 0.5. In the present research, the data suitability value is 0.835; which fits the range from medium to excellent suitability. Thus, we are confident that the collected data are suitable for factor analysis. After testing the usefulness of the data, the authors performed a factor analysis of the data to estimate the factors essential for the improvement of public service quality.

The outcomes of factor analysis for evaluating customers' expected service are provided in Table 8. Factor analysis was produced by means of principal component analysis (PCA). As seen in Table 8, the cumulative value of the expected service component analysis (%) is 60.676.

**Table 8.** Factor analysis of the evaluation of customers' expected service

compon ents	Initial specific (eigen) values			Extraction sums from square loads			Rotation sums from square loads		
	Total	Dispersions %	Cumulative %	Total	Dispersions %	Cumulative %	Total	Dispersion %	Cumulative %
1	9.058	41.174	41.174	9.058	41.174	41.174	6.231	28.323	28.323
2	1.805	8.202	49.376	1.805	8.202	49.376	3.728	16.945	45.268
3	1.359	6.176	55.552	1.359	6.176	55.552	1.911	8.687	53.955
4	1.127	5.124	60.676	1.127	5.124	60.676	1.479	6.721	60.676
5	0.898	4.080	64.756						
6	0.832	3.780	68.536						
7	0.775	3.523	72.059						

8	0.682	3.098	75.157						
9	0.606	2.753	77.910						
10	0.553	2.515	80.424						
11	0.528	2.402	82.826						
12	0.484	2.198	85.024						
13	0.459	2.087	87.111						
14	0.422	1.920	89.031						
15	0.405	1.839	90.870						
16	0.386	1.755	92.626						
17	0.336	1.528	94.153						
18	0.327	1.486	95.639						
19	0.283	1.287	96.927						
20	0.244	1.109	98.036						
21	0.226	1.027	99.063						
22	0.206	0.937	100.000						

Source: the table designed by the authors, performing the statistical processing of the survey data by SPSS 22.00, 2019.

Conducting factor analysis with the method of PCA, four eigenvalues were obtained; the total square load acquisition sums exceeded one, with percental cumulative deviation constituting 60.676 in the case of evaluating customers' expected service. The first factor accounts for 41.174% of the total dispersion. It must be noted that the first factor accounts for a rather large volume of dispersion, whereas subsequent factors account for just a tiny volume of distribution.

As seen in Table 9, the data for evaluating customers' expected service were divided into four groups according to service quality factors. A load of each factor was evaluated. To evaluate the outcomes, it must be noted that the factor load greater than 0.30 is regarded as essential, 0.40 is regarded as important, and 0.50 or more is regarded as very significant. In the present research, the author assumed that only factors with a load above 0.50 are essential (Hair et al. 2010). The higher the factor coefficient, the more critical it concerns the customer's expectations concerning the service quality (Pallant, 2005). In fact, in the present research, minimum factor coefficient values start from 0.429 or more, and these coefficient values are regarded as significant for conducting factor analysis.

**Table 9.** Total dispersion of data of customers' expected service evaluation

	Components			
	1	2	3	4
RG_j_9	0.790			
RG_j_7	0.768			
RG_j_13	0.734			
RG_j_8	0.719			
RG_j_12	0.709			
RG_j_6	0.685			
RG_j_14	0.682	0.462		
RG_j_15	0.615	0.466		
RG_j_10	0.611			
RG_j_11	0.602			
RG_j_5	0.565			
RG_j_16	0.518	0.460		

RG_j_4	0.505			
RG_j_19		0.765		
RG_j_18		0.747		
RG_j_20		0.726		
RG_j_17	0.429	0.666		
RG_j_21		0.559		
RG_j_1			0.797	
RG_j_2			0.791	
RG_j_3			0.673	
RG_j_22				0.836

Source: the table designed by the authors, performing the statistical processing of the survey data by SPSS 22.00, 2019.

**Group I**, with the most important factors customers consider in their evaluation of expected service quality, includes aspects related to such service quality dimensions as **security, responsiveness, and competence**. This group contains factors with a coefficient from 0.79 to 0.505. **Group II** includes factors related to such a service quality dimension as **empathy**. This group comprises elements with a coefficient from 0.765 to 0.559. According to importance, **group III** lists factors related to **material gains**. The coefficient of the facets of this group is between 0.797 and 0.673. **Group IV** lists factors associated with the dimension of empathy, like factor group II; therefore, in the author's opinion, these factor groups (II and IV) may be united. The outcomes of factor analysis for the customers' perceived service evaluation are provided in Table 10. Factor analysis was conducted using PCA. As seen in Table 10, the cumulative value of the perceived service component analysis (%) is 66.966.

**Table 10.** Factor analysis of the evaluation of customers' perceived service

Components	Initial specific (eigen) values			Extraction sums from square loads			Rotation sums from square loads		
	Total	Dispersions %	Cumulative %	Total	Dispersions %	Cumulative %	Total	Dispersions %	Cumulative %
1.	13.216	60.074	60.074	13.216	60.074	60.074	10.941	49.734	49.734
2.	1.516	6.892	66.966	1.516	6.892	66.966	3.910	17.232	66.966
3.	0.880	4.001	70.967						
4.	0.681	3.097	74.065						
5.	0.628	2.854	76.919						
6.	0.554	2.516	79.435						
7.	0.481	2.188	81.623						
8.	0.424	1.929	83.552						
9.	0.414	1.882	85.434						
1.	0.390	1.771	87.205						
11.	0.368	1.672	88.877						
12.	0.331	1.503	90.380						
13.	0.326	1.480	91.860						
14.	0.285	1.297	93.157						
15.	0.250	1.138	94.295						
16.	0.243	1.104	95.399						
17.	0.229	1.043	96.441						
18.	0.200	0.907	97.349						
19.	0.183	0.830	98.179						
20.	0.156	0.711	98.890						
21.	0.126	0.574	99.464						
22.	0.118	0.536	100.000						

Source: the table designed by the authors, performing the statistical processing of the survey data by SPSS 22.00, 2019.

The first factor accounts for 60.074% of the total dispersion. It must be understood that the first factor accounts for the most significant volume of distribution, whereas the subsequent factors account for a small volume of dispersion. As seen in Table 11, the data for evaluating customers' perceived service were divided into two groups

according to importance. A load of each factor was evaluated. The author assumed for the present research that essential elements are those with a load above 0.50 (Pal, 1986; Pal, Bagi, 1987; Hair, Anderson, Tatham, Black, 2003). The higher coefficient of the factor, the more critical it concerns the customer's perceived service quality (Pallant, 2005). In fact, in the present research, minimum factor coefficient values were starting from 0.404 or more, and these coefficient values are regarded as significant for conducting factor analysis.

**Table 11.** Total dispersion of data of the evaluation of customers' perceived service

	Components	
	1	2
r_j_12	0.874	
r_j_14	0.856	
r_j_13	0.855	
r_j_7	0.832	
r_j_16	0.808	
r_j_15	0.787	
r_j_17	0.776	
r_j_9	0.769	
r_j_11	0.755	
r_j_10	0.746	
r_j_21	0.745	
r_j_8	0.731	
r_j_19	0.724	
r_j_20	0.718	
r_j_6	0.716	
r_j_18	0.703	0.404
r_j_5	0.647	0.415
r_j_4	0.645	0.533
r_j_22	0.417	
r_j_2		0.898
r_j_1		0.888
r_j_3	0.491	0.579

*Source:* the table designed by the authors, performing the statistical processing of the survey data by SPSS22.00, 2019.

**Group I** of factors considered most important by customers in evaluating the perceived service quality contains factors related to such service quality dimensions as **security, responsiveness, and empathy**. This group includes elements with a coefficient between 0.874 and 0.645. **Group II** lists factors related to **material gains**. This group contains factors with the coefficient from 0.898 to 0.579.

The comparison of the conducted factor analysis for data groups related to the evaluation of customers' expected and perceived services revealed that customers consider as most important service quality dimensions that need to be improved security, responsiveness, competence, and empathy. Less important are factors related to the dimension of material gains.



### Research data cluster analysis

Cluster analysis is characterized in scientific literature as a tool of statistical classification whereby data or objects (events, people, things, etc.). They are classified into groups so that elements of one cluster are very similar to one another and are very different from elements of other clusters (Fraley, Raftery, 1998).

Service quality evaluation is traditionally related to regression models (Eboli, Mazzulla, 2008, 2010; Hensher et al., 2003; dell'Olio et al., 2011) or structural equation models (De Oña et al., 2013, Eboli, Mazzulla, 2007, 2012; Irfan et al., 2011). However, the majority of these models are limited to a certain extent due to prior defined assumptions and relations between dependent and independent variables; thus, disregarding these assumptions, erroneous evaluations of service quality are obtained.

Analysis of the data of Latvia's public sector administrative service quality was conducted by means of cluster analysis with Ward's method. Data were obtained from customers' surveys conducted in the period of 2017 and 2018. As a result of factor analysis, principal factors that affect service quality were identified. These determining factors were used to perform cluster analysis. Based on the outcomes of factor analysis, indicators were calculated for each factor RG score:

- Factor 1 - survey questions: 4,5,6,7,8,9,10,11,12,13,14,15,16
- Factor 2 - survey questions: 17,18, 19, 20, 21
- Factor 3 - survey questions: 1, 2, 3
- Factor 4 - survey question: 22.

The importance of factors for other survey questions used in the present research is distributed among various factors. Therefore it is impossible to provide severe characteristics of any aspect. As each element includes a different number of questions, the indicator of factor distinctiveness is the arithmetic mean of the numeric evaluation of the responses provided for each question included in the factor. Cluster analysis data normality test was also conducted. See Table 12. For the normality test, Kolmogorov-Smirnov and Shapiro-Wilk criteria were used.

**Table 12.** Cluster analysis data normality test

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Factor _1	,126	292	,000	,953	292	,000
Factor _2	,112	292	,000	,934	292	,000
Factor _3	,164	292	,000	,879	292	,000
Factor _4	,272	292	,000	,880	292	,000

*Source:* the table designed by the authors, performing the statistical processing of the survey data by SPSS 22.00, 2020.

Cluster analysis was conducted by Ward's method of detecting distances by the method of Euclidean distance. To detect the number of clusters as a result of cluster analysis, the method of agglomeration coefficient analysis was used. In step 287 of cluster analysis, the agglomeration coefficient rapidly increased for almost 70 units. This allowed us to single out five customer groups that have standard features of cluster forming factors. Five sets were detected where customers were united in 5 groups, see Table 13.

**Table 13.** Cluster analysis with Ward's method

		Frequency	%	Validity %	Cumulative%
Valid	1	101	34.6	34.6	34.6
	2	74	25.3	25.3	59.9
	3	52	17.8	17.8	77.7
	4	34	11.6	11.6	89.4
	5	31	10.6	10.6	100.0
	Total	292	100.0	100.0	

Source: the table designed by the authors, performing the statistical processing of the survey data by SPSS 22.00, 2020.

**Cluster 1** contains customers who hold essential service quality dimensions such as security, responsiveness, and competence. This customer group is the largest, constituting 34.6% of the total number of respondents. **Cluster 2** lists customers who emphasize as important such quality dimensions as competence and empathy. The number of respondents in this group makes 25.3% of the total number of respondents. **Cluster 3** contains customers who regard the dimension of material gains as the most important one. This group of customers makes 17.8% of all respondents. **Clusters 4 and 5**, similar to cluster 2, accentuate the dimension of empathy. These customer groups constitute 22.2% of all respondents. Data normality test with Ward's method was conducted, see Table 14.

**Table 14.** Normality test with Ward's method

	Ward's method	Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
factor_1	1	,255	101	,000	,847	101	,000
	2	,085	74	,200*	,983	74	,439
	3	,144	52	,009	,954	52	,042
	4	,120	34	,200*	,967	34	,378
	5	,139	31	,135	,892	31	,005
factor_2	1	,272	101	,000	,817	101	,000
	2	,198	74	,000	,930	74	,001
	3	,236	52	,000	,924	52	,003
	4	,181	34	,006	,909	34	,008
	5	,142	31	,113	,926	31	,034
factor_3	1	,297	101	,000	,759	101	,000
	2	,126	74	,005	,944	74	,003
	3	,162	52	,002	,914	52	,001
	4	,195	34	,002	,876	34	,001
	5	,335	31	,000	,690	31	,000
factor_4	2	,348	74	,000	,781	74	,000
	3	,346	52	,000	,763	52	,000
	4	,353	34	,000	,636	34	,000
	5	,317	31	,000	,717	31	,000

Source: the table designed by the author, performing the statistical processing of the survey data by SPSS 22.00, 2020.

As the distribution of factor evaluation in the selected groups does not correspond with the normal distribution, for comparing these evaluations non-parametric Kruskal-Wallis test is used, see Table 15 and Table 16.

**Table 15.** Data Kruskal –Wallis test-1

	Ward's Method	Number	Mean
factor_1	1	101	206.71
	2	74	91.43
	3	52	67.21
	4	34	207.54
	5	31	147.85
	Total	292	
factor_2	1	101	215.64
	2	74	82.50
	3	52	62.57
	4	34	166.78
	5	31	192.56
	Total	292	
factor_3	1	101	191.72
	2	74	60.34
	3	52	129.61
	4	34	171.47
	5	31	205.79
	Total	292	
factor_4	1	101	168.00
	2	74	170.86
	3	52	51.15
	4	34	270.71
	5	31	42.00
	Total	292	

Source: the table designed by the author, performing the statistical processing of the survey data by SPSS 22.00, 2020.

**Table 16.** Data Kruskal –Wallis test-2

	factor_1	factor_2	factor_3	factor_4
Chi-Square	147,300	175,509	131,576	236,073
df	4	4	4	4
Asymp. Sig.	,000	,000	,000	,000

Source: the table designed by the author, performing the statistical processing of the survey data by SPSS 22.00, 2020.

There are statistically significant differences among all factors on 1% significance level among cluster group participants,  $p < 0.01$ .

**Table 17.** Gender distribution of customer clusters

			Gender		Total
			female	male	
Ward’s method	1	Number	67	34	101
		% with Ward’s method	66.3%	33.7%	100.0%
	2	Number	49	25	74
		% with Ward’s method	66.2%	33.8%	100.0%
	3	Number	45	7	52
		% with Ward’s method	86.5%	13.5%	100.0%
	4	Number	29	5	34
		% with Ward’s method	85.3%	14.7%	100.0%
	5	Number	24	7	31
		% with Ward’s method	77.4%	22.6%	100.0%
Total		Number	214	78	292
		% with Ward’s method	73.3%	26.7%	100.0%

Source: the table designed by the author, performing the statistical processing of the survey data by SPSS 22.00, 2020.

Analyzing the obtained customer clusters according to gender, it must be concluded that the majority in all groups are females (see Table 17 above).

**Table 18.** Age groups of obtained customer clusters

			Customer age			Total
			20-40	41-60	60<	
Ward’s method	1	Number	44	46	11	101
		% with Ward’s method	43.6%	45.5%	10.9%	100.0%
	2	Number	8	40	26	74
		% with Ward’s method	10.8%	54.1%	35.1%	100.0%
	3	Number	14	23	15	52
		% with Ward’s method	26.9%	44.2%	28.8%	100.0%
	4	Number	14	14	6	34
		% with Ward’s method	41.2%	41.2%	17.6%	100.0%
	5	Number	21	9	1	31
		% with Ward’s method	67.7%	29.0%	3.2%	100.0%
Total		Number	101	132	59	292
		% with Ward’s method	34.6%	45.2%	20.2%	100.0%

*Source:* the table designed by the authors, performing the statistical processing of the survey data by SPSS 22.00, 2020.

Analysis of the obtained customer clusters according to customer age groups, showed that clusters 1 and 4 have a similar distribution of age groups (20-40 and 41-60 years of age; see Table 18 above). Clusters 2 and 3 are basically constituted of customers aged 41-60. Cluster 5 entails customers aged 20-40. The majority of customers in sets fall in the age group 41-60.

Analysis of the obtained customer clusters according to the principal factors for each cluster showed that all received customer clusters possess distinct characteristics related to such service quality dimensions as competence and empathy.

Analysis of the obtained customer clusters according to service quality dimensions revealed that two of the most distinct groups are incredibly similar in evaluating such service quality components as security and responsiveness. One of the customer clusters that may be called fastidious customers has given the most negative evaluation for all service quality dimensions.

Service quality research based on cluster analysis was produced to get detailed customer profiles with similar service evaluations. This approach detects customer groups' unique requirements and needs concerning the service quality and personalized service provision strategy. This segmentation methodology alleviates providing customized services that are adjusted to the individual needs or wishes of various customer groups. Service adjustment enhances customer satisfaction and loyalty (Cheung et al., 2003; Vesanen, 2007).

## Conclusions

In the quality of Latvian public sector administrative services, the essential quality dimensions for customers, the performance of which needs to be improved, are reliability, responsiveness, and competence. The clients rated reliability - on average 4.73 points, responsiveness - on average 4.69 points and competence - on average 4.53 points.

The quality of administrative services in all quality dimensions is assessed as unfavourable. The quality of security, responsiveness, and competence dimensions were assessed with -0.668 points, -0.626 points, and -0.518 points, respectively. A less negative evaluation of quality is observed only in the measurements of material benefits (-0.209 points) and empathy (-0.388 points). A similar study revealed that service quality dimensions such as responsiveness could positively affect customer satisfaction (Mosimanegape et al., 2020). Clients consider the essential quality of services provided by public administration institutions are the security of the service, competence, and responsiveness of the service providers. Factor group I lists factors considered by customers most important as to expected service quality and contains such service quality dimensions as security, responsiveness, and competence. Elements of this group have a coefficient from 0.790 to 0.505. Factor group II according to their importance, contains factors related to such a service quality dimension as empathy. Characteristics of this group have a coefficient from 0.765 to 0.559. Factor group III lists factors related to the material gains dimension. The coefficient of this group is from 0.797 to 0.673.

Comparing the produced factor analysis for data groups concerning the customers' expected service and perceived service evaluation revealed that customers consider security, responsiveness, competence, and empathy to be the most critical service quality dimensions. The performance whereof must be improved. Less essential are factors related to the measurement of material gains. The results of factor analysis confirm the outcomes of the public service evaluation survey conducted within the research. Clients of public administration institutions form four conditional groups according to the factors considered important as concerns the quality of the received services.

A service quality investigation based on cluster analysis was conducted to obtain detailed customer profiles with similar service evaluations. This approach detects customer groups' unique requirements and needs concerning service quality and personalized service provision strategy. This segmentation method makes the provision of customized services adjusted to various customer groups' unique needs or wishes.

Cluster 1 lists customers who hold as important service quality dimensions as security, responsiveness, and competence. Cluster 2 contains customers who single out as necessary competence and empathy. Cluster 3 entails customers who consider the dimension of material gains as the most important. The majority of customers of cluster 4, similar to cluster 2, emphasize the dimension of empathy.

The analysis of customer groups obtained as a result of cluster analysis according to service quality dimensions leads to the conclusion that two of the most distinct groups are remarkably similar in evaluating such service quality components as security and responsiveness. One of the groups is unique in its most negative evaluation of all service quality dimensions. This group may be called the fastidious customers.

The study evaluates the quality of administrative services provided by Latvian public sector institutions and compares it with the efficiency of these institutions. Within the research framework, factors have been identified that are considered necessary by the clients of Latvian public administration institutions regarding the quality of administrative services provided but which are less critical. Specific clusters or groups are formed by the clients of the Latvian public administration according to the factors that are important to them in the quality of the received services.

Due to the limitations to the volume of the research work, the research on customer service quality is concentrated mainly in the largest cities and towns in Latvia – Riga, Daugavpils, Jelgava, Ventspils, and Valmiera. The quality of administrative services was assessed only for face-to-face services, as 54% of the surveyed residents, describing the reasons for face-to-face communication, indicated the impossibility of solving the problem on the Internet (SKDS, 2019).

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**Iveta KATELO** is a researcher at the Center for Social Research, Institute of Humanities and Social Sciences, the Daugavpils University. Research interests: management science, quality management, public administration.

ORCID ID: <http://www.orcid.org/0000-0001-7939-576X>

**Irēna KOKINA** is a professor at the Daugavpils University, Faculty of Education and Management. Research interests: organizational culture; talent development in organizations; self-growth of the leader; knowledge management.

ORCID ID: <http://www.orcid.org/0000-0001-6778-0783>

**Vitalijs RAŠČEVSKIS** is a docent at the Daugavpils University, Social science Faculty. Research interests: personality activity; social notions; occupational stress; psychosocial well-being.

ORCID ID: <http://www.orcid.org/0000-0002-4697-9977>

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## THE IMPACT OF MONETARY AND FISCAL POLICY VARIABLES ON THE EU ECONOMIC GROWTH. PANEL DATA ANALYSIS\*

Joanna Stawska <sup>1</sup>, Katarzyna Miszczyńska <sup>2</sup>

<sup>1</sup>University of Lodz, Faculty of Economics and Sociology, Department of Central Banking and Financial Intermediation, 39 Rewolucji 1905 r. street, 90-214 Lodz, Poland

<sup>2</sup>University of Lodz, Faculty of Economics and Sociology, Department of Public Finances, 39 Rewolucji 1905 r. street, 90-214 Lodz, Poland

E-mails:<sup>1</sup> [joanna.stawska@uni.lodz.pl](mailto:joanna.stawska@uni.lodz.pl); <sup>2</sup> [katarzyna.miszczynska@uni.lodz.pl](mailto:katarzyna.miszczynska@uni.lodz.pl)

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**Abstract.** The financial crisis of 2008-2009 has changed an approach to conducting monetary and fiscal policy. Changing economic conditions forced the economic authorities to make decisions that influenced an interaction between the central bank and the government (policy mix) in the European Union countries. The article aims to identify the impact of variables in the area of monetary and fiscal policy on the economy in the EU countries in existing economic conditions. The article verifies the hypothesis that variables from the monetary and fiscal policy have a statistically significant impact on the GDP per capita growth rate in the EU countries. To achieve the goal and verify the hypothesis, the following research methods were used: presentation of statistical data as well as statistical and econometric research methods (panel model). The rationale for the adoption of this topic was to examine the impact of central bank policy and government in the EU countries on their economies. The contribution of this article is to present the role of monetary and fiscal policy in the economic growth of the EU countries in 2000-2019. The results of the study indicate that the GDP per capita growth rate in 28 European Union countries in the period of 2000-2019 was statistically significantly affected by such variables as: interest rate (from the monetary policy area), GG deficit/surplus (the variable from the area of fiscal policy). This is important information in the context of conducting monetary policy and fiscal policy by relevant decision-makers, i.e., monetary authorities and fiscal authorities in the EU countries.

**Keywords:** economy; European Union; fiscal policy; monetary policy; policy mix; sustainable policy

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## 1. Introduction

In the period of 2000-2019 that is examined in this article, economic conditions in the European Union countries changed, affecting the decisions of their economic authorities. In 2004, 10 countries joined the European Union, then in 2008-2009, the financial crisis began, which turned into a crisis of public finances. The monetary and fiscal authorities of the surveyed countries tried to counteract the effects of the crisis, which most often contributed to an increase in public debt and budget deficit. As a result of the increase in budget deficits, the so-called Excessive Deficit Procedure was imposed on the EU countries whose GG deficit exceeded 3% of GDP, which resulted in a need for subsequent decisions of economic authorities relevant to the economies of these countries.

The main motivation to take up this topic is the fact that variables in the field of monetary and fiscal policy affect the economic activity of many countries. In this case, we wanted to check whether over the 20 years (2000-2019) these variables are important for economic growth in the EU countries in the conditions of many structural changes and economic shocks (such as the financial crisis or the debt crisis). Sen & Kaya (2015) emphasize that macroeconomic policy plays an important role in achieving economic, rapid and sustainable growth without worsening inflation (which, according to economic theory, is related to the level of interest rates), and the leading tools of macroeconomic policy are monetary policy and fiscal policy. Voda et al. (2022) emphasize that it is precisely ensuring fiscal stability in the EU Member States that has become an important task in the current economic situation. Appropriate economic policy can contribute to fiscal consolidation and to contain the fiscal shock that has consequences for national budgets. Suescun (2020) notes that fiscal policy should be viewed in terms of long-term fiscal plans and not in terms of single-term shocks, because fiscal policy is the process of initiating and implementing socio-economic measures by the government to prevent fiscal stochastic shocks that may have the effect of destroying the economic balance and limiting fiscal - budgetary sustainable development. Chugunov et al. (2021) contest that the policy mix should focus on increasing public welfare and maintaining long-term macroeconomic stability by achieving moderate inflation, sustained economic growth, debt sustainability and sustainable public finances. The priority of fiscal policy should be creating favorable conditions for economic growth by regulating revenues, expenses and budget deficit. In turn, the priority of monetary policy should be maintaining price stability. Hence, the main purpose of policymakers using monetary and fiscal policy tools is to respond to economic fluctuations. Although the main goal of monetary policy is to respond to a change in inflation and fiscal policy is focused on public finances, both policies can be used to respond to economic activity.

In this study, particular attention was paid to variables that come from the area of monetary policy and fiscal policy. The impact of changes in these variables on GDP per capita was observed in the EU countries. The article aims to identify the impact of variables in the area of the monetary and fiscal policy in existing economic conditions on the economy in the EU countries. The article verifies the hypothesis that the variables from the monetary and fiscal policy have a statistically significant impact on the annual GDP per capita growth rate in the EU countries. Annual statistical data for 28 countries of the European Union in the years 2000 - 2019 was used in the study. Based on this data, the fixed effects panel model was created. The explained variable was the annual economic growth rate per capita (presented in PPS) in the EU countries. On the other hand, explanatory variables included GDP per capita (presented in PPS) – the initial level (GDP per capita lagged by one period), investments as % of GDP, General Government (GG) deficit/surplus, short-term interest rate, R&D expenditure per capita and zero-one EMU variable - denoting membership in the euro area.

A novelty in this study compared to previously conducted studies is focusing specifically on monetary and fiscal policy variables. The research period is also interesting because it covers a period of 2000-2019, which includes the accession of 10 countries to the EU in 2004, the financial crisis of 2008-2009, the crisis of public finance and the excessive deficit procedure.

The structure of the paper is as follows. Section 1 is the introduction. Section 2 presents the findings of a review of studies on the determinants of economic growth in the field of monetary policy and fiscal policy. In Section 3, a panel model was presented for the European Union countries in 2000-2019. This section also explains the model's assumptions. Section 4 presents research results, their interpretations and discussion. The last section contains the conclusions.

## 2. Theoretical background

Economic growth depends on many factors, including social, economic, political, environmental and cultural ones. Probably not all of them significantly affect the rate of economic growth in all countries or regions to the same extent. Some of these variables most frequently recurring in numerous empirical studies are presented in the following publications: e.g. Harrod (1939; 1942); Kaldor (1960); Phelps (1961, 1966); Romer (1986); Lucas (1988), Solow (1988, p. 307); Romer (1990); Barro, (1991, pp. 407-444); Mankiw, Romer & Weil (1992); Nonneman & Vanhoudt (1996); Sala-i-Martin, (1997a,b, pp. 178-183); Fernandez, Ley & Steel (2001a, pp. 563-576); Fernandez, Ley & Steel (2001b, pp. 381- 427); Sala-i-Martin, Doppelhofer & Miller (2004, pp. 813-835); Moral-Benito, (2010; 2012); León-Gonzalez & Montolio, (2012); Tadesse & Melaku (2019, pp. 87-115). These are theories of economic growth that arose on the basis of Keynesian macroeconomics, as well as neoclassical models, alternative models of economic growth, or modern optimization models, models of endogenous growth, short-term and long-term models.

Most research on economic growth is based on the search for an explanation of why some countries experience sustained growth in per capita income and others do not (Lucas, 1988). Hence, many varieties of theoretical growth models have emerged in the literature, all of which point to different components of macroeconomic factors that affect per capita income growth. Considering exogenous growth models, pioneered by Solow (1956), it is believed that productivity growth can be explained by direct investment, population growth and technological progress. Solow believed that direct investment and population growth only affect the level of output and do not affect the long-term growth rate. Instead, technological progress is considered to be the only factor influencing the long-run growth rate of economies and is responsible for productivity differences between countries. According to Solow (1956), an increase in the return on capital is associated with innovation. In turn, following the definition of endogenous growth models, the focus was on the assumption that international productivity differences can be explained by factors that affect the efficiency of capital and cause its flight. These factors include: government spending, inflation, real exchange rates and real interest rates. Within endogenous growth models, capital used for innovation purposes is also mentioned, which can induce economies of scale and contribute to international productivity differences. Among the most important factors in this approach are knowledge, human capital, research and development. Capital investment is an important element of endogenous growth when used for innovation purposes, such as investment in innovative and intellectual capital (Frankel, 1962; Grossman & Helpman, 1991) and knowledge and skills (Lucas, 1988). In an extended version of endogenous models, factors affecting capital efficiency growth are, real interest rate (Gelb, 1989), fiscal policy (Barro, 1990; Barro & Sala-i-Martin, 1992), inflation (Bruno & Easterly, 1998) and real exchange rates (Rodrik, 2008).

This paper introduces to the study, among other things, the concept of convergence in economic growth theory. Convergence findings were initially related to the first endogenous economic growth models (Romer, 1990),



which were later enriched with new elements such as technology diffusion, capital flows or labour migration, factors more characteristic of exogenous economic growth models. It is worth adding that there are many concepts of convergence, which makes it difficult to classify them unambiguously. There are no unambiguous results concerning the convergence hypothesis understood as an equalization of GDP per capita levels of different economies. Among the factors that influence the convergence process are capital accumulation and/or technology. In the case of the decisive role of capital in the convergence process - the differences in the levels of GDP per capita of economies at different levels of development should disappear over time. However, if technology is the main determinant of the convergence process, then the convergence of GDP per capita levels will occur among countries with a similar level of development. Thus, convergence in the sense of an economy converging to its state of uniform growth is grounded in both neoclassical economic growth models (exogenous growth models) and endogenous growth models. Economic growth models point to various factors that influence the rate of convergence (Nowak, 2006).

Boldeanu & Constantinescu (2015) emphasized that the determinants of economic growth are related factors influencing the pace of economic growth and they indicated the division of these determinants into six groups (four of which were classified as supply determinants and the other two were productivity and demand). Supply factors are natural resources, capital goods, human resources and technology. The factors determining economic growth vary widely. These factors include public expenditure, capital accumulation, private or public investment, employment rates and exchange rates. It is worth adding that the impact of these determinants on economic growth also depends on whether a given economy is developed or not. Another division of determinants influencing economic growth consists in dividing these factors into direct and indirect ones. The direct ones include: human resources (including an increase in the number of the active population and investments in human capital), natural resources (i.e., land and underground resources), an increase in the capital employed or technological progress. Indirect factors include: institutions (such as financial institutions or state administration), the size of aggregate demand, savings rates, investment rates, the effectiveness of the financial system, budget and fiscal policies, labor migration, capital, and government efficiency.

As a consequence of the financial crisis that started in 2008, the debate on the effectiveness of monetary and fiscal policy in the field of economic activity was resumed. Guerguil et al. (2017) and Özer & Karagöl (2018, pp. 391-409) noticed that as a result of the crisis, monetary policy has a limited impact on economic activity when interest rates are entangled in a zero lower bound. Then, there is a tendency to agree on the strength of fiscal policy as an anti-cyclical macroeconomic policy tool. Pečarić et al. (2018, pp. 81-97) note that with the onset and passing of the 2008 economic crisis, the impact of fiscal policy on economic growth has regained its importance in the scientific and research community. This was due to the fact that with the advent of the crisis, many countries tried to alleviate its harmful effects through automatic stabilizers (social spending, unemployment benefits, etc.). Then, these countries tried to stimulate the economy financially, e.g. by an increase in public expenditure, tax policy reforms, which aimed at encouraging aggregation of demand and, consequently, the GDP growth. It should also be emphasized that along with the expansive fiscal policy, the public deficit and debt often increase. In turn, high indebtedness as indicated by Cecchetti et al. (2011) can significantly increase the risk premium affecting future financial activities. Also Kumar & Woo (2010) stated that the negative impact of high public debt on economic growth may be associated with a decrease in labor productivity caused by a decrease in investment activity. To sum up, fiscal policy as well as other economic policies have a key impact on both short and long-term economic activity.

Talos et al. (2013, pp. 605-617) whose research focused on analyzing the impact of fiscal and monetary policy on economic growth in the European Union (EU) countries noted a strong impact of interest rates on GDP evolution. Talops et al. (2013) noted that in the years 2000-2011, the increase in public debt had a negative impact on GDP growth, the interest rate had a strong negative impact, while the inflation rate and private consumption had a positive effect on GDP changes. Vinayagathasam (2013) emphasizes that usually with restrictive monetary policy

- prices, production, and demand for money are expected to decline, with interest rates rising and exchange rate appreciation. On the other hand, based on empirical research conducted for a sample of 32 Asian countries, it was pointed out that the factors conditioning and motivating economic growth are trade openness and the investment rate. In turn, inflation hampers economic growth when it exceeds 5.43%. As a result, monetary policy affects economic growth. Monetary policy instruments affecting economic growth that are most frequently mentioned in the literature include interest rate (Bernanke & Blinder, 1992, pp. 901-921), unsecured reserves (Strongin, 1995, pp. 463 - 497) and exchange rates (Fung, 2002).

Barro (1990, pp.103-125) or Barro & Sala-i-Martin (1992, pp. 645-661; 2003) indicate that endogenous growth models include channels through which fiscal policy can affect long-term growth. Easterly & Rebello (1993, pp. 417- 458) noticed that many fiscal policy variables are highly correlated with the initial level of income and fiscal variables are potentially endogenous (which is important in the context of endogenous theory of economic growth where state policy has a significant impact not only on the level of production, but it also determines the long-term growth rate). In the Cashin (1995, pp. 237-269) study, a positive relationship between government transfers, public investment and economic growth was estimated based on panel data for 23 developed countries in 1971-1988. However, a negative relationship was noted between distorting taxes and economic growth. Devarajan et al. (1996, pp. 313-344) showed that in 1970-1990, in 43 developing countries, current public spending had a positive impact on economic growth while government spending had a negative impact. As a result, Benos (2009) concludes that both expenditure and income (both sides of the general government budget) are important for sustainable growth in line with endogenous growth models. In the literature on the subject, it is estimated that private investment has a positive impact on economic growth. This is consistent with growth theory (McGrattan, 1998, pp.13-27) as well as empirical research (Levine & Renelt (1992, pp. 942-963); Cooley & Ohanian (1997, pp. 439-472); Dinopoulos & Thomson (2000, pp. 335-362); Bond et al. (2004). Economic openness is also positively affected by the openness of the economy affected by the dissemination of international knowledge spillovers of R&D driven by trade (Coe & Helpman, 1995, pp. 859-887; Lichtenberg & Van Pottelsberghe de la Potterie, 1998, pp. 1483-1491; Coe et al., 1997, pp. 134-149).

Research on the impact of monetary and fiscal policy factors on economic growth was conducted not only in European countries but also in various countries around the world. Interesting research was also conducted by Monamodi (2019), and it concerned the impact of fiscal and monetary policy on economic growth in the South African economies of members of the customs union (SACU) in the years 1980-2017. Public expenditure and revenues were used as variables representing fiscal policy, while real interest rate, inflation and M2 money supply were used as variables in the field of monetary policy. The results indicated that fiscal and monetary policy significantly affected long-term economic growth in all SACU member economies. Inflation and supply of M2 had a positive impact on economic growth in the studied countries. The real interest rate and official exchange rate negatively affected the economic growth in SACU member economies. Fiscal policy has a significant positive impact on economic growth if public expenditure is treated as a functional instrument of fiscal policy, not the state income. Additionally, using the Granger causality test, the direction of long-term relationships between variables was determined and it was noted that the direction emerges from public expenditure, real interest rate, inflation and the official exchange rate to economic growth.

Another example of similar research is the study of the relationship between fiscal variables and economic growth in Asian countries in 1985-2001 conducted by using dynamic analysis of panel data. It was examined whether components and aggregated public expenditure affect real GDP per capita and whether components and other aggregated fiscal variables affect real GDP per capita. A long-term relationship between fiscal policy and economic growth was noted. A positive and statistically significant impact of expenditure on health, education, aggregation of public expenditure and aggregation of other fiscal variables on real GDP per capita was observed (Abdullah et al., 2009).

### 3. Research objective and methodology

The implementation of the research objectives assumed in the study, together with the verification of the research hypothesis was based on the fixed effects regression model in the years between 2000-2019. The use of such modeling was dictated by the solutions used in the literature (Pečarić et al., 2018, pp. 81-97; León-González & Montolio, 2012). Based on the literature review and analysis of available data, potential variables were extracted. Table 1 presents the definitions of all variables in question.

**Table 1.** Description of variables used in the study

Variable	Abbreviation	Description
Growth rate of the real GDP per capita	GDP_GRTH	Growth of real GDP per capita in PPS. The GDP growth was calculated as follows: $\left( \frac{GDP_t}{GDP_{t-1}} - 1 \right) \cdot 100\%$ Source: Eurostat
The real GDP per capita lagged by one year	GDP <sub>-1</sub>	Chain linked volumes (constant prices from 2010), euro per capita in PPS Source: Eurostat
Research and Development (R&D) expenditure per capita	RD	Intramural R&D expenditure (GERD) by sectors of performance and source of funds. Expressed in Purchasing Power Standard (PPS) per inhabitant at constant 2005 prices
Total investment as a share of GDP (%)	INV	Investment share of GDP by institutional sectors Source: Eurostat Gross fixed capital formation as % of GDP for government, business and households sectors
Short term interest rates	IR	Three months interbank interest rates
General Government deficit/surplus as % of GDP	GG_DEF	IR Government deficit/surplus, Percentage of gross domestic product (GDP) Net lending (+) /net borrowing (-)
Membership to the euro area	EMU	Countries which joined the euro area: - in 1999.- Belgium, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, Netherlands, Portugal and Finland - in 2007: Slovenia - in 2008: Cyprus and Malta - in 2009: Slovakia - in 2011: Estonia - in 2014:Latvia - in 2015: Lithuania

Source: own elaboration

The creation of economic growth depends on many factors. In the study, the authors make an attempt to answer a question if the monetary and fiscal policy shape the economic growth of the country. In the years 2000-2019, the gross domestic product increased on average by 3.77% in the European Union countries. Detailed statistics are presented in Table 2.

**Table 2.** Summary statistics of variables in the European Union countries (N=28) between years 2000-2019

Variable	Mean	St. Dev.	Min	Max
GDP_GRTH	3.7751	4.4661	-15.232	35.422
GDP <sub>-1</sub>	24045	11222	4900	79000
RD	8524.3	15321	16,678	1.0121e+005
INV	22.124	4.1147	10.140	45.600
IR	-0.068116	2.5036	-39.000	21.000
GG_DEF	-2.3650	3.5082	-32.100	6.9000

Source: own elaboration

On the basis of the panel sample consisting of 28 countries and 20 observations over time (data for the years from 2000 to 2019), a preliminary pooled panel type estimation of a model was conducted (Hsiao, 1986; Baltagi, 2008; Brañas-Garza et al. (2011, pp. 3-11). The preliminary research was carried out while maintaining stationary variables (Barbieri, 2005, pp. 117-158). The stationarity of the variables was checked with Levin, Lin & Chu test (LLC) (Levin et al., 2002, pp. 1-24; Kleiber & Lupi, 2010). The stationarity results are presented in Table 3. As a result the variables GDP, RD that turned out not to be stationary, were transformed by the first differences or logarithms.

**Table 3.** Levin-Lin-Chu unit-root test for the variables.

Variable	p-value	H0: Panels contain unit roots H1: Panels are stationary
GDP_GRTH	0,000***	H1
GDP <sub>-1</sub>	0,4833	H0
INV	0,0145**	H1
RD	1,000	H0
GG_DEF	0,0001***	H1
IR	0,000***	H1

The LLC test is conducted only for the non-binary variables; significance levels:  $\alpha = 0.10^*$ ,  $0.05^{**}$ ,  $0.01^{***}$

Source: own elaboration in Gretl.

Moving forward, the appropriate estimation procedure was determined, after a prior analysis of panel tests. The final catalogue of variables determining the gross domestic product growth was chosen with the help of the Variance Inflation Factor, partial correlation coefficients and t-Student significance tests. The study was conducted in two variants. In Variant II, in addition to the same variables used in Variant I, a zero-one variable was added - EMU, related to the membership of a given country in the euro area. Membership in the euro area determines the monetary policy of a given country, i.e. interest rates, or the same currency in the EMU countries. The authors wanted to check the importance of membership in the euro area for the dynamics of economic growth.

Table 4 contains the results of tests confirming the selected estimation method.

**Table 4.** Diagnostic tests for panel data model verification in both variants

Hypotheses	Variant I - Tests	Variant II - tests
H <sub>0</sub> : is the OLS model H <sub>1</sub> : is the FE model	F (27, 499) = 3,38541 with p – value = 4,51695e-008	F (27, 497) = 3.336 with p – value = 6.87975e-008
H <sub>0</sub> : is the OLS model H <sub>1</sub> : is the RE model	Breusch-Pagan test LM=23.2213 with p-value = 1,44389e-006	Breusch-Pagan test LM=20.1872 with p-value = 7.02221e-006
H <sub>0</sub> : is the RE mode H <sub>1</sub> : is the FE model	Hausman test H = 27,8591 with p value p = 3,87813e-005	Hausman test H = 28.2248 with p value p = 8.52319e-005

Note: OLS – ordinary least squares. RE-random effects model. FE-fixed effects model

Source: own elaboration in Gretl.

After verifying all tests (see Table 4), it was decided that a fixed effects regression model will be used to estimate the annual gross domestic product growth. Thus, in the further part of the article, the modeling of economic growth will be presented using fixed-effects model, whose formal notation, including the initial catalog of desired variables, is presented as follows:

$$GDP\_GRTH_{it} = \alpha_i + \beta_1 GDP_{it-1} + \beta_2 INV_{it} + \beta_3 IR_{it} + \beta_4 GG\_DEF_{it} + \beta_5 RD_{it} + \varepsilon_{it}$$

where:  $\alpha_i$  - the fixed effect for the i-th country,  $\beta_1, \dots, \beta_5$  - structural parameters of the model;  $\varepsilon_{it}$  - composite error term.

### 3. Results and Discussion

Modeling was carried out in two variants. Variant I had no EMU variable determining euro area membership. Variant II included the EMU variable.

Tables 5 and 6 present the results of the estimation of the model's parameters in both variants. All of the characters standing in front of the estimated parameters are in line with economic expectations. All variables that were included in individual models were classified into the following groups: (Kaldor, 1957), (Moral-Benito, 2012, pp. 566-579), (Sala-i-Martin et al., 2004, pp. 813-835), (Boldeanu & Constantinescu, 2015):

- 1) Human capital: research and development expenditures per capita (Coe & Helpman, 1995, pp. 859-887);
- 2) Fiscal policy: GG deficit/surplus, GDP<sub>-1</sub> (Monamodi, 2019; Benos, 2009; Easterly & Rebelo, 1993, pp. 417-458);
- 3) Monetary policy: IR, Investments (Monamodi, 2019; Vinayagathasam, 2013);
- 4) Membership in the euro area: EMU (in Variant II)

Investments were in the group related to monetary policy because they are indirectly significantly related to the interest rates of central banks, which affects the level of interest rates on loans and thus the lending of banks affects the size of investment in the economy. This is confirmed by Keynes (1936), who indicates that a low interest rate means less entropy of the economic system and has a stimulating effect on investment and GDP growth.

**Table 5.** Estimation of the economic growth in the European Union countries (Variant I)

Fixed effects model, using 532 observations					
28 cross-sectional data units included					
Time series length = 19					
Dependent variable (Y): GDP_GRTH					
Robust standard errors (robust HAC)					
	<i>Coefficient</i>	<i>St. Dev.</i>	<i>t-Student</i>	<i>P-value</i>	
const	39.3334	6.27408	6.269	1.04e-06	***
l_GDP <sub>t-1</sub>	-6.04342	0.452846	-13.35	2.10e-013	***
d_GGdef	0.480564	0.120535	3.987	0.0005	***
d_RD	0.00150427	0.000500501	3.006	0.0057	***
l_inv	7.88825	1.26225	6.249	1.10e-06	***
d_IR	-0.0730406	0.0263938	2.767	0.0101	**
VIF<10.0					
R <sup>2</sup> = 41,89					
Note: Significance levels: $\alpha = 0.10^*$ , $0.05^{**}$ , $0.01^{***}$ .					

Source: own elaboration in Gretl

**Table 6.** Estimation of the economic growth in the European Union countries (Variant II)

Fixed effects model, using 531 observations					
28 cross-sectional data units included					
Time series length = minimum 18, maximum 19					
Dependent variable (Y): GDP_GRTH					
Robust standard errors (robust HAC)					
	<i>Coefficient</i>	<i>St. Dev.</i>	<i>t-Student</i>	<i>P-value</i>	
const	40.9241	6.17693	6.625	4.15e-07	***
l_GDP <sub>t-1</sub>	-6.28345	0.620819	-10.12	1. 10e-010	***
d_GGdef	0.484136	0.122898	3.939	0.0005	***
d_RD	0.00151314	0.000503533	3.005	0.0057	***
l_inv	8.05742	1.43472	5.616	1.10e-06	***
d_IR	-0.0724248	0.0262173	2.762	0.0102	**
EMU	0.507628	0.913225	0.5559	0.5829	
VIF<10.0					
R <sup>2</sup> = 41,94					
Note: Significance levels: $\alpha = 0.10^*$ , $0.05^{**}$ , $0.01^{***}$ .					

Source: own elaboration in Gretl

Thus, the interpretation of the model results was also carried out based on such division of variables. What is more, the VIF test confirmed a correct selection of variables for the model (they are available on request). It should be noted that due to the moderate strength of the correlation coefficient, results between both IR and INV variables were included in the model.

In the years 2000-2019, among the economic variables affecting the formation of economic growth were variables referring to: fiscal policy, monetary policy, and human capital. Those results also partially correspond with the



research conducted by Barro & Sala-i-Martin (1992, pp. 645-661; 2003), Bernanke & Blinder (1992, pp. 901-921), Cashin (1995, pp. 237-269), Abdullah et al. (2009), Talos et al. (2013, pp. 605 - 617), Pečarić et al. (2018, pp. 81-97), Monamodi, 2019).

It is worth interpreting the variable GDP per capita ( $l\_GDP_{t-1}$ ). This variable is associated with the convergence hypothesis denoting the dynamics of the economy towards a stationary state of equilibrium that appeared in the literature on economic growth in the 1950s as an implication of the assumptions of the neoclassical Solow-Swan growth model. However, the greatest development of empirical research on economic convergence occurred in the 1990s, which is directly related to the discussion on growth theory. The reference point for the modern perception of convergence, understood as the convergence of a group of economies to a common or similar state of equilibrium (characterized by a similar level of wealth and a similar rate of economic growth) is the publication of Baumol (1986, pp. 1072-1085). Thus, the process of economic convergence means that relatively poorer countries experience a higher rate of economic growth than rich countries, which is also confirmed by the minus sign with the  $GDP_{-1}$  variable in our study. Barro (1991), based on panel regressions in 98 countries over the period 1960-1985, finds a negative association between the growth rate of real GDP per capita and the initial (1960) level of real GDP per capita.

In the years 2000-2019, an increase in economic growth was most affected by investments (INV). An increase of one percentage point in the share of total investment determined a rise of 7.89 (in Variant I) and 8.05 (in Variant II) in GDP growth, *ceteris paribus*. An increase of one percentage point of interest rate determined, between the years 2000-2019, a fall of 0.07 unit in GDP growth, *ceteris paribus*. Barro (2003) confirms the positive relationship between GDP growth per capita and investment based on panel studies.

R&D expenditure also had a positive impact on the economic growth rate in EU countries over the period considered. R&D is an important contributor to economic growth by positively affecting innovation and total factor productivity (Romer 1990). In economic theory, there is a noticeable emphasis on the accumulation of R&D and human capital in the context of economic growth. It is often measured by how much production will increase when the level of expenditure on R&D increases. This is measured by estimating the production flexibility in relation to capital stock and exactly this is equal to the rate of return to R&D multiplied by the share of the R&D stock in output (Aghion & Howitt, 1992). Blanco et al. (2016) They even recommend that, in view of the existing evidence of synergies between human capital and their own R&D and R&D from other countries, the continual need for countries to strive to improve achievement in education, science, technology and engineering and mathematics, which are key to research and development and thus economic growth.

In turn, the variable - GG deficit or surplus also had an impact on economic growth in line with previous research results. Thus, the decline in GG deficit had a positive impact on the GDP growth rate. In the literature, it was mainly Keynes (1936) who emphasized that in the process of stimulating demand and employment (especially in periods of lower demand than supply of goods and services), the budget and government spending play an important role. It is government spending that can be used to stimulate the economy by inducing investment precisely through government investment (fiscal policy) and lowering real interest rates (monetary policy). Keynes also noted that there are situations when the economy is unable to respond to the price mechanism and return to equilibrium. Hence, counter-cyclical fiscal policies are suggested to reduce the amplitude of the business cycle during the depression and to influence economic growth in the short-run (as market forces influence economic growth in the long run).

Additionally, the authors attempted to check whether the country's presence in the euro area influences economic growth. However, on the basis of the proceedings, this supposition was not confirmed. The EMU variable was not statistically significant. Thus, the statement was made that the country's presence in the eurozone does not have a significant impact on economic growth in the European Union countries.

## Conclusions

On the basis of the conducted research, determinants shaping the creation of the economic growth in the European Union countries were distinguished. The constructed econometric model included variables reflecting the fiscal and monetary policy and human capital. The variables which occurred to be the determinants of gross domestic product growth were also confirmed in the literature review. According to the main goal, which was the identification of the impact of variables in the area of the monetary and fiscal policy in existing economic conditions on the economy in the EU countries, it must be underlined that the impact of chosen variables corresponding with those policies was significant.

The added value of this study is the original approach, which includes the variable monetary and fiscal policy area; GDP variable denoting the wealth of the economy, allowing observation of the convergence phenomenon; R&D relevant to the rate of economic growth. In addition, the panel study allowed to indicate that in the period of 2000-2019 (covering many variables significantly affecting the economic situation in the EU countries), variables in the area of monetary and fiscal policy had an impact on the GDP growth rate. It is worth emphasizing that variables in the area of monetary and fiscal policy are important for sustainable economic growth, hence it is necessary to emphasize their importance in the economy.

Even though the conducted research presents a contribution to the state of research, some limitations should be considered when interpreting the results. Firstly, the time range of the analysis should be extended and, if possible, presented quarterly. In addition, it also seems reasonable to extend the analysis to other non-European Union countries. In this way, the analyzed phenomenon could be captured more completely. This would allow checking the applicability of these findings to other European countries. Therefore, future research should include conducting inference in a broader group of countries to ascertain if the present findings are specific to the selected group of countries or are applicable to other countries as well.

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**Joanna STAWSKA** – Ph.D., assistant professor at the Department of Central Banking and Financial Intermediation, Faculty of Economics and Sociology; University of Lodz; Head of a research project financed by the National Science Center in the Sonata competition; Research manager for ministerial projects for Young Scientists. Author of over 80 scientific publications. Reviewer in many international scientific journals. Scope of research interests: monetary policy, fiscal policy, policy mix, public finance, game theory, enterprise investments, economic policy, banking system, financial system stability.  
**ORCID ID:** <https://orcid.org/0000-0001-6863-1210>

**Katarzyna MISZCZYŃSKA** - Doctor of economic sciences. An assistant professor in the Department of Public Finance at the University of Lodz, Poland. Expert in health economics with a particular emphasis on public finance and econometric modelling. Author of several academic articles, monograph sections, analytical works. Between 2017 and 2019 leader of scientific grant Multicriteria assessment of efficiency of public hospitals in Poland and identification of determinants of their indebtedness financed by the National Science Centre in Poland.  
**ORCID ID:** <https://orcid.org/0000-0003-4924-7605>

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## KEY SUCCESS FACTORS FOR SCALING SOCIAL ENTERPRISES IN SOUTH AFRICA\*

Henry Oswald Esau<sup>1</sup>, Robertson K. Tengeh<sup>2\*</sup>

*Faculty of Business and Management Sciences, Cape Peninsula University of Technology, South Africa*

*E-mails:<sup>1</sup> [Henryesau05@gmail.com](mailto:Henryesau05@gmail.com); <sup>2\*</sup> [tengehr@cput.ac.za](mailto:tengehr@cput.ac.za) (Corresponding author)*

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**Abstract.** Governments rely increasingly on social partners for assistance to deliver on UNESCO's sustainable development goals by 2030. However, community organisations are buckling under socio-economic hardship and a lack of donor funding during a global Covid-19 pandemic. Many social enterprises (SEs) are faced with the reality of cutting back or in some instances, completely shutting down their operations. An investigation of the literature revealed a high rate of early-stage business failure in South Africa. Hence our investigation into the key success factors that will aid SEs to scale and thrive in the hostile South African socio-political and economic climate. Using a qualitative, single case study approach underpinned by an interpretivist philosophy, this paper investigates the critical success factors for scaling SEs in South Africa. Three (3) semi-structured interviews, website content analysis and observations were used in the study to deliver data that was thematically analysed to come to the following results: SEs must express the ambition to scale, provide a best practice model, and have a social entrepreneurship orientation. Grassroots SEs must create access for local communities by focusing on three organisational dimensions, i.e., personal, operational, and strategic. Community partnerships are an overarching factor when considering scaling GSEs. By forming a social contract with communities, SEs allow them to take ownership of the interventions, increasing social impact. This paper adds to the existing knowledge regarding the critical success factors that enable the scaling of SEs in South Africa. It also creates a frame of reference for grassroots SEs in other developing countries.

**Keywords:** social entrepreneurship; youth development; positive youth development; socio-ecological theory; social enterprise ecosystem framework; scaling strategies; key success factors; grassroots social enterprises

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## 1. Introduction

Across the globe, social enterprises (SE) have been lauded as a critical intervention strategy in education, health, and social justice, which have been areas of increased concern in post-apartheid South Africa. In our case, the Tshwane School of Music is a social enterprise active in youth development by providing young people with access to opportunities and support as they develop into well-balanced adults.

Grassroots social enterprises (GSE) are best placed to intervene in community development due to their proximity to the issues at hand and the social capital generated by the support they enjoy amongst their communities (Van Oers, Boon, Moors 2018; Liang, Xu, 2018; Lang, Fink, 2019; Alkire et al., 2020). In practice, however, previously disadvantaged communities (PDCs) bear the brunt of a dysfunctional community model with an increase in gang-related activities and teenage pregnancies (Laldas, 2018), as well as youth unemployment (NYDA, 2019; Molefe, 2020). According to (Statistics SA 2021), the *Quarterly Labour Force Survey (QLFS)* of the 3<sup>rd</sup> quarter of 2021 reported a youth unemployment rate of 66.5% for the age group 15-24 years old.

Grassroots organisations, by and large, take on the form of non-governmental organisations (NGOs) or non-profit organisations (NPOs) and are primarily reliant on donor funding to stay afloat (Iwu et al., 2015). However, with the increasing need for aid funding across the globe and the effects of the global Covid-19 pandemic, NPOs are forced to reimagine their business models to ensure the maximum social impact for their constituencies (Ko, Liu 2021). Therefore, scaling social enterprises (SEs) is a necessary imperative, not just for the growth of the individual organisation but for the more significant social impact that is desperately needed in South African township communities (Fitzgerald, Shepherd 2018).

The rising need for social impact in the backdrop of South Africa's high business failure rate for SEs warrants this paper's examination of the critical success factors that would allow SEs to expand in a South African township context.

### 1.1 Problem statement

Several studies have uncovered the impact of social entrepreneurship on community development. However, an investigation of the literature revealed very little evidence of existing studies on how to scale SEs in South Africa's previously disadvantaged communities (PDCs). In the absence of a scientific study, SEs find it difficult, if not impossible, to bring their businesses to scale in an environment where their services are sorely needed. Elliot (2019) identifies SEs as a catalyst for breaking the poverty trap. In Elliot's analysis, SEs pick up the slack caused by an inability of governments and related agencies to address social and environmental challenges. He highlights the economic contribution made by SEs in the South African context. This vital role of SEs is echoed by Bozhikin, Macke and Folchini da Costa (2019), who recognise it as a key intervention to achieving sustainable development.

Fundamentally, social entrepreneurship focuses on creating impact through the social value generated by their entrepreneurial activities (Fowler, Coffey, Dixon-Fowler, 2019). Our view is that TSOM's business model could serve as a blueprint for other GSEs in South Africa. However, the government should demonstrate urgency and commitment by ensuring that SEs receive the necessary support and guidance to perform their important function in communities. This can be achieved by stimulating social entrepreneurship and social entrepreneurship ecosystems (Bozhikin Macke, Folchini da Costa, 2019). Broad agreement exists amongst scholars that upwards of 70% of small to micro and medium enterprises (SMMEs) fail within the first five to seven years in South Africa (Bushe, 2019). Dzomonda (2021) highlights how social enterprises are experiencing a plethora of struggles in South Africa, impeding their ability to achieve their social missions.

Governments increasingly depend on social partners to meet UNESCO's 2030 Sustainable Development Goals. However, community organisations are crumbling amid a worldwide Covid-19 epidemic. Many SEs are forced to scale down or even shut down their activities. On the contrary, there is a need to expand the number of SEs in South Africa and scale these businesses for maximum impact. This paper aims to provide information that will assist all relevant stakeholders (Government, GSEs, funders, and communities) in understanding the critical success factors that enable GSE scaling in the South African context.

The literature review that follows explores the phenomena of social entrepreneurship, its application around the world, grassroots social enterprises, and various scaling strategies available to increase social impact. We also investigate specific models and theories that help us conceptualise our case study, i.e., UNESCO's Sustainable Development Goals 2030, the Social Enterprise Ecosystem Framework, and Bronfenbrenner's Social-Ecological Model will provide the theoretical frame for our study.

## **2. Literature review**

### **2.1 What is a social enterprise, and why is it important?**

On the business model spectrum, social enterprises are located between traditional for-profit businesses and traditional charitable businesses (Ryder, Vogeley, 2017). Social enterprises create social value for their stakeholders, whereas traditional companies create economic value for their shareholders. Yusuf (2005) highlights that the social entrepreneur generates social value by reducing poverty, boosting social capital and creating environmental sustainability, thus, creating social impact. Some prominent features of SEs are their proximity to their markets and their socio-cultural embeddedness (Vlasov, Bonnedahl, Vincze, 2018). In other words, it is an ideal vehicle for delivering social value to the communities that it serves due to its accessibility.

### **2.2 The worldwide impact of social entrepreneurship**

Social entrepreneurship is ideally positioned to address social ills left unresolved by governments and traditional charitable organisations in communities (Dees, 2001). Social entrepreneurship has the advancement of human well-being through social value creation at its core (Gupta et al., 2020). Gupta et al. highlight that SE as a phenomenon has enjoyed increased interest as an area of research and business activity during the 21<sup>st</sup> century. Scaling impact through innovation is key if organisations reach their social and environmental objectives (Jia, 2020).

According to Light (2011) there is an increased popularity in applying social entrepreneurship to the disciplines of education, health, and cultural settings. The impact of SEs is particularly pronounced when social entrepreneurs and disadvantaged communities form partnerships to address socio-economic challenges (Mair, Marti, 2006; Urban, 2008).

Brock and Ashoka (2008) warn of the difficulty of assessing social impact timely, reliable, and meaningful since the social impact is intrinsically linked to achieving a company's social mission.

The work of Prof. Muhammed Yunus and the Grameen Bank in Bangladesh (e.g. BBC News, 2011) is well documented in academic literature. The bank's unique approach of issuing small loans to the poor ensured that millions of lives were transformed on a global scale. Their interventions aim to improve the socio-economic conditions of the communities in which they operate (Martin, Osberg, 2007; Seelos, Mair, 2005).

Rawhouser, Cummings and Newbert (2019) raise a concern that the dearth of social impact assessment tools could hamper theoretical and empirical advancements in the social entrepreneurship field. In response, Arias and Arango-Botero (2019) propose a framework based on leadership training and predetermined instruments that could assist management in accurately measuring the impact of the social enterprise. On the other hand, Pärenson

(2011) recommends a comprehensive or “solid impact evaluation method” that could deliver credible empirical proof of SE’s impact.

The following section investigates how social entrepreneurship is conceptualised worldwide in various schools of thought.

## **2.2.1 SE in North America**

### **2.2.1.1 The innovation school of thought**

Bravo (2016) claims that the innovation school of thought prioritises innovation over revenue and scalability. Accordingly, the emphasis is on the individual entrepreneur innovatively addressing a social issue. In agreement Dees and Anderson (2006) view Ashoka Foundation’s Bill Draydon, as one of the leading proponents of this branch of social entrepreneurship, which is not dissimilar to commercial entrepreneurship and focuses on the discovery, evaluation and exploitation of opportunities.

### **2.2.1.2 The social enterprise school of thought**

Nicholls (2008) points out that the primary focus of the social enterprise school of thought is earning an income while achieving a social mission is a secondary benefit. Another aim of this approach is that non-profit organisations (NPOs) increase effectiveness by using entrepreneurial strategies in their business processes. The funding mix for these types of organisations excludes grants and subsidies. Edward Skoot, the founder of ‘New Business Ventures for Non-profit Organisations’, is considered one of the foremost advocates of this type of SE as well as Jerr Boschec and Jed Emerson, who founded ‘The National Gathering of Social Entrepreneurs’.

## **2.2.2 SEs in Europe**

### **2.2.2.1 The EMES approach**

The Emergence of Social Enterprise in Europe Research Network developed this approach in 1996. This model sees a social enterprise consisting of a group of citizens having shared ownership of the organisation and being highly involved in the running of the enterprise. Community organisations such as associations, cooperatives, mutual organisations and foundations are more likely to adopt this type of social entrepreneurship because of the high level of autonomy it provides in decision making and responsibility. A significant difference between this form of SE and any other schools of thought is that the distribution of profits amongst shareholders is not prohibited.

### **2.2.2.2 The UK approach**

When the labour party was in power in the 1990s, it implemented the ‘Social Enterprise Coalition’ as a unit in the Department of Trade and Industry. The reinvestment of the profits into the social enterprise is a significant feature of this style of social entrepreneurship. In 2006 however, the UK government placed all SE-related activities under the Ministry of the Third sector to have a more structured framework and encourage growth.

## **2.2.3 SEs in Asia**

The work of one of the most popular social entrepreneurship practitioners, Prof. Muhammed Yunus and Grameen Bank, is well documented in the academic literature. Grameen bank has a strategy of issuing small, unsecured loans to the poor, which has impacted millions of lives. Benefits are derived by way of the improved socio-economic conditions in the communities where the bank operates (Martin, Osberg 2007; Seelos, Mair, 2005).

## **2.2.4 SEs in Africa**

Visser (2011) bemoans the fact that SE is not contextualised in South Africa. This is in sharp contrast with the advances made in other continents where SE research is advanced. To understand the various stages of SE development, Visser developed three categories of economic development, i.e.: (1) Factor-driven economies with a low level of economic development and mainly primary sector production, (2) Efficiency-driven economies

with high levels of industrial development, a growing SMME sector fueled by the availability of capital and high economic activity and (3) Innovation economies that sees complex and well-developed services sector, driven by innovation. Visser (2011) views South Africa as an Efficiency-driven economy. In noticing the similarities in the various approaches, Dees and Anderson (2006) proposed convergence of the different schools of thought. However, it must be said that although differences exist, the aim of social entrepreneurship is united in its quest to create social value in the communities it serves.

### 2.3 Understanding the concept of Grassroots SE

According to Lin and de Kloet (2019), combining grassroots SE, institutional regulation, and the internet yielded positive impacts in rural China. In agreement, Sharma and Kumar (2019) found that developing countries stand to gain from grassroots innovations due to their proximity to local market demands. Sarkar (2018) posits a shift in our understanding of grassroots social entrepreneurs (GSE) from consumers and beneficiaries of aid to creators of socio-economic value amidst highly challenging market conditions. Popov, Veretennikova and Kozinskaya (2018) highlight how social entrepreneurs contribute to just and stable societies while addressing community needs by creating innovative market solutions. In addition, Popov, Veretennikova and Kozinskaya (2018) believe that an enabling institutional environment is critical for the success of GSE. Vlasov, Bonnedahl, and Vincze (2018) view socio-cultural embeddedness (adapting one's practices to fit into your locality) as essential for creating social capital for the GSE in the communities where they operate.

### 2.4 What is scaling a business, and why is it important

Every successful business reaches a point in its lifecycle where the market growth requires the entrepreneur to relinquish control and put systems in place to accommodate the increased demand (Gulati, Desantola, 2016). In the case of SEs, additional market forces are often at play, with community engagement and government partnerships contributing increasingly to bringing the business to scale (Palomares-Aguirre et al., 2018). Bocken, Fil and Prabhu (2016) agree that there is a dearth of information on how social businesses reach scale and proposed various strategies the SE can scale. In its most basic form, therefore, scaling implies growing your business without necessarily spending more money to accommodate the growth. In the context of SEs, scaling means creating more social value through ecosystem growth so that more beneficiaries can benefit from the collective social impact created by the various role-players in the ecosystem (Islam, 2020).

### 2.5 Scaling strategies

Scaling social impact can only occur after considering the specific stage of life that the social venture is in. Casanovas and Bruno (2013) identified two developmental stages in the lifecycle of social enterprises, i.e., social incubators and social accelerators. According to Casanovas and Bruno (2013:182), as depicted in Table 1, there are qualifying requirements an organisation must satisfy to be grouped in a specific stage.

**Table 1.** Common traits of social incubators and accelerators

REQUIREMENTS	SOCIAL INCUBATORS	SOCIAL ACCELERATORS
Company registered	No	Yes
Full time-employees	None or some	At least two
Years of experience	0-3	Three or more
RESOURCES		
Training	Entrepreneurial skills	Management skills
Mentoring	Focused on a business model and initial business plan	Focused on growth strategy
Networking	Other social entrepreneurs and the broader ecosystem	Other social ventures and broader ecosystem
Access to Funding	Grants or seed capital	Debt or equity

Source: Casanovas, Bruno (2013)



Moore, Riddell and Vocisano (2015) highlight four different scaling options that the enterprise should consider:

- (1) Scaling out strategy aims to reach more significant numbers by duplicating an existing program into other geographic territories. Principles are spread while remaining sensitive to the contextual realities of the new venture.
- (2) Scaling up increases the social impact through changing existing policies or laws. Lobbying and advocacy are one form of creating this more significant impact.
- (3) Scaling deep involves spreading big cultural ideas by creating learning communities and by investing in transformative learning.
- (4) Cross-cutting scaling seeks to access new resources, build networks and partnerships while broadening the problem frame.

Alvarado et al. (2017) developed a 6-Step scaling process which serves as a helpful guide for SEs who wish to embark on an impact scaling strategy depending on the developmental level of the company, i.e., 1) Develop a robust program design, 2) Ensure fidelity of implementation (is the program delivered as intended), 3) Produce indicators of positive outcomes, 4) Obtain evidence of positive program outcomes, 5) Replicate positive program outcomes with solid design, 6) Scale the program in the same or new contexts.

Ćwiklicki (2019:56) highlights a pre-condition that the existing model must first prove its viability for SEs to scale social impact. Ćwiklicki (2019) found that generating earnings, partnership building, staffing, communication and replication are the most important requirements for scaling SEs internationally. Stimulating market forces and lobbying activities were viewed as less significant factors in the scaling process.

## **2.4 Theories and Models used in this study**

Three theories and models that illuminate our understanding of the prevailing discourse on sustainability, social ecology, and social enterprise ecosystems were identified. It serves as the basis of our conceptualisation of the phenomenon under study. For this purpose, we will investigate the UNESCO's Sustainable Development Goals (SDGs 2030), Socio-ecological Model (SEM), as well as the Social Enterprise Ecosystem Framework (SEEF).

### **2.4.1 UNESCO's Sustainable Development Goals (SDGs 2030)**

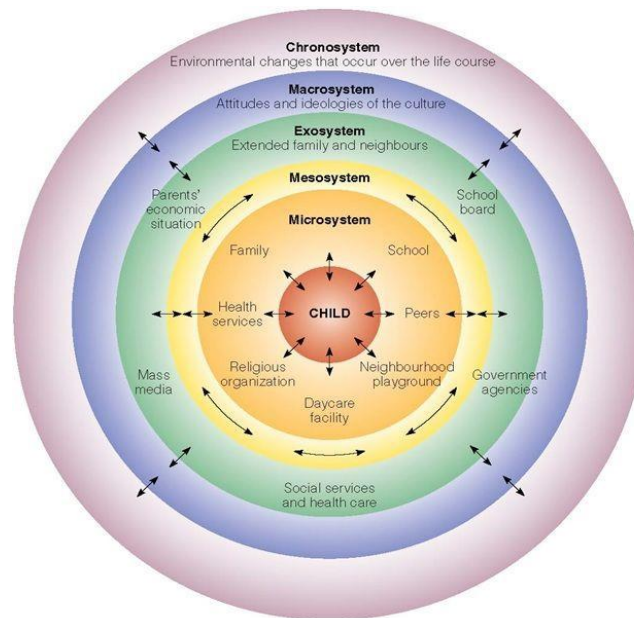
At the 2015 UN General Assembly Meeting, 17 SDGs have adopted that focus on the economic, social and environmental dimensions of human development within the limitations of the finite resources at our disposal (Fonseca, Domingues, Dima, 2020). Individual countries adapted these broad principles into unique Millenium Development Plans to give substance, meaning, and specific targets to vague, ambitious ideas (Bali Swain, Yang-Wallentin, 2020). Our case study is based on a grassroots social enterprise that seeks to normalise South African township youth access.

#### **2.4.1.1 Social enterprises and sustainability**

Yusuf (2005) draws a link between environmental sustainability and the social impact created by SEs. In agreement, Prof. Muhammad Yunus and his colleague Hans Reitz, designed 7 principles of a social enterprise (Yunus, 2010) i.e., (1) reducing poverty and eliminating threats against people and society; (2) economic sustainability; (3) no dividend is payable; (4) profits are reinvested into businesses; (5) gender sensitivity and environmental sensitivity; (6) market-related wages and great work environment; (7) making the business a joyful experience. There are visible parallels between Yusuf's SE model and UNESCO's SDGs. In a World Economic Forum (WEF) article, Pearson and Mc Elwee (2021) applaud the value of the work done by Catalyst 2030, a social enterprise movement (network), in achieving the 17 SDGs across the globe during the current Covid – 19 pandemic. Governments and other stakeholders in the social justice space could quickly reach some of their SDG targets by partnering with SEs that can assist in achieving the UNESCO's Sustainable Development Goals 2030.

#### 2.4.2 Socio-ecological Model (SEM)

Urie Bronfenbrenner is credited with developing a theoretical model for understanding human development in the 1970s. During the 1980s, it was formalised into what we know as Bronfenbrenner's SEM theory (Kilanowski, 2017). According to this model, human development occurs within a nested context (see Figure 1). The human being is at the nucleus of an ecological ecosystem made up of various systems.



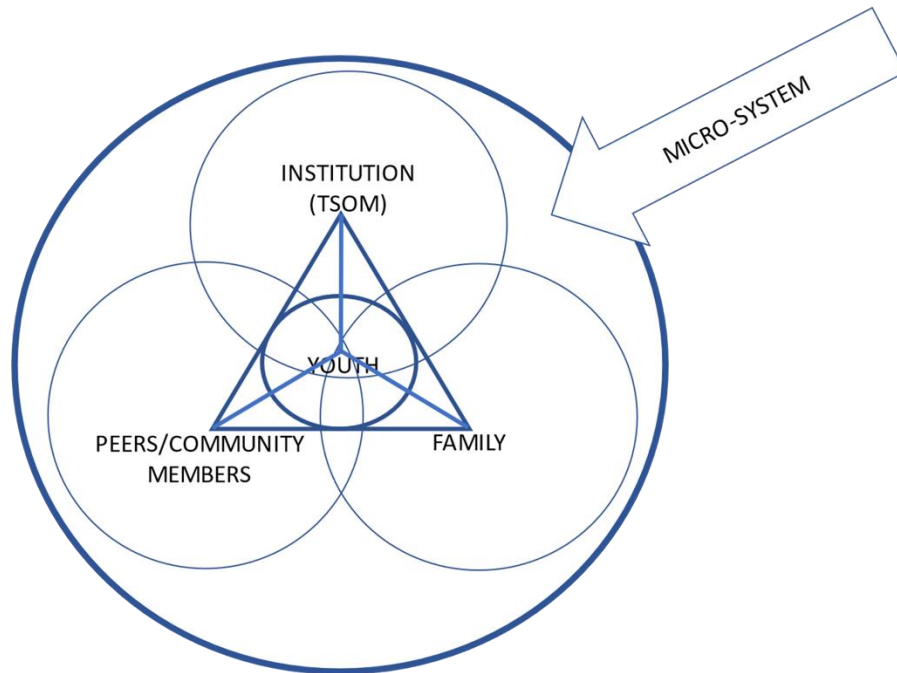
**Figure 1.** The Socio-Ecological Model (SEM)  
Source: Adopted from Bronfenbrenner 1995:619-647

#### 2.4.3 Social Enterprise Ecosystem Framework (SEEF)

According to a 2016 report, the Halcyon Organisation did a study to improve their understanding of the social enterprise ecosystem in the United States (Halcyon 2016). This study resulted in developing the four pillars of the Social Enterprise Ecosystem Framework, i.e., Funding, Quality of life, Human Capital and Regulation and Receptivity. We found this model helpful in analysing the data collected during our interview and content analysis process.

#### 2.4.4 Conceptualising a grassroots SE working in youth development

Bronfenbrenner's SEM model is the basis of the conceptual framework of this paper. A typical South African township consists of the following social role-players within its Microsystem, i.e., Community organisations/Schools (TSOM), Family and Peers/Community members (See Figure 2). The symbiotic relationship between the various role-players in their immediate proximity is brought about by a progressively complex process of reciprocal interactions (Bronfenbrenner 1995). From the depiction, the youth take centre stage while the role-players act as facilitators or inhibitors of their development. Similarly, other beneficiaries will occupy the nucleus of the ecosystem, trying to enable or inhibit their growth through social impact.



**Figure** Error! No text of specified style in document.. Conceptual framework of a GSE working in youth development  
Source: Authors

The model suggests that the actual impact or social value lies in a community-based organisation's ability to satisfy the unmet needs left by the other role-players in its shared ecosystem.

Tavallaei and Abu Talib (2010) highlight that the role of theory in qualitative research is highly debated. Divergent opinions exist on the importance of theory underpinning methodology, as Kelly (2009) makes an argument argues. In contrast, Collins and Stockton (2018) warn that an over-reliance on theory could cause the researcher to miss emerging themes and findings emanating from the data.

#### 2.4.5 Tshwane School of Music as a model social enterprise

Tshwane School of Music (TSOM) is a SE operating from its base in Eersterust. They run a music school with a mission of creating access to the impoverished youth that they serve. TSOM is exemplary in its effort to make a social pact with its community and is highly active in building corporate partners with private businesses and the government (Tshwane School of Music, 2021). What makes TSOM a candidate for replication as a SE blueprint is its compliance with all the requirements for scaling social impacts (Alvarado et al. (2017) bar one. That is the fact that they are only active in one locality.

During this inquiry, the researcher used a combination of three theories and models, i.e., the UNESCO's Sustainable Development Goals (SDGs 2030), Socio-ecological Model (SEM) as well as the Social Enterprise Ecosystem Framework (SEEF), to conceptualise the problem under study, draw conclusions and find solutions in the Analysis Matrix Framework (Table 2).

### 3. Research Methods

Research methodology is the researcher's beliefs in knowledge (epistemology) and reality (ontology) (Tobi, Kampen 2018). For this paper, the researcher collected data using a multi-method qualitative approach, capturing the views of youth workers regarding the critical success factors for scaling grassroots SEs.

#### 3.1 Research design strategy

The researcher used Saunders, Lewis and Thornhill's (2007) 'research onion' to guide this paper's philosophical and methodological choices (De Oliveira Orth & Maçada, 2020). This systematic approach to developing a methodology is supported by Melnikovas (2018), especially for business studies research. This systematic approach to research design aims to increase the credibility and reliability of the study (Crotty 1998).

#### 3.2 Research population, sampling technique, and sample size

Polit and Hungler (1999) assert that a population is all possible objects, subjects, or members meeting the criteria for inclusion in a study. In line with Polit and Hungler (1999), the eligibility criteria for inclusion in this study were the interviewee had to be a past or present staff member of the organisation, and the individual must have grassroots youth work experience.

A non-probability, a convenience sample was used as it is based on the qualities of interviewees who are proficient and well informed about the phenomenon of interest and what needs to be known (Bernard 2002; Teddlie & Tashakkori, 2003). A convenience sample was ideal, as the researcher used readily accessible interviewees in the study (De Vos et al., 1998; LoBiondo-Wood & Haber, 1998).

A sample size of three youth workers who were previously or currently employed by the organisation was used to investigate various viewpoints. The relatively small sample size was due to the unavailability of staff and students to interview. The organisation was brutal to hit the Covid-19 restrictions and decided to lay off most of the team and close the organisation's doors until 2022 to benefit the children's health and safety.

#### 3.3 Collection and analysis of the data

In agreement with Van Manen (1990) view, semi-structured open and closed-ended questions were used as it lends themselves to small samples. Specific details were gathered by asking critical questions supplemented by more general discussions to clarify and flow the panels (Gill et al. 2008). The researcher also used organisational documents and website information to corroborate interview responses. Silva (2008) advocates for this type of cross-validation, describing it as an inconspicuous way of inquiry. The organisational documents and website data provided the researcher with a deeper understanding of the phenomena by highlighting future projects, bringing new questions into the frame, and fact-checking interview responses (McMillan & Schumacher, 2010). The researcher used a thematic analysis matrix to organise, summarise and interpret the data outlined by Ary, Jacobs and Razavieh (2002). Petty, Thomson and Stew (2012) recommend this form of data organisation for the responses from the inquiry to provide meaning and logical flow to the concepts under discussion.

This paper's thematic analysis matrix (Table 2) summarises the findings and conclusions against three significant models and theories, i.e., Sustainable Development Goals 2030, the Socio-Ecological Model (SEM), and the Social Enterprise Ecosystem Framework. The matrix also highlights the three major themes emanating from the interviews conducted during the study.

Table 2. Analysis Framework Matrix

Analysis Framework Matrix						
Thematic Analysis		Analysis Model and Theories	Research Question	Aim	Summary of Findings	Conclusions
Theme 3: Scalable township social business model	1	Analysis Model and Theories	How can TSOM’s Model of Social Entrepreneurship be scaled to other previously disadvantaged communities?	To examine whether TSOM meets the requirements for scaling a social enterprise.	<ul style="list-style-type: none"><li>- For a social enterprise to scale its impact successfully in PDCs, it must satisfy three criteria:</li><li>- The SE must express the ambition to scale, provide a model of best practice and have a social entrepreneurship orientation.</li><li>- There is a great need for social entrepreneurial intervention in South African township communities.</li><li>- Opportunities to scale come by way of government requests for innovative social solutions or pro-active by SE venturing out during the normal course of running their businesses.</li><li>- A model of best practice for a township social enterprise must include amongst other things; individuals with social entrepreneurial characteristics, a well-resourced business as well customer-centric orientation to doing business. Most Importantly it needs a social contract with the community within which it hopes to operate.</li></ul>	From the literature, interview responses and website analysis, it is evident that TSOM meets the requirements to scale its business model to other communities. This will lighten the social burden on SEs which is in short supply in South African townships. An area of concern is the fact that funding remains a challenge to SEs which is represented by pillar 1 of SEEF (See SEEF Model). A list of 15 key success factors was identified amongst which entrepreneurial characteristics, <u>organisational</u> structural elements and business strategies were highlighted as the most critical elements for township social enterprises to be successful.
	2	Sustainable Development Goals 2030				
	3	Social Enterprise Ecosystem Framework				

Source: Authors

#### 4. Results and discussion

This paper employed an Analysis Framework Matrix to increase the reliability and trustworthiness of the data analysis process (Cloutier & Ravasi, 2021). Branchi, Fernández-Valdivielso and Matias (2014), Verdinelli and Scagnoli (2013), support this practice to organise, summarise, simplify, or transform data while providing a logical flow to the findings.

Table 2 provides a synopsis of the main findings and conclusions in line with the research question and aim analysed considering three theories and models, i.e., UNESCO's Sustainable Development Goals 2030, the Socio-Ecological Model (SEM), and the Social Enterprise Ecosystem Framework. The central theme that emanates from our research is a scalable township social business model.

Considering the data gathered through the interviewing of three interviewees, the content analysis of the company documents and website data guided by a review of the literature, the researcher was able to answer the research question of this investigation of “How can TSOM's Model of Social Entrepreneurship be scaled to other previously disadvantaged communities?”.



**a. Theme: Scalability of a township social business model**

Three vital elements come into play when scaling social enterprises: (1) ambition to scale, (2) social entrepreneurship orientation and (3) a model of best practice.

**Sub-themes:**

**1) Expressing the ambition to scale**

**Interviewee 2** expressed an ambition to scale by alluding that the SE has developed a workable business model. "I realised that fathering is an issue in our tribe (speaking about the community), and if I can come up with a model, that is why I started with my kids just at home, to start to play music ... I think now we have kind of developed a blueprint, we can scale". **Interviewee 2** confirmed his new appointment as chairperson of the Arts Forum for a new initiative by the City of Tshwane Municipality to encourage growth in the creative industries. The benefit of being acknowledged by your peers in this way "gives you some form of credibility for the work you have already done. By understanding the value of the creative industries' contributing to community development and social cohesion, the local government expressed a clear call for a partnership between themselves and grassroots creatives to help address the systemic problems experienced in many township communities.

During another exchange, **Interviewee 1** expressed that he is in the process of starting up his social enterprise. While explaining his point of difference, he mentioned: "I'm no longer part of Tshwane School of music, right? In the context of running the institution and all of that. I'm now building my own, let's call it clientele, our school. But with a specific focus. Tshwane School of Music had broad strokes, covering multiple disciplines, etc. Now, in my personal and private capacity, the niche has been made smaller". This expression of interest had the clear objective of focusing on specific interventions instead of catering to multiple disciplines.

**2) Social entrepreneurship orientation**

The significant difference between social and commercial businesses is that their primary aim is to achieve social change through the impact that they can generate. Therefore, it was vital for us to investigate the existence of this feature in the case under study.

To be socially orientated, self-knowledge is vital. **Interviewee 2** answered as follows: "I regard myself as a social entrepreneur, and this awareness also came about, as a result of the work that we were doing and are doing, but also as a trailblazer in the area of education and innovative models, more so to Kickstart to revitalise the township economy". Elaborating further on how the organisation came about, the interviewee said: "I could see immediately how I could be of use then and started to pilot all sorts of programmes from restorative justice to family group conferencing family preservation programmes. And those I'm talking about the last 25 years of my body of work". **Interviewee 2** highlighted the value of brand equity in creating a level of credibility and trustworthiness for the business by adding: "You treat it like a social enterprise or a social entrepreneurship space. You must understand what your brand is all about. So, you must be able to speak and to articulate what your brand is".

**Interviewee 1**, a senior staff member, explained: "In 2018, I studied social entrepreneurship through the Gordon Institute of business sciences based on TSOM's founders' influence to bring a different perspective ... Our core business was fathering first, and we use[d] music as a vehicle. Secondly, we used these platforms to speak into the lives of children. Just to tell you, the Tshwane School of Music was not just a music institution to teach people how to play an instrument but be fathers, and we were there to develop essential skills within individuals. So,



what is a success in this context? If a child can become a little more whole and more healed, then that is success". Success in this context relates to the impact that was made in the lives of the students who are part of the institution in our case.

**Interviewee 2** felt the impact on a personal level while experiencing the positive impacts through their youth work intervention when he remarked; "Be so passionate about people development beyond yourself that when things start to manifest, where you can actually smell the change within the hearts of young people, and the pride and the sense of achievement, and you know, TSOM is like that and then gives me enough fuel to move forward".

"Using the vehicle of music to establish elements of confidence, Independence, and self-worth" was a key element experienced by **Interviewee 3**.

After establishing a clear ambition to scale and a social entrepreneurship orientation, the study investigated whether a model of best practice existed by asking interviewees to list 5 key characteristics of a successful grassroots SE.

### 3) A model of best practice

All interviewees agreed that the case under study was a replicable best practice model that other grassroots SEs could emulate. It was, however, pointed out by **Interviewee 3** that developing a successful SE takes a partnership between the organisation and the community it is trying to impact. Therefore, one cannot just copy and paste the existing model into another setting but rather co-design a solution with the communities in question.

**Interviewee 1** gave the following answer about the "must have's" for a successful SE:

- i) "Number one, the individual needs a sense of self-achievement".
- ii) "Then, number two, you must be very adamant. You must be very driven by the thing you would want to pursue. So that in the NPO space in the social space, it is a challenge, and you must be robust, maybe adamant was not a word, but you must be robust".
- iii) "And then my next point is to have a passion for what you do for yourself to work with that passion for other people. It requires emotional intelligence more than normal".
- iv) "It is then to know the people you work with or the people you will engage just to know the people because the culture is important".
- v) "And then to remind yourself that you do not come with a solution, you are not the solution. The community offers the solution, you come alongside what that is, and you use a vehicle to speak into the need of the culture of the community".

**Interviewee 1** focussed on entrepreneurial characteristics as a vital component of a model for successful SE.

**Interviewee 2** focussed his response on the resources required by a successful SE:

- i) "The first thing I would want to look at would be a facility [talking about the option of full ownership or rental options of a building] for business activities".
- ii) "The second most important thing is that you need qualified, competent people".
- iii) "The third thing would be you need an extreme business case".
- iv) "Fourthly, I would say community buy-in".
- v) "Don't wait until you have money for the resource to start. (He explained that many things could be achieved while you are raising funds for the business). Funds are not unimportant; however, they should not be the driving force behind why you are in a social business. It should be to create social value".

On the other hand, **Interviewee 3** had a different take on what is essential for SE success.

"OK. The first one would be to identify the client and identify the client's needs, which involves a lot of research into the social ills.

- i) The second step would be to develop a strategy to address those needs and have an implementation strategy.
- ii) And thirdly would be to create access. In the form of obtaining cash as every programme requires funds to run or keep its doors open, and it's very crucial to receive funding for sustainability's sake.
- iii) OK, number four is information and openness. Clients must be informed as to what the programme is all about.
- iv) And lastly. To give feedback and evaluation are also prioritising to exceed the clients' expectations".

**Interviewee 3** viewed customer-centricity and market orientation as essential for building a successful SE. His view is that identifying a target market, focusing on customer satisfaction and giving timeous customer feedback will ensure brand loyalty.

Grassroots SEs can function better if they take the following advice from the interviewees onboard: **Interviewee 1** explained that although models of best practice are helpful, SEs should guard against implementing a project without adapting it to be context-specific. "So, how can other institutions benefit from our story, as much as we can benefit from their story through dialogue, and through the record of the things that we have done the meaning of individuals of functions of achievements, etc. We cannot start another Tshwane School of Music in Cape Town; we can't because this is Tshwane School of Music".

**Interviewee 2** had this to say to prospective SEs: "People must understand that to put a community-based programme of quality, like what we have done, we don't settle for anything less than the fullest. Because we believe our children deserve it, you know, without any entitlement, that I believe that if you have that kind of conviction. There's a saying in Afrikaans that says, jy moet hare op jou tande het (You must be tenacious or resilient)".

While **Interviewee 3** shared his endorsement of the model under study by stating: "I think that TSOM's business model is incredible, and I think it should be replicated to all townships ... Pointing to the nature of problems encountered by township youth".

The interviewer asked what would constitute key success factors for scaling grassroots SEs in the South African context. Accordingly, the interviewees' responses were summarised in Table 3.

**Table 3.** Key features for social enterprise success

Key success factors for scaling a grassroots social enterprise		
Executive (Interviewee 2)	Manager (Interviewee 1)	Administrator (Interviewee 3)
Strategic Dimension	Personal Dimension	Business Operational Dimension
Availability of Infrastructure	Sense of achievement	Customer-centricity
Human resources (Create a winning TEAM)	Determination to succeed (Grid and Determination)	Clearly defined business strategy
Business case	Passion	What is your USP (Creating Access)
Financial resources	People's person	Feedback and evaluation
Community partnership	Community partnership	Community partnership

Source: Authors

Table 3 highlights the key success factors for scaling a grassroots social enterprise in a South African township context, identified as critical elements by the social entrepreneurs interviewed during this research project. All

three interviewees viewed community partnerships as essential for successfully implementing a grassroots SE solution in a South African context.

From the literature review, interviews and content analysis, we also found that entrepreneurial characteristics, resource deployment and sound business strategies are critical elements for grassroots SEs to achieve success.

## **Conclusions**

Social entrepreneurship helps communities grow, and social businesses are part of an ecosystem of community stakeholders working together to enhance the communities they serve. Due to South Africa's Apartheid history, socio-economic inequality, and record-breaking unemployment rate, social businesses play an essential role. Social entrepreneurship helps communities grow. Social businesses are part of an ecosystem of community stakeholders working together to enhance the communities they serve. Social enterprises are critical in South Africa due to the country's Apartheid heritage, socio-economic disparity, and record-breaking unemployment rate. This paper examines the essential success factors for scaling a social enterprise model in a South African grassroots community context.

This single case study confirms the sterling work done by social enterprises in South African grassroots communities. It gave a first-hand experience of youth's various challenges as they mature into adulthood. Innovation and creative classroom strategies yield the desired results when engaging young people. The investigation proposes building partnerships as part of a strategy to scale impact through grassroots SEs. SEs and commercial entities encounter socio-economic factors and political factors that impact their ability to deliver on their mandates. As a result, global pandemics and wartime conditions make it difficult for SEs to do their work in marginalised communities.

The study highlights the resilience of township communities that somehow find a way to make things work in the face of extreme hardships. It also delivers on our aim of identifying the key success factors for scaling SEs after adapting it to local contextual realities.

This paper confirms that scaling should be contextually relevant as social problems and community development needs differ vastly from one community to the next. For this reason, partnerships between the SEs and their local communities were flagged as the most critical success factor in this study. In other words, contextual embeddedness is a major key factor for scaling social enterprises. These partnerships will ensure greater ownership while allowing communities to co-design and co-create the solutions that will benefit them.

Our findings confirm that the case study is a best practice model for grassroots SEs in South Africa. Implementing a cross-cutting scaling strategy will significantly impact acquiring alternative funding resources, building social networks/partnerships, and broadening the social frame.

## **5.2 Implications**

This paper's primary aim was to examine the critical success factors for scaling a social enterprise model in a South African grassroots community context. The researchers thematically analysed the interview responses using an Analysis Framework Matrix using the following models, i.e., UNESCO SDG's, the social-ecological model, and the social enterprise ecosystem framework, to arrive at the findings that will have theoretical and stakeholder (SEs, Government, and Commercial Enterprises) implications.

### **5.2.1 Theoretical implications**

This paper confirms the importance of organisational embeddedness in the community in line with Bronfenbrenner's SEM Theory which posits that society functions in an ecosystem of systems. The aim of

identifying key success factors for scaling GSE in a South African context was therefore achieved by providing a list of 15 critical success factors straddling three organisational dimensions, i.e., Personal, Business and Strategic Dimension.

### 5.2.2 Stakeholder Implications

- i) Social Enterprises should prioritise skills transfer to equip their beneficiaries for the world of work.
- ii) SEs should expose beneficiaries to cutting edge innovations to equip them for future opportunities.
- iii) SEs will have a better chance of survival if they use a varied funding mix, especially in global economic hardships. The organisation in our case study suffered cutbacks due to financial constraints.
- iv) SEs using a cross-cutting scaling strategy, i.e., scaling out, scaling up and scaling deep, will have a more significant impact.
- v) It is in the interest of governments to collaborate with social enterprises to normalise access to previously disadvantaged communities (PDCs).
- vi) SEs are an excellent vehicle to assist the government in addressing dysfunctionality in many communities in South Africa.
- vii) Commercial enterprises can improve their brand equity and long-term sustainability by partnering with credible SEs, while addressing the skills gap of youngsters hoping to enter the workplace.

### 5.3 Limitations of the study and future research

Our empirical inquiry was informed by in-depth interviews and observations with three interviewees, a website content analysis of one website, and a qualitative examination of organisational documents from one SE because this single case study is limited to one SE in one South African township and cannot be generalised.

This single case study leaves a lot of unanswered questions, and therefore a multiple case study could give a more comprehensive view of the phenomenon under investigation. This qualitative study is a data-rich perspective from the management and staff's perspective of the impact generated by the SE. Therefore, a mixed-method study, including the students' opinions, will go a long way in presenting the youth's voice on the matter.

Developing an impact assessment tool will prove helpful in assisting all role-players in the social enterprise space to monitor and evaluate the impacts of the various projects. An impact assessment tool could also facilitate funding opportunities for these grassroots SEs.

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**Henry Oswald ESAU** is a master's student at the Cape Peninsula University of Technology, where he recently submitted his thesis for examination to qualify for the degree MTech. Business Administration (Entrepreneurship). Henry has a keen interest in social entrepreneurship and how it relates to youth development while addressing issues of social justice, redress, and access for previously disadvantaged communities in South Africa.

ORCID ID: <https://orcid.org/0000-0002-1065-3887>

**Robertson K. TENGEH**, professor.

ORCID ID: <https://orcid.org/0000-0003-2485-0205>

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## IMPACT OF EMPLOYEE ATTITUDE ON THEIR PRO-SOCIAL BEHAVIOR: A CASE STUDY

Edmunds Čižo<sup>1</sup>, Raheel Amir Awan<sup>2\*</sup>, Rizwan Ali<sup>3\*</sup>, Nisar Abid<sup>4</sup>

<sup>1</sup>Department of Economics, Daugavpils University, Parades Str. 1-421, Daugavpils, LV-5401, Latvia

<sup>2,3\*</sup>Lahore Business School, The University of Lahore, 1-KM Defence Road, Lahore, Punjab, Pakistan

<sup>4</sup>Department of Education, The University of Lahore, 1-KM Defence Road, Lahore, Punjab, Pakistan

E-mails: <sup>1</sup> [edmunds@chemi-pharm.com](mailto:edmunds@chemi-pharm.com); <sup>2</sup> [raheel.amir@lbs.uol.edu.pk](mailto:raheel.amir@lbs.uol.edu.pk);  
<sup>3</sup> [rizwan.ali1@lbs.uol.edu.pk](mailto:rizwan.ali1@lbs.uol.edu.pk) (Corresponding author); <sup>4</sup> [nisar.abid@ed.uol.edu.pk](mailto:nisar.abid@ed.uol.edu.pk)

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**Abstract.** The authors investigate what factors impact employee attitude and how employee attitude shapes their behavior. They admit that pro-social behavior (PSB) is a consequence of internal market and learning orientation since it affects the attitude of front-line employees. Therefore, the article focuses on the internal market and learning orientation, enabling an organization's culture via employee attitudes. A survey was conducted to collect the data from managers and front-line employees at higher educational institutes in Pakistan. The findings of the study are that (1) the internal market orientation (IMO) has a positive influence on the pro-social behavior of front-line employees (FLE); (2) employee attitude mediates the effect of IMO on PSB, and (3) employee attitude mediates the effect of learning orientation (LO) on PSB. Implications of the obtained results and further research directions are also mentioned.

**Keywords:** internal marketing orientation; learning orientation; pro-social behavior; higher education; front-line employees; attitude; Pakistan

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### 1. Introduction

Service companies, irrespective of the country they operate, understand how vital pro-social behavior (PSB) of employees, especially of so-called "front-line employees (FLE)" for a company's image and performance (Sanden, & Lonsmann, 2018; Minarová et al., 2021).

Considering the importance of PSB, researchers have been trying to understand how service organizations can promote and motivate PSB in FLE (Podsakoff et al., 2009; Lages, 2012; Malhotra & Ackfeldt, 2016). Job satisfaction and organizational commitment are studied as positive influencing factors on PSBs of FLEs (Choi & Joung, 2017). In addition, workplace fairness is also referred to as an antecedent of PSB (Hu, 2020). Hence, this study considers two indicated dimensions of PSB. Extra-role customer behaviors refer to the extended positive behavior of FLE towards external customers, and cooperate behaviors are associated with positive behaviors of

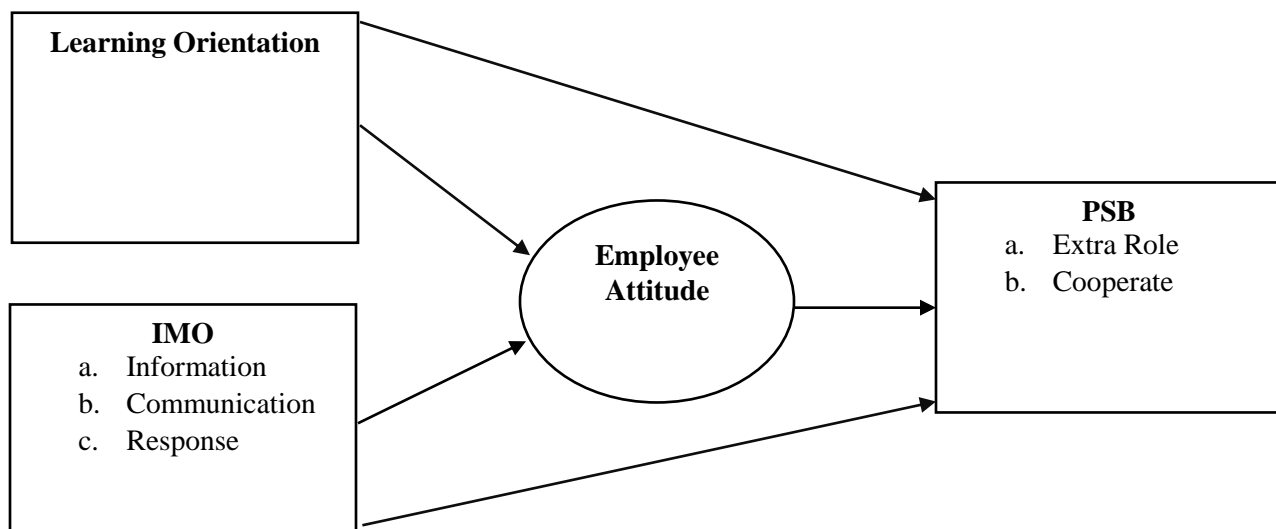
FLE toward their colleagues, supervisors, followers, and organization (Bettencourt et al., 2005). Existing literature on service marketing urges to search for a mechanism that deliberately manages and maintains positive attitudes and PSB among FLE (Ansari et al., 2018).

Lings (2004) has documented internal market orientation (IMO) as an essential tool to maintain a positive culture within the service organization. Another study has highlighted implementing IMO within service organizations to develop and maintain positive PSB of FLE (Domínguez-Falcón et al., 2017). IMO is a process of implementing external market orientation within the organization, and there are three behavioral dimensions of IMO ‘information generation’; internal communications and internal responsiveness (Lings, 2004). Malhotra & Ackfeldt (2016) advocated internal communication as an essential dimension of IMO to enhance organizational commitment, which ultimately positively influences PSB of FLE. Sanden and Lonsmann (2018) stressed the strong impact of IMO on employee attitude. Even though rather many studies have investigated the formation process of PSB, there is still a continuous need to estimate and understand employee attitudes in different circumstances as PSB influencing factors (Choi & Joung, 2017; Buhusayen et al., 2021).

As mentioned earlier, learning aspects also develop attitudes to influence PSB of FLE (Ajzen & Fishbein, 1970). LO is a tool of higher learning in creating behaviors based on competitive advantage. LO allows employees to question any information regarding an organization's internal strategies and avoids inertia (Day, 1994; Baker & Sinkula, 1999; Alshaikh & Masmoudi, 2021).

When an organization motivates employees to learn and think out of the box, it will create a culture to act pro-actively to influence employee attitude.

The authors will study the influence of IMO and LO on PSB by mediating the employee's role in Pakistan's higher education sector. Pakistan is a bureaucratic state where command and control rules (Ahmed, 1996), and high-power distance dominates Pakistani culture (Routamaa & Hautala, 2008). Power distance culture and bureaucratic state create a need for an organizational setting that simultaneously facilitates the service organization and the management hierarchy (Leonavičienė & Burinskienė, 2021). This research adds to the existing literature by investing in the mediating role of employee attitude between IMO and LO on PSB amongst FLE in the education sector of Pakistan.



**Figure 1.** The conceptual framework for the impact of employee attitude on their pro-social behavior: a case study

*Source:* elaborated by the authors based on the review of literature

## **2. Literature Review**

### **2.1 Internal Market Orientation**

Internal market orientation (IMO) is an exchange between employees and the firm (Lings & Greenley, 2005). IMO has a positive and significant influence on employees' perceived ability concluded by (De bruin et al., 2021). IMO guides leadership to align the external market objectives with internal strategies through a valid process. IMO can produce positive behaviors in FLE to develop the service organization (Domínguez-Falcón et al., 2017). Existing literature has described three dimensions of IMO: information generation, communication, and responsiveness (Lings & Greenley, 2005). To gain competitive advantages, a high-performance firm should focus on improving IMO (Harrington et al., 2017; Komarac et al., 2017). Internal marketing orientation and employee motivation enhance pro-social behavior and, ultimately, strong relationships with external customers (Gazzoli et al., 2022).

There is a lot of attention to needs affecting the behavior of FLE. We can get such information through formal and informal methods, i.e., formal surveys or face-to-face meetings and daily interactions between managers and FLE (Lings & Greenley, 2005; Yousaf et al., 2020). IMO is affected as well by internal communication, which is a tool by which the service sector shares its objectives, strategies, and vision with FLE (Lings & Greenley, 2005; Gounaris, 2008). Consequently, it affects the behaviors of FLE by aligning their goals with organizational goals (Nassar, Strielkowski, 2022).

The third and last dimension of IMO is the response; it involves the reaction of higher management to the information generated about the needs of employees, including the requirements of FLE (Lings & Greenley, 2005; Gounaris, 2008; Kudins, 2022).

### **2.2 Learning orientation**

Learning orientation (LO) is a set of beliefs that inspires the organization to use knowledge for proactive learning. So, the employees can enhance sensitivity to market change, grab opportunities, and think out of the box for creativity by questioning the organization's vision (Mavondo et al., 2005; Kipfmiller et al., 2019; Mura et al., 2021). Robust capability motivates employees, which can lead to firms' improvement in the quality of information, operationalization, and all other strategic orientations, particularly learning orientation (Baker et al., 2022).

### **2.3 Employee Attitude**

Attitudes are long-lasting evaluations of FLE about the service organization (Mintz et al., 2020). FLE's attitude is an incomplete and debatable topic amongst researchers, and many researchers are investigating the influence of organizational culture on FLE's attitude in the service sector (Awwad & Agti, 2011). A study on attitude toward work in different generations, including baby boomers (born before 1950), generation X (born between the 1950s and 1980s), and generation Y (born in the late 1980s to 2000) analyzed by (Kamau et al., 2014). Few studies have reported corporate culture as one of the most substantial factors influencing FLE's attitude (Cherian et al., 2021; Makumbe, 2022; Abbas & Dogan, 2022).

### **2.4 Pro-Social behaviors**

Pro-Social behaviors (PSB) are associated with the helping behaviors of FLE towards their colleagues/organization and customers in the service sector (Malhotra & Ackfeldt, 2016). Such as friendliness, helpfulness, and generally peaceful nature of FLE (Malhotra & Ackfeldt, 2016). Two dimensions of PSB are essential aspects of PSBs: extra-role behaviors and cooperative behaviors (Malhotra & Ackfeldt, 2016). Many studies showed that pro-socially motivated employees are determined and proactive in performing well and highly committed (Xanthopoulou et al., 2008) and build supportive relationships with other members of the organization



(Holte, 2014). Ethical leadership has a positive influence on them, and they are psychologically attached because the respect, care, and support they receive motivate them to contribute to the organization's performance (Xu et al., 2016).

## 2.5 Attitude theory

We utilized Attitude theory to determine mechanisms of behaviors, and actions of FLE, as the direct consequences of intentions and subjective norms, which ultimately get influenced by attitudes (Fishbein & Ajzen, 1970). Intentions are the agreeableness and willingness from the cognitive part of FLE, and subjective norms are the beliefs related to the culture, which can be different for different cultures. Attitude theory affects the ability to describe PSB of FLE in service organizations. FLE's attitudes (positive or negative) are predicted to have significant strong effects on PSB. FLE's attitudes are motivated and encouraged by inferring the internal and external factors. Any impolite policies by management will affect the FLE's philosophy negatively, which in turn will influence the behaviors and may eliminate PSB in the service sector. In short, this research considers Attitude theory to emphasize that IMO will positively affect FLE's attitude, and the outcome will be PSB.

## 2.6 Conceptual Development

Service industries have significant concerns regarding FLE behaviors which can be resolved through IMO (Gounaris, 2008). Lings and Greenley (2005) investigated the considerable effect of IMO on service provider external success, which can be inferred here as caused by PSB. We argue that appropriate IMO practices will motivate the FLE to align their identifications with the service organization's objective and strong desire to work hard to remain a member of a particular company (Domínguez-Falcón et al., 2017). We can make advancements towards developing a hypothesis by purposing that implementation of IMO (information, internal communication, and response) will significantly positively impact PSB (different roles and cooperation) of FLE.

Previous literature has observed that IMO influences employee attitudes (Lings & Greenley, 2005). According to Attitude theory (Fishbein & Ajzen, 1970), rich culture can enhance favorable and robust employee attitudes by implementing IMO through information generation, internal communications, and responses. IMO is a mechanism to empower employees, and empowerment, directly and indirectly, impacts employee attitude.

Orientation theory explains that individuals with low learning outcomes usually avoid challenging situations, while others with tangible learning outcomes stay in such conditions (Dweck and Leggett, 1988). The FLEs learn new performance standards, job roles, and expectations during the work adjustment. Individuals high on learning outcomes are naturally inspired to improve their work adjustment. Learning is a crucial factor affecting employees' attitudes and performance (Fishbein & Ajzen, 1970; Benet-Martínez & Hong, 2014; Takeuchi et al., 2019; Artusi & Bellini, 2021; Moskvina, 2022).

Let us recall that according to Attitude theory, every individual has specific perspectives, and these attitudes influence behaviors (Fishbein & Ajzen, 1970). We argue that positive attitudes about an organization will positively influence employee behaviors. This study proposes the significant effect of employee attitude on their PSB.

**Hypothesis 1:** There is a significant favorable influence of IMO on PSB.

**Hypothesis 2:** IMO has a significant direct impact on employee attitude.

**Hypothesis 3:** Employee attitude mediates the relationship between IMO and PSB.

**Hypothesis 4:** There is a significant favorable influence of LO on PSB.

**Hypothesis 5:** There is a significant direct impact of LO on employee attitude.

**Hypothesis 6:** Employee attitude mediates the relationship between LO and PSB

**Hypothesis 7:** There is a significant relationship between employee attitude and PSB.

### 3. Research Methodology

A questionnaire was designed to evaluate the considered variables. The respondents work on the front line and as managers of the service sector in Lahore. Seven questions aim to measure IMO (Lings & Greenley, 2005). Five questions were adapted to reveal LO (Baker & Sinkula, 1999). Seven questions allowed to calculate employee attitude (Kamau et al., 2014). Five questions tackled measuring PSB (Bettencourt et al., 2005). (See Appendix 1). Preacher-Hayes model 7 has been adopted to test the hypothesis. Mediating effects, correlations, and regression analysis has been done through AMOS. The cross-Sectional technique is being used for data collection in this research. The data was collected through a question from one of the largest private universities in the largest populated province Punjab, Pakistan. Namely, the University of Lahore (UOL) is one of the youngest and most prominent Universities in Pakistan, which significantly contributes to the education sector and produce vibrant managers who successfully serve different organizations and enhance the business operations in society. FLEs from other departments of UOL working in administrative positions were selected using a convenient sampling technique. A total of 200 questionnaires were distributed, out of which 115 questionnaires were returned. One hundred ten usable questionnaires out of 200 questionnaires make the response rate 55%.

### 4. Results and Discussion

This study contributes to the research field of service marketing by investigating the cultural perspective of IMO and LO to its effects on enhancements of employee behaviors. According to the Attitude theory, IMO and LO positively influence extra-role customer service and cooperative behaviors. The results of this research are depicted graphically in Figure 2 and Figure 3.

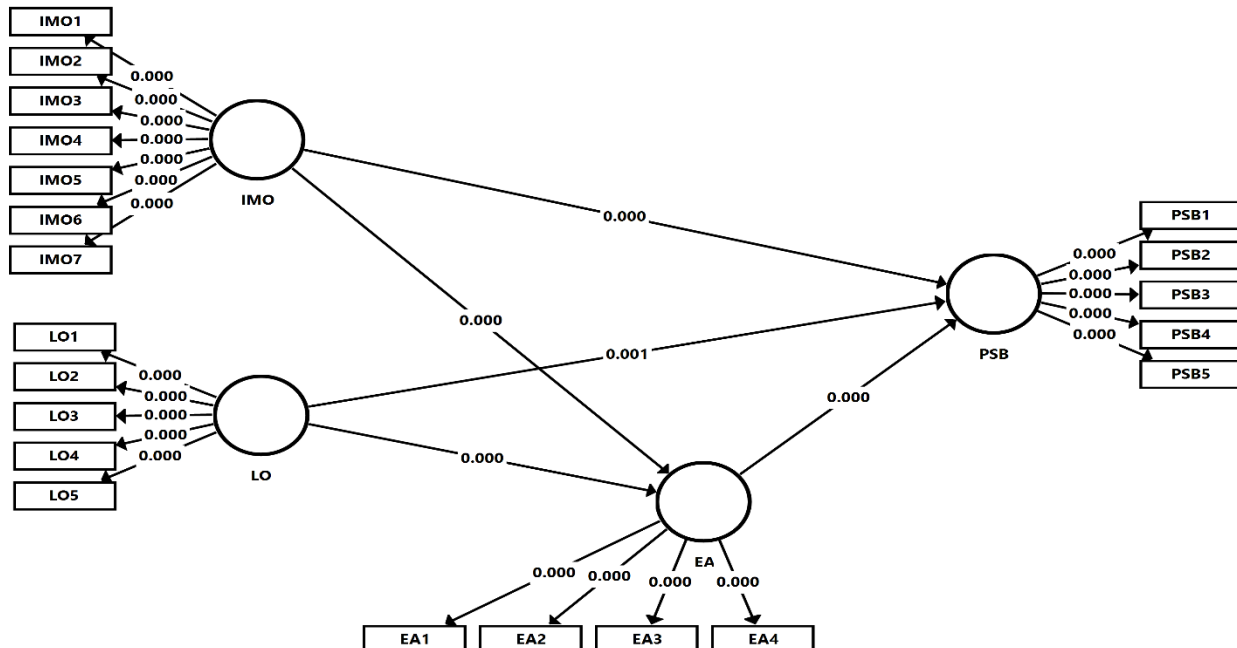
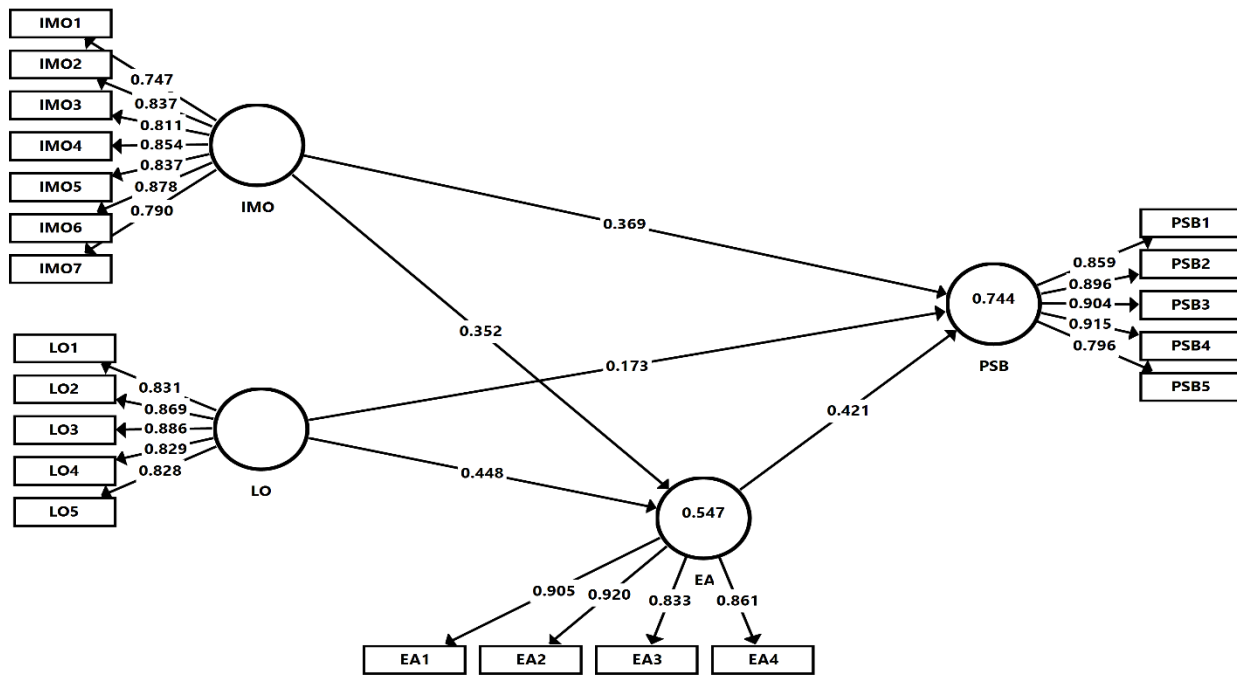


Figure 2. Results of IMO, LO on PSB and mediating relationship of EA



**Figure 3.** Results of IMO, LO on PSB and mediating relationship of EA

From a managerial perspective, our findings indicate that higher educational institutes in Pakistan must improve the quality of organizational culture by implementing IMO and LO. Internal communication with their FLEs. Effective responses and transmission of organization-related information significantly influences employees' attitude and enhances their PSB, which, in turn, spurs their behaviors towards both colleagues and customers. Hence, managers should craft the IMO and LO practices required to stimulate FLE discretionary customer service behaviors and good citizenship. Therefore, organizations operating in dynamic environments should orient their energies toward the development and upkeep of an IMO and LO culture that stimulates positive behaviors toward the end consumer and colleagues. To achieve defined goals and objectives, managers must try to transform the IMO and LO culture into behaviors.

Finally, it is vital to recognize the limitations of this study that could become the future directions for further research in this field. Foremost, the results of this study cannot be generalized because the sample of the educational institute is from The University of Lahore, Punjab, Pakistan only, and it would be great to apply this model in other countries. Secondly, this is a cross-sectional study; consequently, it would be interesting to conduct longitudinal studies to draw more robust conclusions. Future studies would also be interesting to analyze the other variables produced by the IMO, such as satisfaction, loyalty, and commitment. Finally, it could be helpful to incorporate the clients' perspectives in future studies. For example, to include customer evaluations of FLE and PSB to validate our findings.

## Conclusions

The results of the study confirmed most of the hypothesized relationships among internal marketing orientation (IMO), learning outcomes (LO), employee attitude (EA), and pro-social behavior (PSB). The results confirmed that internal market orientation is a helpful instrument for encouraging positive employee attitudes. This study shows that top management should focus on promoting internal market orientation to improve employee attitude and pro-social behavior. Employees in the service industry, especially front-line employees, are critical in shaping the experience of new hiring; their behaviors and attitudes can create value-added for firms. This study proposed that IMO and LO affect EA directly, and EA mediates the relationship with PSB. In investigating the internal service-profit chain model, this study supported that IMO and LO were positively related to PSB directly and indirectly through EA. The findings complement previous research (Mintz et al., 2020; Cherian et al., 2021; Makumbe, 2022; Abbas & Dogan, 2022; Baker, 2022), which underline the importance of attitudes of employees and their behavior for companies' performance.

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**Appendix 1. Questionnaire**

No	Statement	SD	D	N	A	SA
	<b>(Lings &amp; Greenley, 2005)</b>					
1	The organization tries to find out employees' real feelings about their jobs	1	2	3	4	5
2	The organization regularly talks to the staff to find out about their work	1	2	3	4	5
3	If the organization notices an employee acting differently from average, the organization will try to find out if a problem is causing a behavior change	1	2	3	4	5
4	The organization tries to find out what employees want from the company	1	2	3	4	5
5	The organization regularly reports to my staff about issues that affect their working environment	1	2	3	4	5
6	The organization regularly meets with all staff to report on issues relating to the whole organization	1	2	3	4	5
7	When the organization finds that employees would like the organization to modify their conditions of employment, the departments make concerted efforts to do so	1	2	3	4	5
	<b>(Baker &amp; Sinkula, 1999)</b>					
8	Managers agree that our ability to learn is the key to competitive advantage	1	2	3	4	5
9	The fundamental values of this business unit include learning as a key to improvement	1	2	3	4	5
10	The sense here is that learning is an investment, not an expense	1	2	3	4	5
11	Learning in my organization is a critical commodity to guarantee organizational survival	1	2	3	4	5
12	All employees are committed to the goals of learning	1	2	3	4	5
	<b>(Kamau et al., 2014)</b>					
13	I access information instantaneously	1	2	3	4	5
14	I am entirely different from my parents as far as work attitude is concerned	1	2	3	4	5
15	I use modern media for communications in the workplace	1	2	3	4	5
16	I do not live to work but work to live	1	2	3	4	5
17	I do not like work	1	2	3	4	5
18	I do care less about salaries	1	2	3	4	5
19	I prefer more flexible working hours	1	2	3	4	5
	<b>(Bettencourt et al., 2005)</b>					
20	I help other employees who have heavy workloads	1	2	3	4	5
21	I am always ready to lend a helping hand to those employees around me	1	2	3	4	5
22	I help orient new employees even though it is not required	1	2	3	4	5
23	I voluntarily give my time to help other employees	1	2	3	4	5
24	I willingly help others who have work-related problems	1	2	3	4	5

Note: SD-strongly disagree, D-disagree, N-neutral, A-agree, SA-strongly agree

**Data Availability Statement:** More information can be obtained on a reasonable request.

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**Edmunds ČIŽO**, is PhD in Economics and Entrepreneurship, Assistant professor at the Department of Economics of Daugavpils University (Latvia). Research interests: economics, sustainable economic development.

ORCID ID: <https://orcid.org/0000-0003-0654-2962>

**Raheel Amir AWAN**, is a Lecturer in Lahore business school of the University of Lahore (Pakistan). His research interests are in consumer loyalty, marketing communications, and marketing strategies.

ORCID ID: <https://orcid.org/0000-0002-0829-1338>

**Rizwan ALI**, Dr., Assistant Professor in Marketing at the Lahore Business School of University of Lahore (Pakistan). His research interests are in consumer behavior, marketing communications, pricing, and consumer psychology. He has published his work in international journals such as Psychology in the Schools, and International Journal of Business Environment, amongst others.

ORCID ID: <https://orcid.org/0000-0001-6551-2152>

**Nisar ABID**, Dr., received a PhD from the Institute of Education and Research (IER), University of the Punjab, Pakistan. He is currently an assistant professor in the Department of Education, The University of Lahore. Dr. Nisar Abid's research interests lie in curriculum studies, technology education, teacher education, and academic enabling behaviors. His publication topics include students' academic enablers, teachers' competencies, attitudes toward technology, e-learning and research, and the use of ICT in education.

ORCID ID: <https://orcid.org/0000-0002-2696-4241>

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## ANALYSIS OF PERCEIVED CUSTOMER SATISFACTION IN THE CONTEXT OF RAIL TRANSPORT: A CASE STUDY OF THE SLOVAK MARKET\*

Ludovit Nastisin <sup>1</sup>, Beata Gavurova <sup>2\*</sup>, Radovan Bacik <sup>3</sup>, Ivan Kopor <sup>4</sup>, Stefan Kral <sup>5</sup>

<sup>1,3,4,5</sup>University of Prešov, Faculty of Management and Business, Department of Marketing and International Trade, Konštantínova 16, 08001, Prešov, Slovakia

<sup>2\*</sup>Technical University of Košice, Faculty of Mining, Ecology, Process Control and Geotechnologies, Letná 9, 042 00, Košice, Slovakia

E-mails: <sup>1</sup>[ludovit.nastisin@unipo.sk](mailto:ludovit.nastisin@unipo.sk); <sup>2\*</sup>[beata.gavurova@tuke.sk](mailto:beata.gavurova@tuke.sk) (Corresponding author); <sup>3</sup>[radovan.bacik@unipo.sk](mailto:radovan.bacik@unipo.sk); <sup>4</sup>[ivan.kopor@smail.unipo.sk](mailto:ivan.kopor@smail.unipo.sk); <sup>5</sup>[stefan.kral@smail.unipo.sk](mailto:stefan.kral@smail.unipo.sk)

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**Abstract.** Rail transport is one of the most widely used modes of transport in most parts of the world. Therefore, knowing what customers think of its quality means valuable information for making informed decisions. The aim of this paper is to assess the statistical significance of the relationships between selected analyzed variables of passenger satisfaction with rail transport in the selected market. To achieve this goal, the paper made use of questionnaire data. Data collection took place in the months of February to April 2022. A total of 252 verified records were included in the analysis. Prior to the analysis, the authors researched relevant literature and existing research studies (basic framework for the analysis). The research part of the study made use of the Mann-Whitney U test and the Kruskal-Wallis test to analyze the differences, followed by the Spearman's correlation coefficient to assess the relationships. The results did not confirm the statistical significance of the differences in the context of the analyzed groups, but in the case of the context of the individual analyzed factors, statistical significance was observed. The findings were put into a wider context in terms of the existing research. The limitations of the study and the possibilities for future research were also outlined.

**Keywords:** analysis; satisfaction; customer; railway transport; Slovak market

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**JEL Classifications:** M19, L15, R40

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## 1. Introduction

Tourism-related transport has been booming since the last century. Even today, the issue of transport is still seen mainly from the point of view of technology, even though it is one of the core services of tourism along with accommodation and restaurant services. As more and more people have access to motor vehicles, transport companies need to attract potential customers, retain regular customers and boost the attractiveness of the sector (not only from the customer's point of view). Public transport is one of the main factors determining the quality of a city, region as well as a country (Korba et al. 2021). Improvements in public transport services are known to affect customer satisfaction and quality of life (Yilmaz et al., 2021; Melnikova et al. 2016; Turisova et al. 2021). Customer satisfaction and customer loyalty are also affected by the perception of transport quality by passengers (Eboli & Mazzulla, 2014; Petruf et al. 2015). The task of improving public transport lies with cities, countries, ministries and other responsible entities who are in charge of measuring service quality, identifying gaps, improving service quality levels (Shen & Li, 2014) and providing financial supports (Ključnikov et al., 2020a; Civelek et al., 2022; Szabo et al. 2022). Thus, the collaborations of governments with other responsible institutions might also be crucial to overcome these issues (Civelek et al., 2020; Civelek et al., 2021; Ključnikov et al., 2020b; Periokaitė & Dobrovolskienė, 202; Ključnikov et al., 2021).

By focusing on the most important underlying factors, we can assess this mode of transport and its individual parts. Therefore, the aim of this paper was to assess the statistical significance of the relationships between selected analyzed variables of passenger satisfaction in the context of rail transport in the selected market. In this regard, this study differs from other studies that also focus on Slovakian market in different purposes (Štefko et al., 2020; Dvorsky et al., 2021; Petrakova et al., 2021; Kolková & Ključnikov 2021; Metzker et al., 2021; Ključnikov et al., 2022). The first part of the study presents an overview of the relevant literature and research and the methodology used. This is followed by the part where research results are presented. The discussion part places the research results within the context of existing research.

## 2. Theoretical background and current state of research

The aim of business is the company value, which depends on its ability to generate future profits (Machova et al., 2020). They refer to activities and abilities that increase profitability, decrease risk, and support the company's growth (Vochozka et al., 2017). The economy sector is always growing; Horak et al. (2020) stated that, there are companies that offer an ever-growing range of goods and services. A good company has their own future prediction. There is no doubt that the issue of making a good prediction about a company's possible failure is very important, as well as complicated (Vochozka et al., 2020). Future of the company is so important to all the stakeholders. The earnings and asset valuation methods are used to value the part of the company (Šuler et al., 2021). The future of the company is most of the time based on the future investment. It is very desirable, not for the profit from the investment but for the low investment risk (Vrbka & Vochozka, 2018). Another big step in company development is the innovations, which are going hand in hand to meet the customers expectations and to satisfy them. The subsequent estimations are based on the structural modelling of the innovation process, i.e. decision to innovate, innovation input and innovation output (Vokoun, 2018). A great company focuses on profit and customer satisfaction.

Customer satisfaction is a term often used in marketing. Marketing is nowadays heavily influenced by the social medias. It is important to know the risks associated with entering this environment, but also the benefits (Kučera & Smolková, 2022; Simionescu, 2021). Marketing is one of the core parts of every company. It is a measure of how the products and services provided by the company meet or exceed customer expectations (Krajčík, 2022). Farris et al. (2010) define customer satisfaction as the number or percentage of the total number of customers whose experience with a company, its products or its services exceeds the set satisfaction goals. Customers play

an important role and are essential in maintaining the relevance of a product or service. In their work, Hill and Alexander (2017) state that organizations of various types and sizes have been gradually realizing how important customer satisfaction is. It is well known that retaining an existing customer is much less costly than acquiring a new customer. There is a strong link between customer satisfaction, customer retention and profitability. Customer satisfaction is becoming a key goal of many organizations. It is important to invest in improving performance in areas that significantly contribute to customer satisfaction, such as quality and customer service (Košč et al. 2021). Customer satisfaction can come from benefits that the company offer to their customers. Most customers own a loyalty card only because of a possible benefit or reward (Kalinova & Mílová, 2022).

The customer is satisfied when the performance provided exceeds his expectations. However, if the customer expects better performance than the one he was provided with, the customer is dissatisfied and does not enjoy the service provided (Gejdoš and Šatanová 2011). The quality of the services provided is closely related to customer satisfaction. Harvey and Green (1993) have already described quality as a relative term. Quality is relative as it depends on the user's perspective and other circumstances. In this case, quality is a subjective concept because every customer may perceive quality differently. The quality of services can be divided into physical (material elements), social (image, reputation, reputation) and interactive (interaction of staff and customers as well as customers themselves).

In order to measure the service quality, the SERVQUAL method comes at hand. The method is based on a model of the expectancy-disconfirmation paradigm. This method was first published by Parasuraman et al. (1985) to measure quality in the services sector. Although this method is widely used, a significant disadvantage of this method is the problem with high customer expectations and at the same time a higher probability of a difference between expectations and actual experience. Chowdhury et al. (2015) conducted their research on rail transport in Bangladesh using the SERVQUAL method. The method consists of the following five dimensions: tangibles (everything the customer sees and with which the customer comes into contact - appearance of amenities, facilities, equipment, staff, etc.), reliability (ability to perform the promised service reliably and accurately), responsiveness (willingness to help customers and provide fast services), assurance (knowledge and understanding of employees, courtesy and their ability to inspire confidence) and empathy (striving for a sensitive and individual approach). Satisfaction factors in public transport were broken down by the authors Linh and Sanh (2016) into five categories. Transport (factors directly related to transport from the place of departure to the destination, such as availability of tickets and interior cleanliness), timeliness (frequency of transport services), information (various information available on transport services, etc.), professionalism (behavior and communication style of staff) and staff attitudes (customer care).

According to Agarwal (2008), who worked on research on rail customer satisfaction in India, satisfaction factors in public transport can be broken down into 6 categories, in particular behavior of the staff (friendly staff, quick service, etc.), tangibles of the platform (platform cleanliness, vending machines for drinks and snacks on the platform, etc.), services on the train (e.g. train cleanliness, safety features on the train, up-to-date information available on the train), train availability and tickets (number of trains, availability of tickets, etc.), basic services on the platform (information system, seating, etc.) and the ticket office (number of ticket offices, opening hours of the ticket offices, waiting time in line, etc.). In their research on public transport customer satisfaction in the European Union, Minelgaite et al. (2020) divided customer satisfaction factors into four categories, namely frequency and reliability, comfort and safety, ticket prices and amenities at stops and stations. The basic groups of factors according to Le-Klähn et al. (2014) include comfort, accessibility and usability, quality of service and factors of price, information, usability and staff. Felleeson and Friman (2012) consider the system (timetable), safety and staff to be important factors in addition to comfort.

Recently, the issue has been researched from various points of view, in particular by Park et al. (2022) who focused on datamining on social media, Chauhan et al. (2021) and their research in the context of multimodal transport HUBs (MMTH), Güner (2018) measured the quality of public transport using a multi-criteria decision-making technique, Kostiuk et al. (2021) compared the added value of public transport in EU countries in the pre-pandemic period, Hybel and Mulalic (2022) assessed the relationship between transport and quality of life in Denmark with similar research carried out by in the US market by Mattson et al. (2021).

### 3. Research objective and methodology

The research goal was to assess the significance of the relationships between selected analyzed variables of satisfaction of passengers with the services provided by the national railway carrier of the Slovak Republic. To do so, three research hypotheses were formed:

H1: There is a statistically significant difference in the perception of the analyzed rail transport variables between men and women.

H2: There is a statistically significant difference in the perception of the analyzed rail transport variables depending on the availability of another mode of transport.

H3: The selected qualitative variables of satisfaction have a statistically significant impact on the overall satisfaction with rail transport.

The dataset consisted of primary data collected using the questionnaire distributed in electronic form by the CAWI method among railway passengers in the selected market. Data collection took place from February to April 2022. The research sample consists of a total of 252 respondents, of which 135 are women and 117 are men. The largest share of respondents falls in the age group of 19 to 29 years olds (108 respondents, almost 43% of all respondents). 98.4% of respondents are in the productive age (15 to 64 years), the rest are respondents in the post-productive age (65 and over). The youngest respondents are 16 years old, the oldest respondent is 69 years old. In the context of social status, most respondents are employed - 121 respondents (48% of respondents). The second largest category consists of students (almost 22% of respondents), the third largest group consists of entrepreneurs and self-employed persons (more than 14% of respondents). Almost 16% of respondents are unemployed, parents on parental or maternity leave and the smallest share is formed by pensioners.

The research made use of the tools of frequency statistics, correlation analysis and difference analysis for statistical analysis. The data collection consisted of twenty-nine items, which were divided into six factors as shown in Table 1. For each item, the respondent was able to express his level of satisfaction (the Likert scale). The results were further processed by means of analysis of differences and relation, where, based on the analysis of the sample, non-parametric tests were proved necessary.

**Table 1.** Factors affecting customer satisfaction

Analysed factor	No. of items
Comfort	4
Tangibles	7
Quality of service	6
The staff	4
Ticket office services and price	5
Overall satisfaction	3

Source: own elaboration



Table 2 presents the analyzed variables, i.e. the factors that were used in the analysis. The first factor, comfort, contains four items (cleanliness, safety, seat availability and vehicle space), the factor tangibles contains seven items (modern amenities, availability of information, staff, availability of information, on-board catering facilities, catering facilities at the station and stops and other station and platform amenities). The quality of service factor contains six items (frequency of trains, additional services, timeliness of arrival and departure, reliability of trains, internet connection and website). The staff factor contains four items (staff knowledge, staff behavior, quick service, and conflict resolution). Ticket office services and the price consist of five items (ticket office opening hours, ticket office waiting times, number of ticket offices, ticket purchasing process and ticket price). The last factor, overall satisfaction, consists of three items and is constructed on the basis of an expanded overall satisfaction factor (two additional items – likelihood of recommending railway transport to friends, future use of railway transport and satisfaction with railway transport).

**Table 2.** Factor evaluation (5-point Likert scale)

Variables	Avg.	Median	Std.Dev
<b>Comfort</b>			
Cleanliness	3.24	3	1.13
Safety	3.56	4	1.19
Seat availability	3.24	3	1.17
Vehicle space	3.16	3	1.13
<b>Tangibles</b>			
Modern amenities	3.12	3	1.24
Information boards	3.66	4.	1.13
Polite staff	3.95	4	1.13
Staff availability	3.44	4	1.16
Catering on the train	3.28	3	1.13
Catering at the station	3.55	4	1.17
Station amenities	3.36	3	1.15
<b>Quality of service</b>			
Train frequency	3.07	3	1.17
Additional services	3.20	3	1.04
Timeliness	2.79	3	1.15
Reliability of trains	2.94	3	1.15
Internet quality	2.56	2	1.25
Web	3.68	4	1.04
<b>Staff</b>			
Knowledge	3.81	3	1.13
Behavior	3.81	4	1.19
Service and feedback	3.60	3	1.17
Conflict solving	3.61	3	1.13
<b>Ticket office services and price</b>			
Opening hours	3.69	4	1.07
Waiting period	3.47	4	1.08
Number of ticket offices	3.54	4	1.10
Ticket purchasing process	4.13	4	1.09
Ticket price	3.54	4	1.32
<b>Overall satisfaction</b>			
Recommendation	3.44	4	1.13
Future use	3.64	4	1.12
Overall satisfaction	3.54	4	1.13

Source: own elaboration

The first of the established research hypotheses focused on the existence of a statistically significant difference in the perception of the analyzed rail transport variables between men and women. At the baseline level, the largest difference was observed for the comfort factor, where the difference reached the value of 13.01 (approximately 10.83% less value for women than for men). The smallest difference was observed for the staff factor, the difference being 1.36 (approximately 1.20% lower for women than for men), with all average values being higher for men than for women. Overall, the difference in the average values of the factors is low. To verify the assumption that the sample has a normal distribution, the research made use of the Shapiro-Wilk test, which showed a violation of normality at the significance level  $\alpha = 0.05$ . It follows that the file does not have a normal distribution. The set was subjected to a nonparametric Mann-Whitney U test the aim of which is to find a statistically significant difference between 2 independent variables.

**Table 3.** Difference in the perception of factors – Mann Whitney U test

	Comfort	Tangibles	Quality of service	Staff	Ticket office	Overall satisfaction
Mann-Whitney U	6085.000	5537.500	6110.500	6186.000	5901.000	5984.500
p-value	.714	.135	.755	.875	.456	.565

Source: own elaboration

Based on the results of the Mann Whitney U test presented in Table 3, it could be stated that there is no statistically significant difference between men and women, because for each factor the p-value is higher than the set significance level  $\alpha = 0.05$ . Therefore, this hypothesis is refuted.

**Table 4.** Difference in the perception of factors – Kruskal Wallis test

	Comfort	Tangibles	Quality of service	Staff	Ticket office	Overall satisfaction
Kruskal Wallis	1.356	0.520	0.608	1.130	1.510	1.321
p-value	.508	.771	.738	.568	.470	.517

Source: own elaboration

The aim of the second hypothesis was to find out whether there is a statistically significant difference in the perception of the analyzed rail transport variables depending on the availability of another mode of transport. Here, three groups were analyzed and compared. Due to the nature of the normality of the group, the Kruskal Wallis test was applied. The results are presented in Table 4. Based on the results of the Kruskal Wallis test, it could be said that there is no statistically significant difference between the groups of respondents, because for each factor the p-value is higher than the set level of significance  $\alpha = 0.05$ . Therefore, this hypothesis is refuted.

**Table 5.** Relationship of factors – Spearman's coefficient

factor	Comfort	Tangibles	Quality of service	Staff	Ticket office
Comfort	1	.733	.668	.602	.505
Tangibles	.000	1	.713	.651	.582
Quality of service	.000	.000	1	.604	.535
The staff	.000	.000	.000	1	.600
Ticket office and price	.000	.000	.000	.000	1

Source: own elaboration

The last hypothesis assessed the statistical significance of the relationship between selected qualitative variables and overall satisfaction in the examined conditions. Due to the abnormal distribution of the set, the nonparametric Spearman coefficient was applied. Table 5 shows the correlation coefficients (above the main diagonal) and the p-values (below the main diagonal). A strong direct correlation was recorded between the factors of tangibles and quality of services, the correlation coefficient reached 0.713, at a p-value of 0.000. The lowest dependence between the two variables was recorded for the factors comfort and the ticket office and price. The correlation coefficient reached the value of 0.505, with a p-value of 0.000 (lower value than the significance level  $\alpha = 0.05$ ).

**Table 5.** Relation to overall satisfaction – Spearman’s coefficient

factor	Overall satisfaction	
	Corr. Coef	p-value
Comfort	.636	.000
Tangibles	.703	.000
Quality of service	.676	.000
The staff	.638	.000
Ticket office services and price	.651	.000

*Source:* own elaboration

With regard to the correlation between the major factors with the overall satisfaction factor, it was observed that all the selected factors correlate with the factor of overall satisfaction, with the p-value of all the factors being less than the significance level  $\alpha = 0.05$  as presented in Table 5. The strongest correlation was recorded between the overall satisfaction factor and the tangibles factor, with the correlation coefficient reaching 0.703 (strong direct correlation). The second strongest correlation coefficient was found between the factor overall satisfaction and the factor quality of services, where the coefficient reached the value 0.676 (mean direct correlation). The weakest correlation coefficient was found between the factor of overall satisfaction and comfort, where the coefficient reached the value of 0.636 (mean direct correlation). All correlation coefficients reached a value greater than 0.600. Based on the obtained results, the statistical hypothesis of the existence of this correlation is accepted.

#### 4. Discussion

The aim of this paper was to assess the significance of the relationships between the selected analyzed variables of the satisfaction of railway passengers in the selected market. Based on the hypotheses we were able to confirm the relationship between the factors of customer satisfaction with the transport and overall satisfaction, as well as the relationship between the factors. This finding correlates with the research of Le-Klähn et al. (2014), which focused on the correlation between public transport factors. Interestingly enough, Le-Klähn’s research also did not confirm a significant relationship between the characteristics of the respondent and the evaluation of selected factors (in terms of characteristics shared by both studies). Minelgaite et al. (2020), whose research also focused on public transport, examined the levels of satisfaction and its impact on the use of railway transport in the countries of the European Union. Using regression analysis, the research arrived at a weak degree of negative dependence between the factors and gender. As for the Slovak Republic, a weak but statistically significant correlation between the frequency and reliability of trains, amenities at stations and the level of satisfaction was observed. The significant correlation was confirmed by Felleson and Friman (2012) in their publication on the satisfaction with public transport services. The publication claims that in order to improve the public transport, it is not only necessary to increase the quantity of services provided, but it is also important to improve the quality of services provided as it is the quality that is reflected in the overall assessment of customer satisfaction. The research by Linh and Sanh (2016) focused on public transport in Vietnam, in particular vehicle comfort (especially vehicle cleanliness) and timeliness (in our case, timeliness and frequency of trains), and found a

correlation between gender and satisfaction assessment. Research on rail transport in India by Agarwal (2008), which consisted of six satisfaction factors divided into 47 items plus the overall rail satisfaction factor, also correlates with the hereunder findings, as it showed that quality of services and staff behavior have a clear impact on the overall customer satisfaction in rail transport. Given the average evaluation of service quality factors (significantly lower than average) and staff factor (higher than average), this finding is relevant for future research on this issue.

## Conclusions

Based on the above analysis and the previous survey of existing theoretical sources, it was possible to fulfill our research goal, that aimed to assess the significance of the relationships between selected analyzed variables of satisfaction of passengers with the services provided by the national railway carrier of the Slovak Republic. We were able to verify the established hypotheses and determine their significance. The gender of respondents did not prove to be a significant factor, however, the individual factors proved to be statistically significant. The prevalence of respondents from the younger age group and thus the heavy focus on one market segment proved to be a significant limitation of the research. Another limitation of the research was its focus on only one market, on the basis of which we are not yet able to generalize the results outside the given geographical area, only to use them as a basis for the formulation of future research plans. This research is therefore a partial source of findings in the context of a broader perspective of the research plan dealing with the issue. However, these limitations open up the possibilities of future research, where these aspects could be consolidated. The further research could include respondents from several markets and with a wider sample age interval. Another level of future research is its extension to other factors that were not part of this research, as well as a partial examination of these factors separately and more in depth. An interesting view is also possible factors comparisons between countries.

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**Ludovit NASTISIN** is the associate professor at University of Prešov, Faculty of Management and Business within the Department of marketing and international trade. Research interests: Marketing, Branding, Customer Loyalty, Social Media, Online Reputation, Destination Marketing.

**ORCID ID:** <https://orcid.org/0000-0002-4403-7580>

**Beata GAVUROVA** is an expert in finance, financial analysis and financial risk management. She focuses in her research work on issues of measurement and performance management in various sectors, process management and process optimization, strategic and performance benchmarking. Her dominant research area is the development and testing in the management and performance measurement, the evaluation of methodologies and the preparation of an application platform for innovative management and performance measurement with the support of ICT. She led several national projects, has participated in many international projects targeting the innovative applications of ICT in the private and public sector.

**ORCID ID:** <https://orcid.org/0000-0002-0606-879X>

**Radovan BACIK** is the associate professor at University of Prešov, Faculty of Management and Business within the Department of marketing and international trade. Research interests: Public Relations, e-Commerce, Online Marketing, Branding, Management.

**ORCID ID:** <https://orcid.org/0000-0002-5780-3838>

**Ivan KOPOR** is an external PhD student at University of Prešov, Faculty of Management and Business within the Department of marketing and international trade. Research interests: Online Marketing, e-Commerce and Branding

**Stefan KRAL** is an internal PhD student at University of Prešov, Faculty of Management and Business within the Department of marketing and international trade. Research interests: e-Commerce and Online Marketing.

**ORCID ID:** <https://orcid.org/0000-0002-5780-3838>

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## THE INFLUENCE OF WORLD OIL PRICES ON THE CHINESE YUAN EXCHANGE RATE

Jaromír Vrbka <sup>1</sup>, Jakub Horák <sup>2</sup>, Tomáš Krulický <sup>3</sup>

<sup>1,2,3</sup> School of Valuation and Expertness, Institute of Technology and Business in České Budějovice, Okružní 517/10, České Budějovice 37001, Czech Republic

E-mails: <sup>1</sup> [vrbka@email.cz](mailto:vrbka@email.cz); <sup>2</sup> [horak@email.cz](mailto:horak@email.cz); <sup>3</sup> [krulicky@email.cz](mailto:krulicky@email.cz)

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**Abstract.** This article aims to find out if and if any influence the evolution of oil price on the world market influences the value of the Chinese currency. Data, which we used for analysis, is available on the World Bank website. The analysis uses data about the Chinese Yuan (CNY) to the US Dollar (USD). The second series of data is the Brent crude oil price expressed in US Dollars per barrel. The time interval for which data will be available is the daily closing value of both variables, beginning on September 1, 2014, and ending on August 30, 2019. To accomplish our research aim, we must conduct an experiment. Therefore, the experiment assumes a uniform procedure with a gradual change of one parameter, namely the delay of the CNY / USD time series. Regression is performed using neural structures. We generate 10,000 neural networks for every single experiment combination (time delay, set of independent variables). As a result, we perform 10 calculations and get ten different outputs. From each experiment, we always preserve 5 artificial neural networks that show the best aspects. It could be estimated that fluctuations in oil prices on world markets would affect the CNY / USD price; however, it was not clear to what extent. Based on this paper, we demonstrate that such influence exists; it can be identified at an interval of 1.97% to 9.57%. This is a very significant influence, even regarding the importance of the raw material.

**Keywords:** world oil price; Chinese Yuan; exchange rate; artificial neural networks; price development, time series

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**JEL Classifications:** C22, C45, F31

**Additional disciplines:** political sciences; energetics and thermoenergetics; informatics

### 1. Introduction

The influence of oil price on the Chinese Yuan has received a great pact of consideration in recent years. Decades ago, empirical research showed noxious relationship between oil price shocks and gross domestic product. However, recent studies stated a diverse relation between oil price shocks and macroeconomy depending on the economic status of a country (Iwayemi, Eowowe 2011).

Important role represents world oil price directly or indirectly influencing the Exchange rate (Vochozka et al. 2020). The effect can be either negative or positive. Although China produces oil, the country is dependent heavily on imported oil because the demand of the commodity is higher than domestic production (Strakova, Kalinova 2020).

The researcher investigates the influence of world oil prices on the Chinese Yuan Exchange rate, and reviewed literatures mainly from web of science that are related to the topic.

## 2. Literature review

Every country has differences in earning which are cohered to different macroeconomic and microeconomic determinants (Valaskova, 2021). Time series predictions can be used for exchange rate analysis (Machova, Marecek, 2019). Based on the analysis, it is clear that the public sector and the national economy are appreciable importance (Rousek, 2020; Halaskova et al., 2021). In addition, according to Ginevicius (2020) and Kocisova et al. (2018) economic development represents for countries own competitiveness influenced by various factors. The importance of the macro- and microeconomic determinants working together we see in the major economies across the world. According to Valaskova (2021) paper factors such as behaviour of managers, comparing the influence of similar factors across countries detect the critical intentions management of earnings. Their own companies, and others, which are based there, influence every country. Liquidity and quality of reported earnings are significantly emphasised on companies due to macroeconomic conditions (Durana, 2021; Onuferova, Cabinova 2018; Belas et al. 2018). In addition, according to Kharroubi (2021) and Krajčák (2022) rapid developments in science and technology are essential ingredients of globalization, which provides diverse workforce a reality in present day organization. Market development is influenced in individual economic cycles with the support of state and government decisions (Valaskova et al., 2021; Filipova et al., 2016; Dvorsky et al., 2021). For the survival of organizations in the global market is the adoption of a global approach (Kharroubi et al., 2021; Gavurova, 2012; Fedorko et al. 2018; Masood et al., 2019). Despite optimistic forecasts for 2021 (5% for global economic growth) according to World Economic Situation and Prospects by United Nations (2021) predicts only 4,7% global economic growth, which will primarily offset the losses incurred in 2020 (Durana et al., 2021).

In mid-2014, the crude oil price began to decrease considerably, and this sharp fall in the crude oil price had an appreciable impact on the world economy and international trade. In mid-2014, world oil prices experienced a sharp decrease, which had a very great impact on global trade (Smelc, 2020). According to Sultonov (2017), consequential results exhibited relevant changes in dynamic conditional correlation and causality relationship among commodity and foreign exchange markets during the period of the crude oil price decrease.

China dominates the largest world markets (Krulicky, Brabenec, 2020). The changing oil prices as of late has arose simultaneously with a quick extension of Chinese export. The stock market of China shows an earlier instability in the series of prices (Dias et al., 2020a; Dias et al., 2020b). China and Indonesia form the bottom of the ranking in diversity and inclusion, where they show the development of an economy with a wide range of workforces (Kharroub, 2021) countries at the bottom of diversity and inclusion rankings include China and Indonesia, have large emerging economies with a substantial local labour supply. The outcomes Suggest a steady relationship and yields somewhat positive qualities at the cost of oil and variable coefficients for cost intensity, alongside the normal negative flexibility for the genuine conversion scale (Faria et al., 2009).

Apart from the United States, oil trading is influenced by a consolidated change in oil price and exchange rate. Especially, for the world's biggest oil importer, China (Machova, Marecek, 2020). Siyao et al. (2019) believed that any minor instabilities in oil price essentially affect China's oil importation, but in oil exporting countries like

Azerbaijan and Kazakhstan whose economies depend on oil, the macroeconomic indicators like currency, GDP severely depend on the oil factor. Humbatoya and Hajiyew (2019) inferred that daily oil production and consumption have less effect on the formation of the world oil prices. In contrast to that, Rangasamy (2017) revealed that inflation is driven by a change in oil prices in South Africa. In addition, in Russia, an investigation of the Russian Ruble (RUB) and the US Dollar (USD) demonstrated that the USD/RUB exchange rate was influenced by the adjustments in oil price in the study-periods. The impact of oil cost on the USD/RUB conversion scale was more grounded after the 2008 world financial crisis. This affirms the speculation that the Russian Economy indicates manifestations of the Dutch Disease in 2008 as suggested by Bilan et al. (2018). Law (2018) found that in a case of large appreciation in oil price, there was a depreciation of exchange rate in Thailand. According to Valaskova (2021) political and financial conditions appear to be exceedingly important. Current macroeconomic conditions worsen the competitive position of companies and enlarge the compulsion on financial managers (Durana, 2021).

There is a unanimous agreement, that oil prices influence farming costs through exchange rate. Authorities should consider the importance of cross-sectional differences according to Valaskova (2021). A challenge in energy security in China can easily spillover to maintaining food security, alternatively putting pressure on the country's economy. Ma et al. (2015) demonstrated that farming costs are not fundamentally influenced by the sudden changes in oil prices. Reliably, farming costs are unbiased to changes in oil prices over the long haul. Considering the macro-level aspects, legal and regulatory systems help mitigate opportunistic managerial behaviour (Valaskova et al., 2021; Evteeva et al., 2019; Tende, Obumneke, 2014).

Brahmasrene et al. (2014) shared similar views and supported exchange rate shock has a substantial adverse effect on crude oil prices while the impulse response of the exchange rate variable to a crude oil price shock was statistically insignificant, the impact of extreme price volatility in June 2008 on exchange rates was substantial. Hasanov et al. (2017) accepted that world oil prices are deniably a major leading force behind exchange rate and suggested that productivity is another major player. Amano and Norden (1998) in 1998 were not certain in their findings. They pointed that oil prices may have been the dominant cause of obstinate exchange rate shocks because they found even relation between oil price shocks and the US currency exchange rate. (Das, Dutta 2019) shared similar view with (Baghestani, Toledo, 2019). They stated that oil price has a huge impact on both, exchange and interest rate. Huang and Feng (2007), after examining the scale to which oil price shock affect the Chinese RMB exchange rate, proposed that there was an insignificant appreciation of the future exchange rate. In addition, Milani (2008) alleged that the effect of oil price shocks is minimal as pronounced by agents. The research stated that oil prices affect the economy through a supplementary channel, which is the formation of agents' beliefs. Milani supported the claim with the implied responses of oil price fluctuations in the 1970s compared with 2008.

Over the years, whenever there is a change in commodity price information, the exchange rate of non-commodity currencies strongly influence price changes (Vochozka et al., 2021). While many researchers undoubtedly believe that oil prices occupy high position in the macroeconomic pursuits. Some other researchers do not believe the notion that oil price shocks influence macroeconomic activities. Barsky and Kilian (2004) alleged that a primary cause for the constant acceptance of the oil shock supposition was acuity that explained the US recession in the 1970s and since then the topic become popular to date. In general, oil prices represent a relevant position in global economic system. Escobedo and Madrigal (2013) investigated the dependence between oil and wheat prices. Using time series data, they concluded that there is both short-term and long-term relationship between the two commodities. Chen and Chen (2007) revealed that oil prices not only have been the dominant source of exchange rate but can also have substantial predicting power of future exchange rates.

Since the financial crisis in 2007/2008, there has been an increase in uncertainty (Mulacova, 2012) and global oil prices are the most important determinant of currency exchange rates, and the Chinese Yuan is not an exception. A stable world oil price minimizes exchange rate fluctuations and uncertainty in the Chinese yuan. Fluctuation in oil prices as a significant energy asset influences all parts of the economy (Vochozka et al., 2020). Based on the literatures reviewed, the influence of world oil price on the Chinese Yuan exchange rate is significant and requires further investigation. From the literatures reviewed, it can be inferred that oil price and Exchange rate are correlated because it can be seen that a change in world oil price is accompanied by a season of fluctuations in Exchange rate value of currencies. This conclusion agrees with all researchers who believed a correlation between oil prices and exchange rate, particularly with Qiang et al. (2019) that concluded the impact level relies upon the overall level of every nation influenced by oil price.

The goal of the allowance is to find out whether and what impact the advancement of oil prices on the world market have on the value of Chinese currency.

### 3. Data and methods

The works of Chen and Chen (2007), Qiang et al. (2019) or Vochozka et al. (2020) clearly indicate the existence of correlation among the oil price based on data from world market and the value of CNY. However, the question is whether its influence is significant enough to be identified and measured. The detailed analysis of the main objective of the contribution results in two research questions:

1. Is there a relation among the oil price on the world market and the value of CNY?
2. Can such a relation be identified and measured?

For the analysis, we used data, which are available on the World Bank websites. For the analysis, the information about CNY and USD exchange rate. The second time series will be represented by Brent oil price in USD per barrel. The use of USD value for calculating the price of CNY and oil eliminates the shift that could occur by the fluctuation of USD value. These data are also available on the website of World Bank. The time interval for which the data are available is the daily closing value of both variables starting from 1 September 2014 until 30 August 2019. The descriptive data characteristics are given in Table 1.

**Table 1.** Data set characteristics

Samples	Brent in USD/barrel Input variable	CNY/USD Output variable (target)
Minimum (Training)	27.8800	0.139600
Maximum (Training)	102.7900	0.163600
Average (Training)	58.5614	0.152175
Standard deviation (Training)	12.9949	0.006092
Minimum (Testing)	30.5000	0.139800
Maximum (Testing)	100.2000	0.163600
Average (Testing)	61.7022	0.152119
Standard deviation (Testing)	12.2878	0.006461
Minimum (Validation)	31.5500	0.139600
Maximum (Validation)	102.7700	0.163600
Average (Validation)	59.8710	0.152370
Standard deviation (Validation)	18.2674	0.009356
Minimum (Overall)	27.8800	0.139600
Maximum (Overall)	102.7900	0.163600
Average (Overall)	59.2272	0.152196



Standard deviation (Overall)	13.1782	0.006168
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Source: Authors

Figure 1 shows a graphical representation of chosen statistical characteristics of the CNY/USD exchange rate development including the histogram of the entry data.

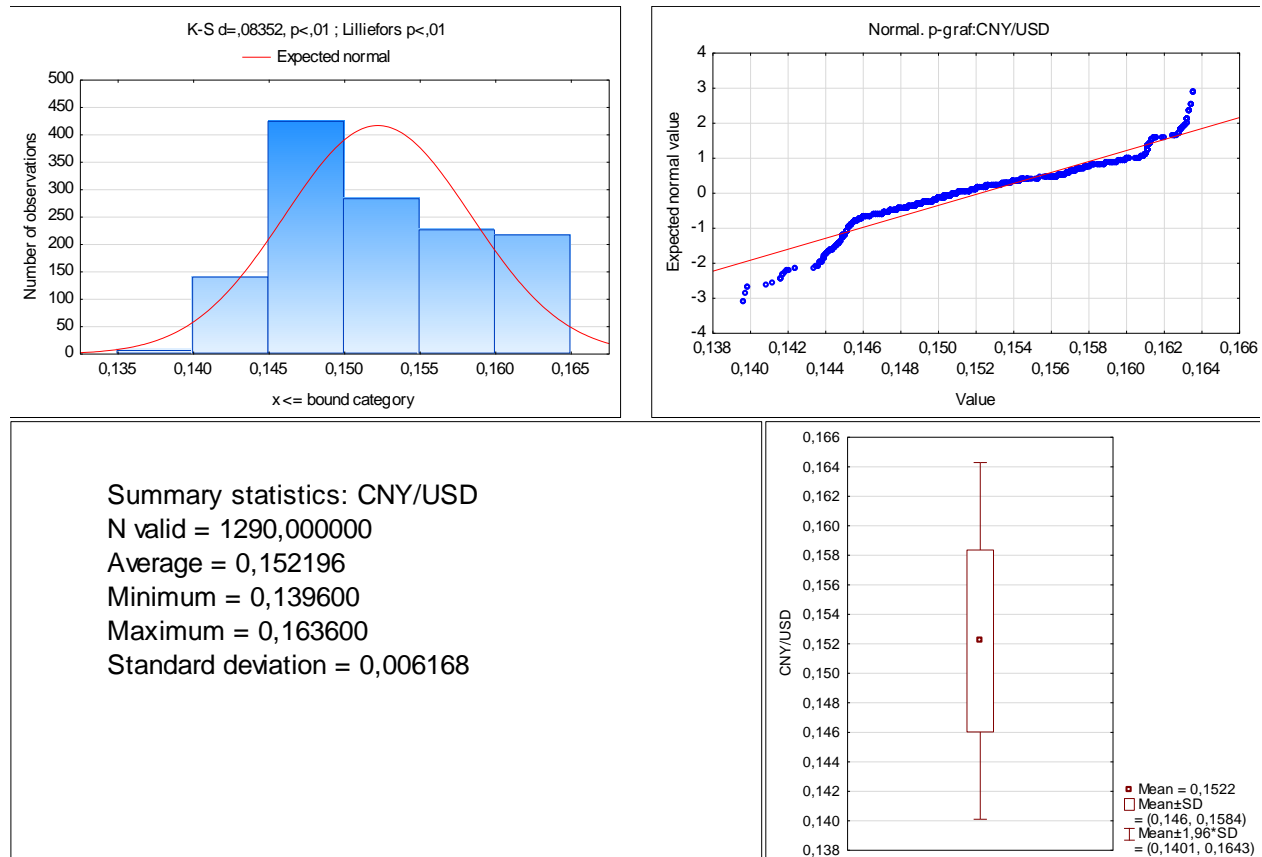


Figure 1. Graph of basic statistical characteristics of CNY/USD

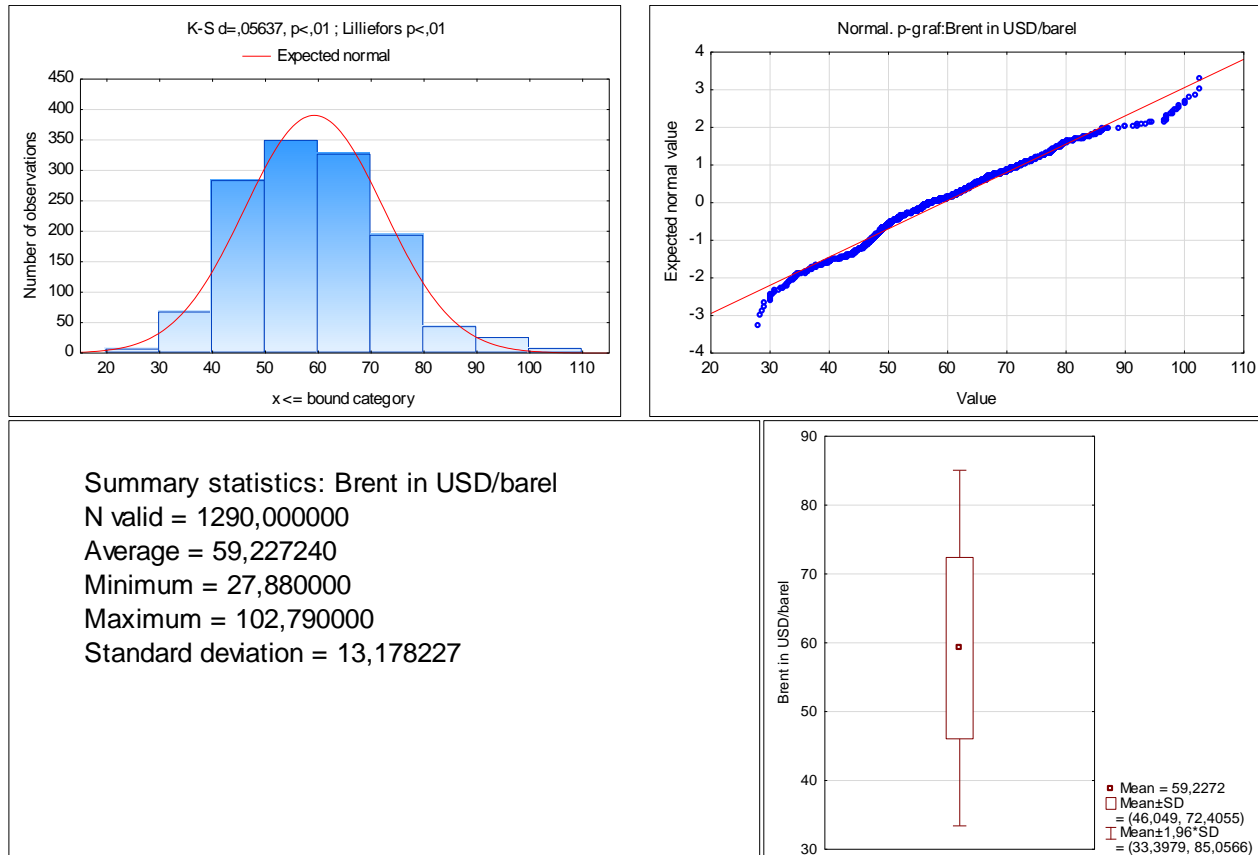
Source: Authors.

Figure 2 shows the same characteristics as the first for the second time series, i. e. Brent oil prices in USD per barrel.

An interesting fact is that unlike the Brent in USD/barrel, the CNY/USD histogram does correspond to standard distribution. For data processing, DELL's Statistica software, will be used version 12.

For better understanding the course of both inspected time series, Figure 3 is included, demonstrating in one combined graph the course of both time series. The blue line represents the course of CNY/USD, while the red one represents Brent in USD/barrel. Axis X represents time. Due to the software used, it is necessary to explain that this is time on days when the software marks 1 January 1900 as the beginning of the axis. This means that the first day of the monitored period, that is, 1 September 2014 is the 41,883rd day from the beginning of the defined

time axis. On the left side of the axis, the value of CNY/USD is marked, while the left side shows the price of Brent in USD/barrel. It may appear at first sight that there is a certain match in the course of both time series, although the lag is not steady but changes over time. An interesting period is between the 4,268th and the 42,900th day, when the course of the data is inverse to the previous period.



**Figure 2.** Graph of basic statistical characteristics for Brent oil price per barrel

Source: Authors

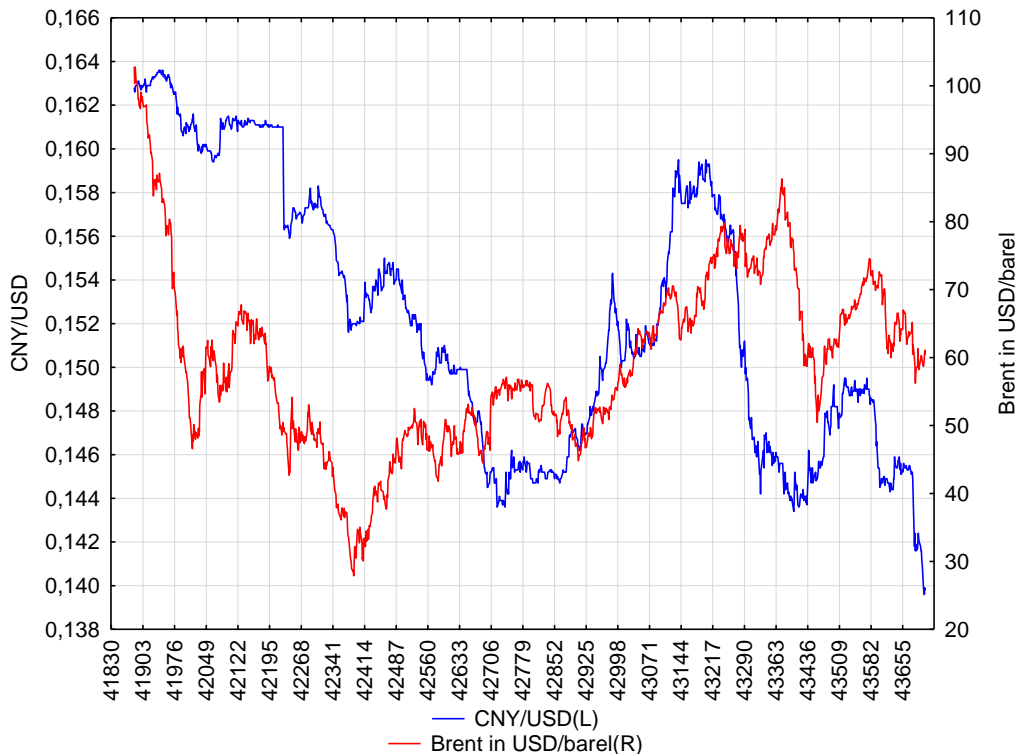
It is important to be aware of the fact that even if there is a relation among Brent in in USD/barrel and CNY/USD, it does not have to be identifiable immediately. It can happen that the changes in the world oil price will affect the value of CNY only after a few days. To achieve the objective of this research, an experiment has to be carried out.

The time lag can only be determined heuristically. Therefore, the experiment will assume a unified procedure with a gradual change of one parameter – time lag of the time series CNY/USD. The assumptions will be as follows:

1. The change in CNY/USD will show on the same day. In such a case, CNY/USD would not react to the price of Brent in USD/barrel but to the causes leading to the change of price of Brent in USD/barrel.
2. The change in CNY/USD will show one day after the adjustment in the price of Brent in USD/barrel.
3. The change in CNY/USD will show 5 days after the adjustment in the price of Brent in USD/barrel.

4. The change in CNY/USD will show 10 days after the adjustment in the price of Brent in USD/barrel.
5. The change in CNY/USD will show 30 days after the adjustment in the price of Brent in USD/barrel.

Since we do not investigate the time lag after each day, the real time lag is a risk which will also be estimated in the result. Despite this risk, the estimation will be close to reality. Moreover, the time lag does not occur constantly during the monitored period. In such a case, it would not be realistic to obtain an accurately result. However, this accuracy is not the objective of this contribution.



**Figure 3.** Development of CNY/USD and Brent in USD/barrel

*Source:* Authors.

It is important to be aware of the fact that even if there is a relation among Brent in in USD/barrel and CNY/USD, it does not have to be identifiable immediately. It can happen that the changes in the world oil price will affect the value of CNY only after a few days. To achieve the objective of this research, an experiment has to be carried out.

The time lag can only be determined heuristically. Therefore, the experiment will assume a unified procedure with a gradual change of one parameter – time lag of the time series CNY/USD. The assumptions will be as follows:

6. The change in CNY/USD will show on the same day. In such a case, CNY/USD would not react to the price of Brent in USD/barrel but to the causes leading to the change of price of Brent in USD/barrel.
7. The change in CNY/USD will show one day after the adjustment in the price of Brent in USD/barrel.
8. The change in CNY/USD will show 5 days after the adjustment in the price of Brent in USD/barrel.
9. The change in CNY/USD will show 10 days after the adjustment in the price of Brent in USD/barrel.

10. The change in CNY/USD will show 30 days after the adjustment in the price of Brent in USD/barrel. Since we do not investigate the time lag after each day, the real time lag is a risk which will also be estimated in the result. Despite this risk, the estimation will be close to reality. Moreover, the time lag does not occur constantly during the monitored period. In such a case, it would not be realistic to obtain an accurately result. However, this accuracy is not the objective of this contribution.

Regression will be performed by using neural structures in the Statistica software. We will generate multilayer perceptron networks (ML) and radial basis function networks (RBF). The dependent variable will be CNY/USD. The experiment will assume two sets of independent variables:

1. Brent in USD/barrel (continuous variable): in this case, we will only measure the relationship of the two variables with a preordained time lag. This will provide an answer to the research question 1: if there is a relation between the oil price in the world market and the value of CNY.
2. Brent in USD/barrel and date (continuous variable): in this case, if the answer to the first research question is yes, the influence of Brent in USD/barrel on CNY will be measured. This will provide the respond to the research question 2.

The time series will be randomly divided into three datasets – Training, Testing, and Validation. The first set will contain 70% of the input data. Based on the Training dataset and neural structures will be generated. The remaining two datasets will each consist 15% of the input information. Both sets will be used for the verification of the identified neural structure trustworthiness. A total of 10,000 neural networks will be generated for each experiment (time lag, set of independent variables). As a result of 10 calculations carried out, ten various outcomes will be obtained. From each experiment, 5 artificial neural networks with the best characteristics\* will be preserved. The first results shall provide the answers to the research question 1, while the other set of outputs shall provide the answers to the research question 2. It may appear logical to carry out all five experiments in the defined time lag, and then to carry out only the calculation for the identified most precise time lag in the case of the second test of independent variables. If the results are correct, the assumption will prove to be right. Therefore, it is recommended to carry out the calculations for all defined time lags also in the case of the second set of independent variables. If the same time lag is identified as the most precise one in both different sets of independent variables, the result, as well as the methodology and assumption, will be validated.

The MLP hidden layers will contain 2–8 neurons in the case of first set of independent variables, and 3–9 neurons in the case of the second set. In the case of radial basis function, the hidden layer will always consist of the minimum of 21 neurons and the maximum of 30 neurons. For the multilayer perceptron network, the following distribution function will be considered in the output and hidden layers:

- Linear,
- Logistic,
- Atanh,
- Exponential,
- Sinus.

Other settings will remain default (according to the ANN tool – automated neural networks). If necessary, the weights of the individual neurons will be reiterated using the ONN tool (own neural networks). However, it shall be stated that the improvement of ANN using this tool is a coincidence rather than an exact process with a well-predictable outcome.

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\* We will use the method of least squares. The generation of networks will be terminated if there is no improvement, i. e. if there is no decrease in the sum of the squares. We will thus keep the neural structures whose sum of residual squares to the actual development of CNY/USD will be as low as possible (zero in ideal case).

Finally, the results of both groups of retained neural networks will be compared.

### 3. Results

#### *Dependence of CNY/USD on Brent in USD/barrel*

Based on the procedure specified above, a total of 10,000 neural networks were generated for each predefined time lag. Out of these networks, 5 with the best parameters were preserved. Table 2 appears the overview for the data without time lag.

**Table 2.** Overview of retained neural networks in experiment without time lag considered

Network	Training perf.	Test. perf.	Valid. perf.	Training error	Testing error	Validation error	Training algorithm	Error function	Activation of hidden layer	Output activation function
RBF 1-24-1	0.412751	0.372668	0.511868	0.000015	0.000018	0.000014	RBFT	Sum of squares	Gaussian	Identity
RBF 1-29-1	0.402858	0.411735	0.501684	0.000016	0.000017	0.000015	RBFT	Sum of squares	Gaussian	Identity
RBF 1-27-1	0.421069	0.363556	0.501947	0.000015	0.000018	0.000015	RBFT	Sum of squares	Gaussian	Identity
RBF 1-29-1	0.416481	0.331440	0.505133	0.000015	0.000019	0.000015	RBFT	Sum of squares	Gaussian	Identity
RBF 1-25-1	0.403294	0.314854	0.501389	0.000016	0.000019	0.000015	RBFT	Sum of squares	Gaussian	Identity

Source: Authors.

There are only RBF networks. The input layer contains only one variable – Brent in USD/barrel (continuous variable). This is represented by one neuron in the input layer. In the hidden layer the neural networks contain between 24 and 29 neurons. The output layer contains logically one neuron and one output variable – CNY/USD. For all networks, RBFT training algorithm was applied. For the activation of the neurons in the hidden layer, Gaussian curve was used, while the neurons of the output layer were activated using the Identity function (for further details, see Table 2). All retained neural networks used method of least squares as an error function. The performance is given by the correlation coefficient, which achieves the values between more than 0.37 and more than 0.51 across the retained neural networks.

Table 3 shows retained neural networks for 1-day time lag.

**Table 3.** Overview of retained neural networks for the experiment with 1-day lag

Network	Training perf.	Test. perf.	Valid. perf.	Training error	Testing error	Validation error	Training algorithm	Error function	Activation of hidden layer	Output activation layer
RBF 1-25-1	0.367709	0.265241	0.423495	0.000016	0.000019	0.000017	RBFT	Sum of squares	Gaussian	Identity
RBF 1-27-1	0.412785	0.344563	0.432329	0.000015	0.000018	0.000017	RBFT	Sum of squares	Gaussian	Identity
RBF 1-25-1	0.434149	0.292056	0.427362	0.000015	0.000019	0.000017	RBFT	Sum of squares	Gaussian	Identity
RBF 1-30-1	0.448699	0.321214	0.421693	0.000015	0.000018	0.000017	RBFT	Sum of squares	Gaussian	Identity
RBF 1-26-1	0.411882	0.336311	0.431904	0.000015	0.000018	0.000017	RBFT	Sum of squares	Gaussian	Identity

Source: Authors.

The table shows that the networks retained are only the RBF networks. In the hidden layer the neural networks contain 25–30 neurons. The output layer logically includes one neuron and one output variable – CNY/USD. For all networks, RBFT training algorithm was applied. The neural structures used Gaussian curve for the activation of the hidden layer of neurons. Identity feature has been applied to activate the output layer. As an error function, the sum of the least squares was used by all maintained neural structures. The performance is given by the correlation coefficient, which achieves the values between more than 0.26 and more than 0.44 across the retained neural networks and the datasets.

Table 4 shows the retained neural networks for 5-day time lag.

**Table 4.** Overview of retained neural networks for experiment with 5-day lag

Network	Training perf.	Test. perf.	Valid. perf.	Training error	Testing error	Validation error	Training algorithm	Error function	Activation of hidden layer	Output activation function
RBF 1-28-1	0.359699	0.428676	0.462018	0.000016	0.000018	0.000017	RBFT	Sum of squares	Gaussian	Identity
RBF 1-21-1	0.375812	0.449748	0.483160	0.000015	0.000018	0.000016	RBFT	Sum of squares	Gaussian	Identity
RBF 1-23-1	0.383388	0.387543	0.459824	0.000015	0.000019	0.000017	RBFT	Sum of squares	Gaussian	Identity
RBF 1-25-1	0.369094	0.448173	0.468541	0.000015	0.000018	0.000016	RBFT	Sum of squares	Gaussian	Identity
RBF 1-21-1	0.344893	0.422891	0.459610	0.000016	0.000018	0.000017	RBFT	Sum of squares	Gaussian	Identity

Source: Authors.

Even in this case, the RBF networks show the main characteristics. In the hidden layer the neural networks include 21–28 neurons. RBFT training algorithm was applied for all networks. The neural structures used Gaussian curve for the activation of the hidden layer of neurons. For the activation of the output layer, the Identity function was used. All retained neural structures used the sum of least squares as an error function. The values of the correlation coefficient are between nearly 0.36 and more than 0.48 across neural networks and datasets and thus its performance is determined.

Table 5 shows the retained neural networks for the data with 10-day lag.

**Table 5.** Overview of retained neural networks for experiment with 10-day lag

Network	Training perf.	Test. perf.	Valid. perf.	Training error	Testing error	Validation error	Training algorithm	Error function	Activation of hidden layer	Output activation function
RBF 1-23-1	0.422277	0.289404	0.411383	0.000015	0.000018	0.000017	RBFT	Sum of squares	Gaussian	Identity
RBF 1-22-1	0.449527	0.335184	0.421136	0.000015	0.000018	0.000017	RBFT	Sum of squares	Gaussian	Identity
RBF 1-25-1	0.446497	0.281631	0.413589	0.000015	0.000018	0.000017	RBFT	Sum of squares	Gaussian	Identity
RBF 1-28-1	0.450363	0.285487	0.417970	0.000014	0.000018	0.000017	RBFT	Sum of squares	Gaussian	Identity
RBF 1-21-1	0.412808	0.271661	0.417731	0.000015	0.000018	0.000017	RBFT	Sum of squares	Gaussian	Identity

Source: Authors



In addition, in this case, only the RBF networks showed the best characteristics. The neural networks contain between 21 and 28 neurons in the hidden layer. The output layer logically contains only one neuron and one output variable, i. e. CNY/USD. For all networks, was applied RBFT training algorithm. The neural structures used Gaussian curve for the activation of the hidden layer of neurons. For the activation of the output layer, was used the Identity function. All retained neural structures used the sum of least squares as an error function. The performance is given by the correlation coefficient achieving the values of between more than 0.28 and more than 0.45 across the preserved neural networks and datasets.

Table 6 contains the retained networks for the first set of variables with a 30-day lag.

**Table 6.** Overview of retained neural networks for experiment with 30-day lag

Network	Training perf.	Test. perf.	Valid. perf.	Training error	Testing error	Validation error	Training algorithm	Error function	Activation of hidden layer	Output activation function
RBF 1-29-1	0,504936	0,417204	0,469858	0,000013	0,000015	0,000015	RBFT	Sum of squares	Gaussian	Identity
RBF 1-25-1	0,492835	0,402539	0,467906	0,000013	0,000016	0,000015	RBFT	Sum of squares	Gaussian	Identity
RBF 1-28-1	0,491749	0,426946	0,474171	0,000013	0,000015	0,000015	RBFT	Sum of squares	Gaussian	Identity
RBF 1-24-1	0,503934	0,421252	0,477249	0,000013	0,000015	0,000015	RBFT	Sum of squares	Gaussian	Identity
RBF 1-27-1	0,515606	0,481461	0,468058	0,000013	0,000014	0,000015	RBFT	Sum of squares	Gaussian	Identity

*Source:* Authors

The table shows that there are only RBF networks. In the hidden layer, the neural networks contain 24–29 neurons. For all networks, was applied RBFT training algorithm. Neural structures used Gaussian curve for the activation of the hidden layer of neurons, while for the activation of the output layer, was used the Identity function. All retained neural structures used the sum of least squares as an error. The performance is appeared by the correlation coefficient achieving the values of between above 0.40 and above 0.51 across all the retained neural networks and datasets.

The best results are shown by the neural networks with the highest performance (= with the highest correlation coefficient), which, in ideal case, is identical in the training, testing, and validation datasets, and with the smallest error. All maintained neural networks are affected by minimal error. The highest performance in all datasets is achieved in two cases – without any time lag and with a 30-day lag, or the differences between them are minimal, with slightly better results achieved in the case of the networks representing a 30-day lag. This could be explained by the fact that the time lag is probably between 0 and 30 days. At the same time, it can be stated that the time lag does not have to be constant within the interval. More detailed characteristics of the maintained neural networks for the dataset with a 30-day lag are given in the text below.

Table 7 shows the performance of the individual data sets by specific neural networks.

**Table 7.** Correlation coefficients of individual datasets

Network	CNY/USD Training	CNY/USD Testing	CNY/USD Validation
1.RBF 1-29-1	0.504936	0.417204	0.469858
2.RBF 1-25-1	0.492835	0.402539	0.467906
3.RBF 1-28-1	0.491749	0.426946	0.474171
4.RBF 1-24-1	0.503934	0.421252	0.477249
5.RBF 1-27-1	0.515606	0.481461	0.468058

Source: Authors

It results from the table that the performance of all retained neural structures is approximately the same. Minor differences do not have a significant impact on the performance of the individual networks. The value of the correlation coefficient in all training datasets is at the interval of more than 0.49 to more than 0.51. The correlation coefficient of the testing datasets achieves the values of between above 0.40 and above 0.48 for all neural networks. The correlation coefficient of the validation datasets of all neural networks is about 0.47. To choose the most appropriate neural structure, a more detailed analysis of the results acquired must be carried out. Table 8 shows the basic statistical characteristics of the individual datasets for all neural structures.

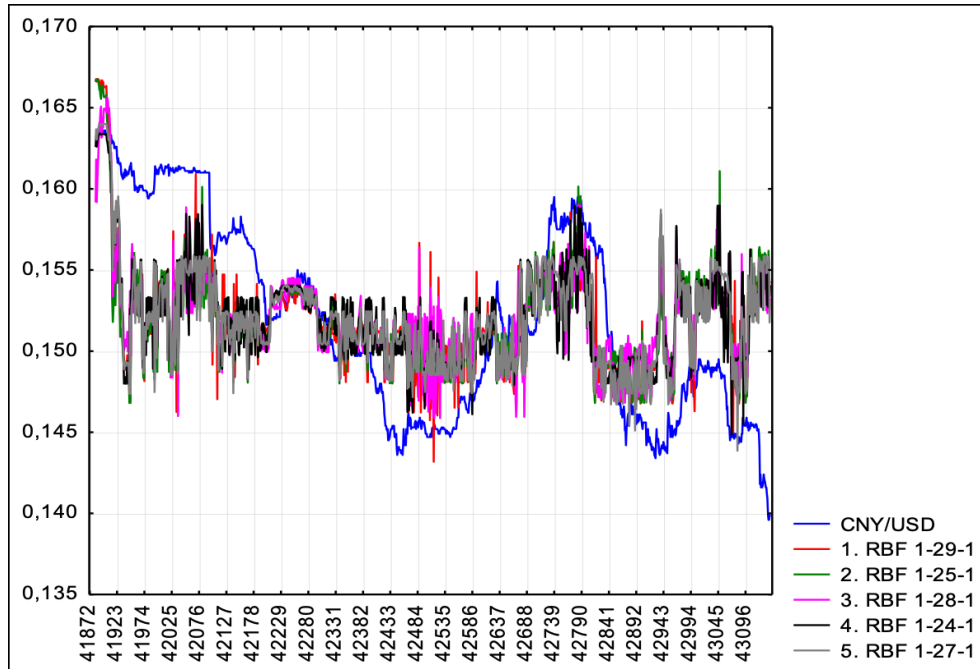
**Table 8.** Statistics of individual datasets by retained neural structures

Statistics	1.RBF 1-29-1	2.RBF 1-25-1	3.RBF 1-28-1	4.RBF 1-24-1	5.RBF 1-27-1
Minimal prediction (Training)	0.14318	0.14680	0.14586	0.14487	0.14386
Maximal prediction (Training)	0.16677	0.16676	0.16564	0.16341	0.16400
Minimal prediction (Testing)	0.14683	0.14680	0.14594	0.14620	0.14510
Maximal prediction (Testing)	0.16676	0.16675	0.16496	0.16336	0.16400
Minimal prediction (Validation)	0.14625	0.14683	0.14599	0.14798	0.14671
Maximal prediction (Validation)	0.16669	0.16676	0.16534	0.16341	0.16400
Minimal residuals (Training)	-0.01463	-0.01658	-0.01601	-0.01592	-0.01620
Maximal residuals (Training)	0.01449	0.01460	0.01280	0.01310	0.01403
Minimal residuals (Testing)	-0.01449	-0.01406	-0.01344	-0.01425	-0.01405
Maximal residua (Testing)	0.01227	0.01228	0.01082	0.01312	0.01202
Minimal residuals (Validation)	-0.01255	-0.01428	-0.01317	-0.01454	-0.01483
Maximal residuals (Validation)	0.01485	0.01246	0.01521	0.01308	0.01258
Minimal standard residua (Training)	-4.01689	-4.51769	-4.35931	-4.36985	-4.48091
Maximal standard residuals (Training)	3.97793	3.97692	3.48442	3.59497	3.88114
Minimal standard residuals (Testing)	-3.68314	-3.54739	-3.44145	-3.62991	-3.71718
Maximal standard residuals (Testing)	3.11746	3.09997	2.76965	3.34226	3.17966
Minimal standard residuals (Validation)	-3.25771	-3.70885	-3.44086	-3.80729	-3.84626
Maximal standard residuals (Validation)	3.85619	3.23586	3.97297	3.42616	3.26253

Source: Authors.

The individual characteristics of the neural networks should be horizontally the same (minimum, maximum, residuals, etc.) in ideal case. In the case of equal values, the differences are minimal. Basically, minimal differences are also in the case of residuals characteristics. However, we are not able to specify which of the retained neural networks show the best results. Figure 4 shows a line graph that indicates the actual development of CNY/USD in dependence on Brent in USD/barrel, and the regression curve by individual retained time series.

The graph clearly shows that all retained neural networks can forecast the basic development trend of CNY/USD but are not able to make a reliable prediction of local minimum and maximum.



**Figure 4.** Line graph – development of CNY/USD in dependence on Brent in USD/barrel in the monitored period

Source: Authors.

It can thus be summarized those better results (only slightly) are achieved by the neural networks created with a 30-day lag. However, it cannot be specified which of these networks is able to describe the CNY/USD and Brent in USD/barrel relationship best. This can be since the obvious time lag is not steady in the monitored period. The result is thus not conclusive.

### ***Dependence of CNY/USD on Brent in USD/barrel***

Another set of results was generated based on the procedure specified above. In this case, the independent variables are Brent in USD/barrel and time in the form of a date. In each case, these are 5 most successful networks retained from the original 10,000 generated neural networks. Table 9 shows the survey of neural networks without any time lag.

**Table 9.** Overview of retained neural networks without time lag

Network	Training perf.	Test. perf.	Valid. perf.	Training error	Testing error	Validation error	Training algorithm	Error function	Activation of hidden layer	Output activation function
MLP 2-9-1	0.991104	0.992567	0.988662	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 600	Sum of squares	Logistic	Exponential
MLP 2-9-1	0.989826	0.991889	0.988722	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 579	Sum of squares	Logistic	Tanh
MLP 2-8-1	0.990183	0.991887	0.988570	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 252	Sum of squares	Logistic	Identity
MLP 2-9-1	0.989606	0.991624	0.988597	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 313	Sum of squares	Logistic	Sinus
MLP 2-7-1	0.989353	0.991952	0.988617	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 531	Sum of squares	Logistic	Logistic

*Source:* Authors.

The best results were achieved by the MLP networks. The input layer contains two variables. In the hidden layer the neural networks contain 7–9 neurons. The output layer contains only one neuron and one output variable – CNY/USD. For all networks, BFGS training algorithm was applied, a different variant in each case. The neural networks used the logistic function for the activation of the hidden layer of neurons, while for the activation of the output layer, the exponential, hyperbolic tangent, Identity, and Sinus functions were used (for more details, see Table 9). All maintained neural networks used the sum of least squares as an error function.

Table 10 shows the retained neural networks with 1-day lag.

**Tabulka 10.** Overview of retained neural networks with 1-day lag

Network	Training perf.	Test. perf.	Valid. perf.	Training error	Testing error	Validation error	Training algorithm	Error function	Activation of hidden layer	Output activation function
MLP 2-8-1	0.990150	0.991327	0.990797	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 451	Sum of squares	Logistic	Logistic
MLP 2-9-1	0.989899	0.991714	0.990755	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 407	Sum of squares	Logistic	Identity
MLP 2-9-1	0.990384	0.992272	0.990605	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 247	Sum of squares	Logistic	Logistic
MLP 2-8-1	0.989811	0.990394	0.990614	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 296	Sum of squares	Tanh	Logistic
MLP 2-9-1	0.990456	0.992254	0.991117	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 198	Sum of squares	Logistic	Tanh

*Source:* Authors

The best characteristics were shown by the MLP networks. The input layer contains two variables. The neural networks contain between 8 and 9 neurons in the hidden layer. For all networks, the Quasi-Newton training algorithm (BFGS) was applied, a different variant for each case. The neural networks used the logistic function and the function of the hyperbolic tangent for the activation of the hidden layer, while for the activation of the output layer, logistic, Identity and hyperbolic tangent were used. As an error function, the sum of least squares was used for all retained neural networks.

The overview of retained neural networks for a 5-day lag is shown in Table 11.

**Table 11.** Overview of retained neural networks with 5-day lag

Network	Training perf.	Test. perf.	Valid. perf.	Training error	Testing error	Validation error	Training algorithm	Error function	Activation of hidden layer	Output activation function
MLP 2-9-1	0.990174	0.992059	0.990862	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 365	Sum of squares	Tanh	Exponential
MLP 2-9-1	0.990077	0.992352	0.991139	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 455	Sum of squares	Tanh	Logistic
MLP 2-9-1	0.990033	0.992092	0.990955	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 513	Sum of squares	Tanh	Exponential
MLP 2-9-1	0.990486	0.992449	0.990874	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 587	Sum of squares	Tanh	Tanh
MLP 2-9-1	0.987757	0.991094	0.990796	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 309	Sum of squares	Tanh	Identity

Source: Authors

In this case, only the MLP networks showed the best characteristics. In the hidden layer of all neural networks contained 9 neurons. The output layer contains one neuron and one variable – CNY/USD. For all networks, Quasi-Newton training algorithm was applied (a different variant in each case). For the activation of the hidden layer, all neural structures used the function of hyperbolic tangent, while for the activation of the output layer, exponential, hyperbolic tangent, and Identity functions were used. As an error function, all retained neural structures used the sum of least squares.

Table 12 shows the retained neural networks for a 10-day lag.

**Table 12.** Overview of retained neural networks with 10-day lag

Network	Training perf.	Test. perf.	Valid. perf.	Training perf.	Testing error	Validation error	Training algorithm	Error function	Activation of hidden layer	Output activation function
MLP 2-9-1	0.991655	0.990138	0.991282	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 408	Sum of squares	Tanh	Logistic
MLP 2-8-1	0.991058	0.990685	0.991387	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 539	Sum of squares	Logistic	Logistic
MLP 2-9-1	0.990482	0.990920	0.991438	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 492	Sum of squares	Logistic	Logistic
MLP 2-8-1	0.990527	0.990200	0.990750	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 528	Sum of squares	Logistic	Identity
MLP 2-8-1	0.990662	0.990455	0.991091	0.000000	0.000000	0.000000	BFGS (Quasi-Newton) 287	Sum of squares	Tanh	Logistic

Source: Authors.

Only the MLP networks showed the best characteristics. The input layer contained two variables. In the hidden layer the neural networks contain 8–9 neurons, while the output layer contains only one neuron and one output variable – CNY/USD. For all networks, was applied the Quasi-Newton training algorithm (BFGS, a different variant for each case). The neural structures used the function of hyperbolic tangent and the logistic function for the activation of the hidden layer, while for the activation of the output layer, logistic and Identity functions were used (for more details, see Table 12). As an error function, all maintained neural structures used the sum of the least squares.

The last calculation was carried out for the time lag of 30 days (for more details, see Table 13).

**Table 13.** Overview of retained neural networks with 30-day lag

Network	Training perf.	Test. perf.	Valid. perf.	Training error	Testing error	Validation error	Training algorithm	Error function	Activation of hidden layer	Activation of the output layer
MLP 2-8-1	0,988006	0,988878	0,990756	0,000000	0,000000	0,000000	BFGS (Quasi-Newton) 443	Sum of squares	Tanh	Logistic
MLP 2-8-1	0,989739	0,990934	0,991442	0,000000	0,000000	0,000000	BFGS (Quasi-Newton) 394	Sum of squares	Logistic	Logistic
MLP 2-8-1	0,989014	0,989250	0,990487	0,000000	0,000000	0,000000	BFGS (Quasi-Newton) 586	Sum of squares	Tanh	Logistic
MLP 2-8-1	0,986828	0,988465	0,990590	0,000000	0,000000	0,000000	BFGS (Quasi-Newton) 385	Sum of squares	Logistic	Tanh
MLP 2-9-1	0,988719	0,989029	0,990966	0,000000	0,000000	0,000000	BFGS (Quasi-Newton) 825	Sum of squares	Logistic	Identity

Source: Authors.

The best characteristics were shown by the MLP networks. The input layer contains two variables. In the hidden layer the neural networks contain 8–9 neurons. For all networks, BFGS training algorithm was applied (a different variant in each case). The neural structures used the function of hyperbolic tangent and logistic function for the activation of the hidden layer, while for the activation of the output layer, the logistic, were used Identity and hyperbolic tangent functions. All retained neural networks used the sum of least squares as an error function.

In the case of the second set of results of the second variant of the experiment (that is, when considering the influence of time and Brent in USD/barrel), the results are significantly more positive. The performance of all retained networks is always above 0.98 in terms of the correlation, which indicates almost direct dependence. The involvement of the time factor brought a new dimension, and it can thus be inferred that the development of CNY/USD can be estimated and forecast very well. However, the question is what the influence of Brent in USD/barrel on CNY/USD is. When comparing the results by the time lag, it can be determined that the best characteristics show the retained networks with a 10-day lag. In the text below, we will thus focus on this set of retained neural networks.

The values of the correlation coefficients indicating the performance of the individual retained networks for a 10-day lag and the datasets of each day network data by specific neural networks are shown in Table 14.

**Table 14.** Correlation coefficients of individual datasets

Network	CNY/USD Training	CNY/USD Testing	CNY/USD Validation
1.MLP 2-9-1	0.991655	0.990138	0.991282
2.MLP 2-8-1	0.991058	0.990685	0.991387
3.MLP 2-9-1	0.990482	0.990920	0.991438
4.MLP 2-8-1	0.990527	0.990200	0.990750
5.MLP 2-8-1	0.990662	0.990455	0.991091

Source: Authors.

It results from the table that the differences in the performance of the retained neural structures are almost imperceptible. The value of the correlation coefficient for all datasets is above 0.99. This indicates that all neural structures are applicable. Only the first and second retained neural networks (1. MLP 2-9-1 and 2. MLP 2-8-1) appear to be slightly more successful. A more detailed analysis of the results must be carried out to choose the most suitable neural structure. Table 15 shows the basic statistical characteristics of the individual dataset for all neural structures.

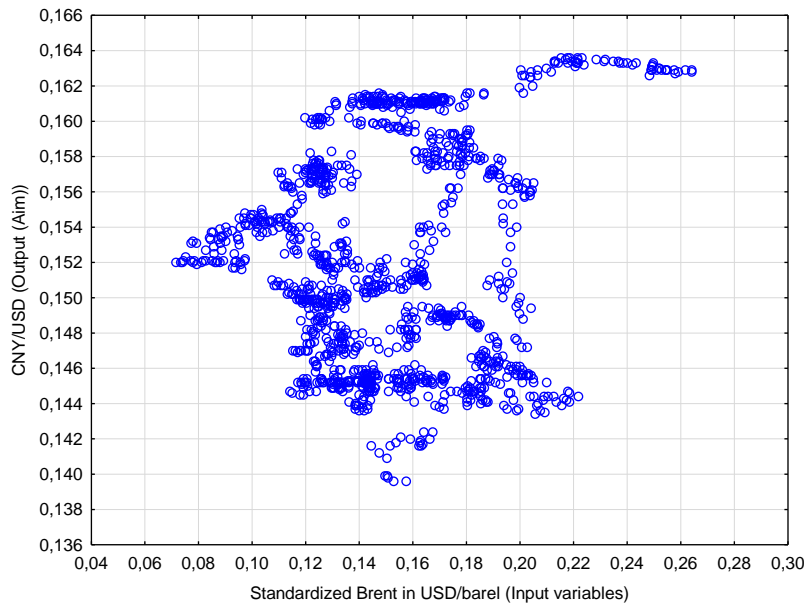


**Table 15.** Statistics of individual datasets by retained neural structures

Statistics	1.MLP 2-9-1	2.MLP 2-8-1	3.MLP 2-9-1	4.MLP 2-8-1	5.MLP 2-8-1
Minimal prediction (Training)	0.14184	0.14184	0.14108	0.14185	0.14208
Maximum prediction (Training)	0.16309	0.16329	0.16312	0.16341	0.16360
Minimal prediction (Testing)	0.14206	0.14195	0.14080	0.14198	0.14225
Maximum prediction (Testing)	0.16309	0.16329	0.16312	0.16333	0.16360
Minimal prediction (Validation)	0.14204	0.14197	0.14097	0.14201	0.14225
Maximum prediction (Validation)	0.16297	0.16321	0.16311	0.16325	0.16360
Minimal residuals (Training)	-0.00238	-0.00277	-0.00273	-0.00237	-0.00256
Maximal residuals (Training)	0.00292	0.00284	0.00313	0.00295	0.00274
Minimal residuals (Testing)	-0.00250	-0.00227	-0.00238	-0.00235	-0.00257
Maximal residua (Testing)	0.00219	0.00212	0.00195	0.00222	0.00198
Minimal residuals (Validation)	-0.00244	-0.00237	-0.00209	-0.00241	-0.00265
Maximal residuals (Validation)	0.00253	0.00182	0.00269	0.00192	0.00185
Minimal standard residua (Training)	-4.32935	-4.86063	-4.64482	-4.03999	-4.40338
Maximal standard residuals (Training)	5.30592	4.99714	5.32968	5.03172	4.70718
Minimal standard residuals (Testing)	-4.02335	-3.74685	-3.98543	-3.77010	-4.17833
Maximal standard residuals (Testing)	3.52278	3.49366	3.26677	3.55779	3.21478
Minimal standard residuals (Validation)	-4.13663	-4.01196	-3.56650	-3.93748	-4.43330
Maximal standard residuals (Validation)	4.27570	3.07970	4.57933	3.14871	3.08587

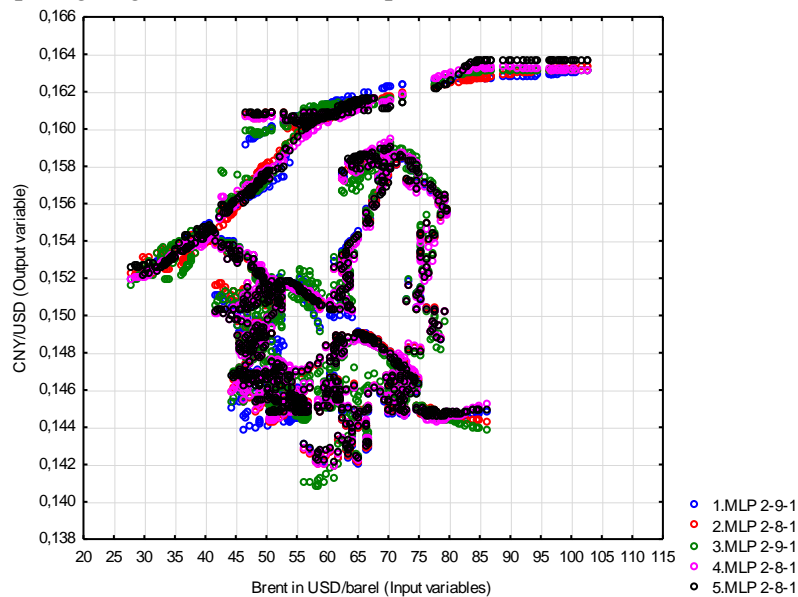
Source: Authors

In ideal case, the individual statistics of the neural networks are horizontally the same in all datasets (minimum, maximum, residuals etc.). In this case, the differences are minimal not only between the datasets used for one set but also between the individual networks. Only based on the residual's values, the network 4. MLP 2-8-1 appears to be the most successful, which did not make the result more precise. An interesting comparison of the individual networks' performance is represented by the scatter plot in Figure 5, showing Brent in USD/barrel on the axis X and CNY/USD on the axis Y. The actual values are shown in the graph in Figure 5.



**Figure 5.** Scatter plot – actual values of Brent in USD/barrel and CNY/USD  
Source: Authors

For the purposes of comparing, Figure 6 shows various predictions.



**Figure 6.** Scatter plot – prediction of Brent in USD/barrel and CNY/USD  
Source: Authors

Figures 5 and 6 clearly indicate that the networks show high accuracy of prediction. However, it is not possible to specify which of the retained networks generates the best result.

Figure 7 shows the graphical comparison of the development of the CNY/USD dependence on Brent in USD/barrel and time.

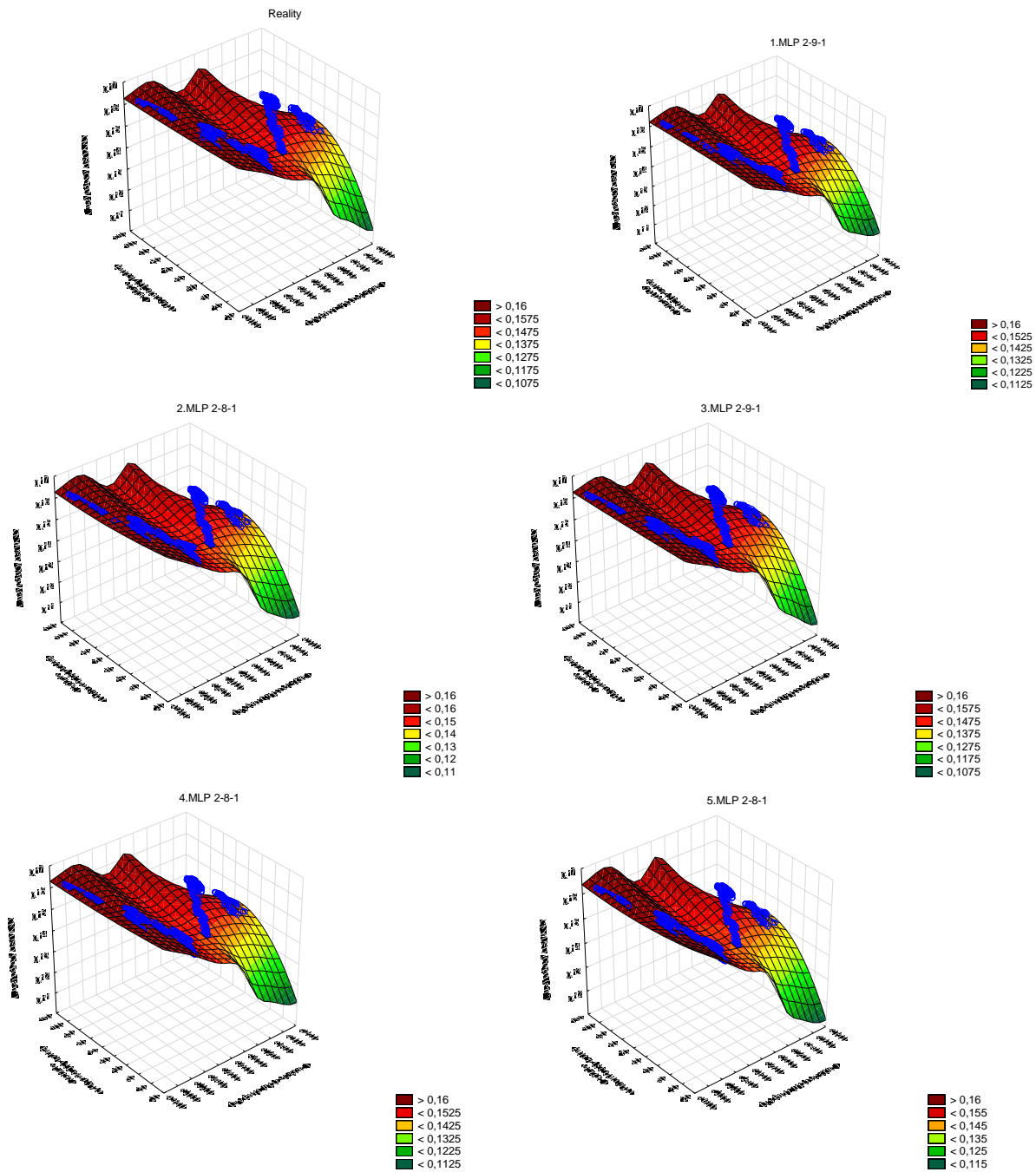


Figure 7. Graphical comparison of CNY/USD development on Brent in USD/barrel and time

Source: Authors

It results from the figure above that the results provided by the individual networks and the reality are almost equal. It is not clear which of the retained networks shows the best characteristics, thus best explaining the relationship of CNY/USD and Brent in USD/barrel and time. However, all retained networks with the dataset represented by a 10-day lag are applicable.

### Discussion – Evaluation, research questions

Based on the results obtained there is dependence of CNY/USD on Brent in USD/barrel. We can identify the dependence as well as the time lag at which this occurs. The best results were achieved in the case of a 10-day lag of the time series CNY/USD. This lag was identified in the calculation of both time series with the third variable (time) included. It was possible to examine the time series by including time as an independent variable, that was only partly corrected by the development of Brent price in USD/barrel. In order to specify the influence of Brent in USD/barrel on the price of CNY, it is necessary to carry out sensitivity analysis of the predicted values on time and Brent in USD/barrel. This is a subject of Table 16.

**Table 16.** Sensitivity analysis of CNY/USD over time and Brent in USD/barrel

Network	Day Brent	Brent in USD/barrel	Share of Brent in USD/barrel on prediction values
1.MLP 2-9-1	147.9889	3.62533	2.39%
2.MLP 2-8-1	132.1881	7.04795	5.06%
3.MLP 2-9-1	123.5318	13.07354	9.57%
4.MLP 2-8-1	167.4539	3.36712	1.97%
5.MLP 2-8-1	116.6771	3.33945	2.78%
Average	137.5680	6.09068	4.24%

*Source:* Authors.

It follows from the table that the share of oil prices on the price of CNY is created on the basis of the model prediction of (a particular retained artificial neural network) 1.97 (4. MLP 2-8-1) up to 9.57% (3. MLP 2-8-1) Brent in USD/barrel.

### Question 1

Yes, CNY/USD is to a certain extent dependent on Brent in USD/barrel. However, it is not dependence that would be characterized by high correlation. When measuring only the dependence of the two variables, the measured value of the correlation coefficient was about 0.4. Nevertheless, it was not possible to specify the time lag at which CNY/USD react to a change in the price of Brent in USD/barrel. According to the analysis of the CNY/USD dependence on Brent in USD/barrel and time, it can probably be stated that the price of CNY/USD changes approximately ten days after the change in the price of Brent in USD/barrel.

### Question 2

Yes, the effect of Brent in USD/barrel on CNY/USD can be measured. Depending on the model used, where all models have approximately the same factors, the influence of Brent in USD/barrel on CNY/USD ranges between 1.97% and 9.57%. Given the aggregate variable CNY/USD, the influence is thus relatively substantial. Oil price thus immediately influences the performance of the Chinese economy.

## Conclusions

The aim of the contribution was to specify whether and to which extent the development of oil price in the world market affects the value of Chinese currency.

Each model created shows a significant simplification. This is also the case of including variables such as CNY/USD and Brent in USD/barrel. In fact, the resulting price of CNY/USD is given by the supply and demand of and for Chinese currency. However, there are several factors that create both supply and demand for Chinese Yuan, for example the performance of the Chinese economy, China's position in international trade, position of other countries in the world economy, etc. A significant role is also played by the energy demands of the production of goods and logically, also by the possibilities and abilities of the Chinese economy to satisfy such a demand. It could thus be estimated that the fluctuations of oil price in the world market will affect the price of CNY/USD; however, it was not clear to which extent. This contribution enabled to prove the existence of such influence. It can be identified at the interval of 1.97% to 9.57%. It could thus be concluded that regarding the importance of the raw material, the influence is significant. The objective of the contribution was thus achieved.

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**Author Contributions:** Conceptualization: *Jaromír Vrbka, Jakub Horák*; methodology: *Jaromír Vrbka, Jakub Horák*; data analysis: *Jaromír Vrbka, Jakub Horák, Tomáš Krulický*; writing—original draft preparation: *Jaromír Vrbka, Jakub Horák*; writing; review and editing: *Tomáš Krulický*; visualization: *Tomáš Krulický*. All authors have read and agreed to the published version of the manuscript.

**Jaromír VRBKA** is bursar at the Institute of Technology and Business in České Budějovice and associate professor at the School of Expertness and Valuation of the Institute of Technology and Business in České Budějovice. Research interests: economic valuation, financial evaluation of companies, neural networks in business.

**ORCID ID:** <https://orcid.org/0000-0002-6356-4810>

**Jakub HORÁK** is Deputy Director for Research, Development and Creative Activities at the School of Expertness and Valuation at the Institute of Technology and Business in České Budějovice. Research interests: financial evaluation of companies, value generators, financial analysis, neural networks in business, circular economy.

**ORCID ID:** <https://orcid.org/0000-0001-6364-9745>

**Tomáš KRULICKÝ** is head of the Expertise department at the School of Expertness and Valuation at the Institute of Technology and Business in České Budějovice. Research interests: business valuation, expertness, financial health of companies, real estate valuation.

**ORCID ID:** <https://orcid.org/0000-0002-0378-2699>

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