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Examining entrepreneurial intentions through the lens of university students' attitudes

Намере о предузетништву испитиване кроз призму ставова студената

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Abstract: The labour markets of the transition countries of Central and Eastern Europe relied on stronger growth of the corporate sector as a mechanism for integrating the growing number of laid-off workers. The Serbian labour market has had a similar experience. Decades after the start of economic reforms, however, the role of entrepreneurship as an integrative employment mechanism has not increased in importance, which is best evidenced by statistical data. This paper focuses on students' intention to start their own business after graduation, and specifically examines the relationship between intention and personal attitudes. The experiment was conducted with two groups of students. The results indicate differences in students' attitudes towards entrepreneurship that deepen according to faculty group, gender, and year of study. From the students' responses, it can be concluded that electrical engineering students, female economics students and students in higher years of study are more inclined towards entrepreneurship. This may have implications for measures to support the development of youth entrepreneurship.
Keywords: attitudes towards entrepreneurship, grants, labour market, economic change, education and training, Serbia, university students.
JEL classification: D91, J21, M13.

Сажетак: Тржишта рада транзиционих земаља Централне и Источне Европе ослањала су се на снажнији раст корпоративног сектора као механизма за интеграцију све већег броја отпуштених радника. Српско тржиште рада има слично искуство. Деценијама након почетка економских реформи, међутим, улога предузетништва као интегративног механизма запошљавања није добила на значају, о чему најбоље сведоче статистички подаци. Овај рад се фокусира на намеру студената да започну сопствени бизнис након завршетка факултета, а посебно испитује однос између намере и личних ставова. Анкета је спроведена са две групе студената. Резултати указују на разлике у ставовима студената према предузетништву које се продубљују у зависности од факултета, пола и године студија. Из одговора студената може се закључити да су студенти електротехнике, студенткиње економије и студенти виших година студија склонији предузетништву. То може да има импликације на мере подршке развоју предузетништва младих.
Кључне речи: економске промене, образовање и обука, склоност предузетништву, Србија, студенти, субвенције за самозапошљавање, тржиште рада.
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Introduction

The labour markets of the transition countries of Central and Eastern Europe (CEE) relied on the more robust growth of the corporate sector as a mechanism for integrating the growing number of redundant workers. This was due to the inherited structure of the pre-transition economy. Large enterprises and the manufacturing industry dominated, while the business services sector was underdeveloped. The restructuring of the economy created great earning opportunities. Therefore, natural conditions were created that encouraged a part of the population to consider taking advantage of the earning opportunities. This way, space was created to develop an entrepreneurial mindset in society, where such options had been limited until recently (Kuratko, Fisher & Audretsch, 2021). This encouraged the development of the small and medium-sized private enterprises sector (McMillan & Woodruff, 2002). This enabled further absorption of the workforce to some extent and slowed the rise in unemployment so that employment rates largely stagnated. This was because private companies were founded thanks to generous state subsidies for creating new jobs. It quickly became apparent that these newly established companies achieved faster employment growth than privatised companies. The latter were motivated to buy domestic companies as they counted on the profit they would make from the share in the domestic market and customer network, so they retained some of the old management after taking over the domestic companies. This gave a number of workers hope that they would stay in the companies if they adapted to the new conditions, apart from the fact that they were familiar with the management, but the ownership structure had changed (Ognjenović, 2015).

On the Serbian labour market, it was most difficult for older workers with experience from old production plants, most of which had been shut down, to find a job. Some of the employees recruited by the new employers were sent for training in branches of these companies in other countries or trained in companies in the country (Ognjenović, 2015). However, most of them with outdated qualifications could not be re-employed, so the early retirement institute, on the other hand, put pressure on the empty pension funds. Finding a job was also difficult for young people without work experience. They came from an education system that continued to produce job profiles for industries that mostly no longer existed (Dinkić, Pešikan, Bjegović Mikanović, Blagojević Hughson, & Milutinović, 2007). The distribution of industries was largely determined by geography, and the education system followed the same concept. The local development of these areas was based on this foundation and was also destroyed by the closure of unprofitable production facilities.

Decades after the start of economic reforms in Serbia, the role of entrepreneurship as an integrative employment mechanism has not yet gained importance. The share of self-employment in total employment is declining in absolute and relative terms. Data from the Labour Force Survey (LFS) show that the number of self-employed in 2022 amounted to 479 thousand or 16.4% of total employment, and only five years earlier, the self-employed accounted for more than a fifth of the total number of employees in Serbia (Statistical Office of the Republic of Serbia, 2023).

This topic has only recently become part of the research agenda in Serbia (Ognjenović, 2023; Ognjenović, 2022) and the countries of the region (Aydin, Knezović, Bičo & Smajić,

2024; Rajh et al., 2018). The motive for this work is to identify the factors in young people that would encourage them to choose the path of an entrepreneur as a profession. This paper uses data collected from economics and electrical engineering students to examine their attitudes towards entrepreneurship and to describe the relationship between these attitudes and the intention to become an entrepreneur after graduation. In addition, current data on the support of young entrepreneurs through institutionally developed programmes will be analysed. Thus, the main research question is whether students' attitudes towards entrepreneurship match the reality of the labour market.

The structure of the paper is as follows. The next section describes the institutional context for young people entering the labour market. This is followed by an overview of the relevant literature and a description of the statistical sources used for the analysis. The part of the paper devoted to the main findings is derived from the two sub-analyses. First, the institutional support for youth entrepreneurship development implemented by the National Employment Service (NES) through the inclusion of unemployed people under 30 in two specially created programmes is analysed. The generalisation of the conclusions regarding the entrepreneurial climate from the perspective of young people is then based on the results of a survey of university students. The paper ends with conclusions and recommendations.

1. Institutional context

Regarding institutional support for employment and youth development, two key documents contain strategies, programs, and support mechanisms for the implementation of youth policy:

1. The National Youth Strategy of the Republic of Serbia for the period from 2023 to 2030 (Government of the Republic of Serbia, 2023);
2. The Employment Strategy of the Republic of Serbia for the period from 2021 to 2026 (Government of the Republic of Serbia, 2021).

The first document sees young people as "active and equal participants in all aspects of social life, developing their full potential with the support of society and contributing to personal and social development and well-being" (Government of the Republic of Serbia, 2023, p. 72, translation). This sentence illustrates the vision of the development of young people in Serbian society. The specific goal of the Youth Strategy is to ensure that "young people have equal opportunities and incentives to develop their potential and skills leading to social and economic independence" (Government of the Republic of Serbia, 2023, p. 73, translation). This goal is achieved through access to education, improving skills and employability in the labour market, and enhancing the entrepreneurial potential of young people.

In achieving the goals related to youth employment and self-employment, the Youth Strategy relies heavily on the Employment Strategy of the Republic of Serbia. The achievement of the strategic goals is envisaged through inter-sectoral activities and through a series of practical measures created to promote entrepreneurship, social entrepreneurship,

and employability of young people. These are the goals pursued since adopting the first Youth Strategy of the Republic of Serbia in 2008 (Kovačević & Krnjaić, 2008). This strategic framework was adopted at a time of economic and social change, accompanied by a declining population, low birth rates and delayed parenthood, high unemployment, and migration, affecting young people in particular (Dinkić et al., 2007). However, young people's prospects for employment and independence remain modest, even though the mechanisms and institutional framework for education and employment have improved significantly.

2. Literature review

The development of the entrepreneurial ecosystem, with a particular focus on the young population, has been studied intensively over the last four decades (Maheshwari, Kha & Arokiasamy, 2023; Liñán & Fayolle, 2015). In Liñán & Fayolle (2015) at least two lines of research on entrepreneurship were identified. One research direction is based more on a theoretical framework linked to social psychology, specifically by focusing on the theory of planned behaviour and examining the empirical impact of key determinants on entrepreneurial intention. The second line of research relates more to studying the organizational aspects of entrepreneurship and entrepreneurial orientation.

In developing and emerging markets economies, in particular, there is a growing number of studies, as entrepreneurship is seen as one of the ways to escape poverty and solve the problems of high unemployment and a low-skilled workforce (Maheshwari et al., 2023; Sahaidak, Prokhorova & Sobolieva, 2022). Support from family members could be a significant moderating factor for the relationship between entrepreneurial alertness and, for example, Nigerian students' entrepreneurial intention. At the same time, innovativeness could also be a trigger for starting their own business (Ugwueze, Ike, & Ugwu, 2022). Institutional support, family members' involvement in entrepreneurship, peer support, and perceptions of self-efficacy and entrepreneurial skills are statistically significant determinants of entrepreneurial intentions among students in large entrepreneurial nations such as India and Pakistan (Martins, Shahzad & Xu, 2023; Jena, 2020). In European countries such as Austria, the entrepreneurial knowledge acquired through education is an important factor of the entrepreneurial intention of students of different educational profiles, economics, science, and engineering, while subjective norms can negatively influence the entrepreneurial determination of the latter two groups of students. The influence of subjective norms in the group of students of economics cannot be isolated as a significant factor of entrepreneurial intention (Maresch, Harms, Kailer & Wimmer-Wurm, 2016). Feelings such as empathy, which could also be seen as peer support, and self-efficacy were found to be important determinants of students' social entrepreneurial intentions (Simmou, Sameer, Hussainey, & Simmou, 2023). In Politis, Ketikidis, Diamantidis, & Lazuras (2016), the importance of theoretical antecedents of planned behaviour as predictors of (social and commercial) entrepreneurial intentions were determined in a sample of postgraduate students from CEE countries. However, it was found that predictors from the group of personality traits, such as the need for achievement, independence, and similar traits, cannot be regarded as statistically significant determinants of social entrepreneurial intentions.

Differences in the socio-cultural context cannot influence entrepreneurial intention with the same intensity (Moriano, Gorgievski, Laguna, Stephan & Zarafshani, 2012). Social norms as theoretical antecedents of planned behaviour are usually investigated in studies that examine the influence on entrepreneurial intentions in a multicultural environment. The results usually confirm the importance of social norms in countries where individual behaviour relies more on the expectations of family, relatives, or peers. Social norms have been shown to be a significant predictor of students' entrepreneurial intentions in selected countries in Central and Eastern Europe, the Mediterranean region, and some Asian countries, while in Western Europe, represented by the Netherlands and Germany, no significant effect of social norms on students' entrepreneurial intentions was found (Moriano et al., 2012). This can be attributed to the gender roles in these societies and the expected differences in the tradition of career choice.

Several recent studies have examined the influence of various factors on entrepreneurial intention in the countries of the Balkan region. Some of these studies have focused on the working-age population, while other studies have focused exclusively on exploring factors of the entrepreneurial ecosystem among university students as potential carriers of entrepreneurial activities after graduation.

Looking at the working-age population, the entrepreneurial intention is more pronounced among the younger population (Aydin et al., 2024). To a certain extent, this confirms the validity of similar studies published in recent years on the student population (Bağış et al., 2023; Ognjenović, 2023; Ognjenović, 2022; Rajh et al., 2018). Research on data for Bosnia and Herzegovina, conducted on a sample of the working-age population, has shown that an individual's propensity for entrepreneurship can have a significant mediating effect when the relationship between the respondent's age and their entrepreneurial, i.e., intrapreneurial, intention is observed (Aydin et al., 2024). The risk-taking factors and innovation-driven motivation have a moderate mediating effect on the investigated relationships. Data collected among economics and business students in Bosnia and Herzegovina showed that entrepreneurial orientation, behavioural control factors, and perception of the importance of others are statistically significant determinants of entrepreneurial intention (Rajh et al., 2018). This research covered the labour markets of four CEE countries (Bosnia and Herzegovina, Croatia, North Macedonia, and Serbia), and the results did not differ significantly between countries, with the desire to become an entrepreneur and the ability to control this process driving students more often than other potential predictors. Similar results were also obtained using data for Serbia, which were collected from samples of students of business, economics, and electrical engineering. These showed that the risk-taking factor does not play a significant role in forming the relationship between predictors, such as propensity to entrepreneurship, behavioural control and importance of others, and entrepreneurial intentions (Ognjenović, 2022).

Research conducted on a sample of business and engineering students from 50 countries, based on the unique 2018 *Global University Entrepreneurial Spirit Students' Survey* has shown that the education and knowledge students gain from mandatory entrepreneurship courses is critical to their choice of a long-term entrepreneurial career.

Slight differences in the impact of entrepreneurship education on the later period of an entrepreneurial career were found among business and engineering students (Sitaridis, Laspita, Kitsios & Sarri, 2023). In addition, Shirokova, Osiyevskyy & Bogatyreva (2016) analysed the discrepancy between entrepreneurial intention and the factors that led to its realization among student entrepreneurs based on the 2013/14 *Global University Entrepreneurial Spirit Students' Survey* database and concluded that the context itself, as well as the environment, transforms intention into entrepreneurial activity. Students in Serbia were excluded from this survey. From the countries in the region, Albania, Croatia, and North Macedonia, for example, took part in the survey. The results regarding the influence of motivational factors on students' entrepreneurial intentions are mixed. For example, Ognjenović (2023) found neither external nor internal motivational factors as significant determinants of students' entrepreneurial intentions.

On the other hand, Bağış et al. (2023) have shown that factors such as the need for achievement significantly influence the entrepreneurial intention and alertness of university students. Low levels of digital skills can be a significant barrier to labour market inclusion, especially for vulnerable groups such as older women and those with low skills (Bradić-Martinović & Banović, 2018). In the context of the impact of digitalization on entrepreneurship development, Youssef, Boubaker, Dedaj & Carabregu-Vokshi (2021) investigated students' entrepreneurial intentions and showed that attitudes towards entrepreneurship and perceived behavioural control are statistically significant determinants of entrepreneurial intentions. It can significantly narrow the gap between the need for the digitization of the economy and its impact on the individual (Krivokuća, Ćoćkalo & Bakator, 2021).

3. Data and methods

In addition to the LFS data from Eurostat, based on which the development of employment and self-employment is explored (Eurostat, 2023), the two most important data sources for the analysis presented in this paper are:

1. Aggregated annual NES data on institutional support for entrepreneurship development among individuals younger than 30 years;
2. Data from a survey on entrepreneurial intentions conducted among students at the University of Belgrade, the largest university centre in Serbia.

Support for youth self-employment is intended for people who were registered as unemployed at the time of applying for measures to promote entrepreneurship. This support is implemented through two active labour market policy measures: (i) entrepreneurship training and (ii) subsidy for starting a business. The training program's methodology has changed since 2021, when it was conducted over three days instead of two and included the development of a business plan (National Employment Service, 2023). Persons applying for a grant must have completed a training course that includes a business plan.

A survey based on a prepared questionnaire (Rajh et al., 2018) was conducted among economics and electrical engineering students (Ognjenović, 2022), and the number of

completed questionnaires amounted to 309 and 307 in the first and second samples, respectively. The sample consists of 348 female and 268 male students (n=616). The data were collected in the 2016/17 academic year, and the survey was not repeated thereafter, so it is a set of cross-section data. In addition to primary demographic data, the survey included a broader set of questions about personal attitudes, behavioural control factors, social norms, and entrepreneurial intentions. All student responses were recorded on a Likert scale of 1-5.

Two complementary methodological approaches were used to determine the factors of entrepreneurial intention and to derive the differences in the students' attitudes. Since the students' responses are rated on a nominal scale, the differences in mean scores between two groups of students are tested using t-statistics. Sometimes the aggregation of responses can lead to general conclusions. Therefore, it was initially decided to adopt an approach that would allow the differences to be tested at the level of each individual question asked of the students. This approach is recommended when the questionnaire is focused on a specific group of questions and when different groups of participants are intuitively observed. Once the differences were uncovered, pairwise correlations between the variables for personal attitudes and entrepreneurial intentions were determined and tested for different subsamples.

4. Results and discussion

4.1. Institutional support to young entrepreneurs

Since 2018, when almost a fifth of young people under the age of 30 were unemployed, the trend of rising youth unemployment has come to a halt. In 2022, the youth unemployment rate in Serbia was 17.1% (Statistical Office of the Republic of Serbia, 2023). At the same time, a much milder decline in the youth unemployment rate was achieved in the EU-27, which amounted to 11.3% in 2022, or 1.5 percent points less than in 2018 (Eurostat, 2023). Incidentally, in a ten-year comparison, almost a fifth of young people under 30 were unemployed in the EU-27, and in Serbia, the unemployment rate was more than twice as high (Eurostat, 2023). In addition to subsidizing the employment of young people by employers, the coverage of unemployed young people through active labour market policies in Serbia has been significantly expanded in recent years, not only through subsidized employment by employers but also through incentives for entrepreneurship development. However, despite these measures, the number of self-employed young people in Serbia has not increased, as the analysis in the following text will show.

Table 1: Beneficiaries of measures in Serbia

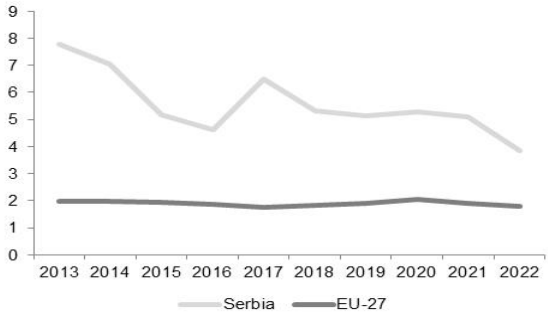
Measure	Year		
	2020	*2021*	*2022*
	All beneficiaries		
Training	12,468	13,698	10,266
Subsidy	3,804	4,209	4,423
	Under 30 years		
Training	3,241	3,799	2,733
Subsidy	995	1,124	1,225
	% of beneficiaries under 30 in total		
Training	26.0	27.7	26.6
Subsidy	26.2	26.7	27.7

Source: the author, based on National Employment Service (2023).

Table 1 shows the number of participants in entrepreneurship promotion programs implemented by NES in Serbia (National Employment Service, 2023). This measure is implemented through training and direct support for self-employment by granting a subsidy. At the level of the overall program, the number of subsidy recipients is increasing. In 2022, 4,423 subsidies were granted, which is 214 and 619 more than in 2021 and 2020, respectively. The reasons for the lower number of grants awarded in the previous two years may be administrative or due to delays caused by the uncertainties challenged by the COVID-19 crisis, which was in full swing at the time. As the number of beneficiaries of the self-employment subsidy is increasing, young people are becoming more interested in entrepreneurship, but the aggregated data on the number of self-employed and their structure does not yet show this.

According to LFS data, there were 2,094.5 thousand self-employed persons aged 15-29 in the EU-27 in 2022, representing 6.0% of total employment in this age group (Eurostat, 2023). Their absolute number and relative participation had decreased in the last ten years when the number of self-employed amounted to 2,141 thousand (6.4% of total employment). In Serbia, self-employed young people account for 7.0% of total employment in 2022 (or 31.5 thousand people). However, their number has decreased significantly in the last ten years, when it amounted to 15.1% (or 46 thousand people) (Eurostat, 2023). Given the high unemployment rate, any promotion of self-employment through entrepreneurship makes sense.

Figure1: Gender gap in youth self-employment, %



Source: the author, based on Eurostat data (Eurostat, 2023).

Women make up around a third of the self-employed in Serbia. In the age group from 15 to 29-year-olds, however, their share is significantly lower, only 22.5% in 2022. Ten years ago, the proportion of young self-employed women was higher in absolute and relative terms and amounted to 24.3%. This ratio between the number of self-employed men and women favoured the emergence of a gender gap, which is significantly higher in Serbia than in the EU-27 (Figure 1).

4.2. Determinants of entrepreneurial intention

Most of the studies cited in this article dealt with the investigation of entrepreneurial intentions in the context of examining the influence of theoretical antecedents of planned behaviour on the propensity to engage in entrepreneurial activity (Bağış et al., 2023; Ognjenović, 2022; Youssef, 2021; Rajh et al., 2018; Politis et al., 2016). The personal attitudes variable stands out as it explains entrepreneurial intention the most. Previous work has found this variable to have the strongest effect on entrepreneurial intention, so this section is devoted to analysing the personal attitudes factor and its correlation with the entrepreneurial intention variable. The mediating role of gender was also confirmed when examining the effects of antecedents of planned behaviour on entrepreneurial intention (Ognjenović, 2022). Table 2 shows the empirical model linking personal attitude to intention. The α-indicator values confirm a high internal reliability of the responses within each question group. The indices 1-economics and 2-electrical engineering correspond to the respondents from the samples of two faculties.

Table 2: Research model formation

Entrepreneurial intent		Attitudes toward entrepreneurship	
Variable	Description	Variable	Description
y_{i1}	*Readiness*	x_{i1}	*Advantages*
y_{i2}	*Professional goal*	x_{i2}	*Attractive as a career*

y_{i3}	*Effort*	x_{i3}	*Opportunities and resources*
y_{i4}	*Determination*	x_{i4}	*Satisfaction*
y_{i5}	*Serious thought*	x_{i5}	*Preferred choice*
y_{i6}	*Firm intention*		
Cronbach's $\alpha_1 = 0.95$, $\alpha_2 = 0.96$		Cronbach's $\alpha_1 = 0.80$, $\alpha_2 = 0.80$	

Source: research by the author.

To complete the picture of the existence of dissimilarities in students' responses and their understanding of the process of implementing an entrepreneurial idea, the differences in responses between young women and men from both faculties were examined. This is significant insofar as young women tend more frequently towards the social science faculties, including economics, and young men towards the technical and natural science faculties. In addition, regardless of age, women in Serbia are much less likely to pursue entrepreneurial careers than men, which confirms the significant gender gap in self-employment. Another important issue is whether the students' answers differ depending on the year of study. Students are grouped at individual faculty levels so that first- and second-year students form one group, and third- and fourth-year students form another group. The results are shown in Table 3 and can be summarized as follows:

1. In Ognjenović (2022), it was shown that there are significant differences only in the attitudes of male and female electrical engineering students regarding career choice, opportunities, and personal satisfaction offered by the profession of entrepreneur, as well as in all components of entrepreneurial intention, while students of economics are determined differently only in relation to the last three explanatory components of entrepreneurial intention.

2. On average, students of economics rated a positive attitude towards entrepreneurship higher than electrical engineering students (Table 3). The much more significant differences in female students' attitudes in these two faculties confirm their reticence regarding the possible choice of an entrepreneurial career. Higher mean scores among students of economics indicate that the idea of entrepreneurship is closer to them and that they have been exposed to these topics at faculty.

3. Men at both faculties agreed to a greater extent with positive attitudes towards entrepreneurship, so the mean scores are higher than those of female students. Regarding the variable of personal attitudes, the only statistically significant difference in the attitudes of male students at these two faculties concerns the satisfaction that an entrepreneurial vocation may bring, which is more attractive to students of economics.

Table 3: Differences by faculty and gender

Variable	Female students	Male students
	Economics *vs* Engineering	Economics *vs* Engineering
y_{i1}	m_1=2.8, m_2=2.3, d=0.5*	m_1=3.0, m_2=2.7, d=-0.3*
y_{i2}	m_1=2.9, m_2=2.4, d=0.5*	m_1=2.9, m_2=2.7, d=0.2
y_{i3}	m_1=2.8, m_2=2.3, d=0.5*	m_1=3.0, m_2=2.6, d=0.4*
y_{i4}	m_1=2.9, m_2=2.6, d=0.3*	m_1=3.2, m_2=3.0, d=0.2
y_{i5}	m_1=2.8, m_2=2.4, d=0.4*	m_1=3.1, m_2=2.9, d=0.2
y_{i6}	m_1=2.9, m_2=2.5, d=0.4*	m_1=3.3, m_2=3.0, **d=0.3**
x_{i1}	m_1=3.8, m_2=3.6, d=0.2*	m_1=3.7, m_2=3.8, d=-0.1
x_{i2}	m_1=3.6, m_2=3.1, d=0.5*	m_1=3.7, m_2=3.5, d=0.2
x_{i3}	m_1=3.9, m_2=3.6, d=0.3*	m_1=4.1, m_2=4.0, d=0.1
x_{i4}	m_1=3.7, m_2=3.2, d=0.5*	m_1=3.8, m_2=3.5, d=0.3*
x_{i5}	m_1=2.9, m_2=2.8, d=0.1	m_1=3.0, m_2=3.0, d=0.0

*Notes: m1 and m2 denote the average values for the corresponding group of students, whereby the indices 1 and 2 stand for the faculties of economics and electrical engineering respectively; d is the difference between m1 and m2. * Statistically significant at 5%; bold values at 10%.*

Source: research by the author.

It is also possible to culturally define the differences achieved in students' entrepreneurial intentions (Gardašević, Brkanlić & Kostić, 2020). As mentioned above, this topic has been studied in depth by other authors, but in the context of different countries, in order to compare the impact of the socio-cultural dimension on the entrepreneurial behaviour of young adults (Bağış et al., 2023; Moriano et al., 2012). In this particular study, the questionnaire did not capture too many personal characteristics of the students. Questions included characteristics such as gender and age, but the data collected can be further broken down by year of study and faculty. Therefore, in this study, full attention was paid to the observed differences between faculties. In both faculties, the average age of the students involved in the experiment was 22 years. In terms of gender, however, the situation is completely different. In the sample of economics students, almost 77% were young women, while in the sample of electrical engineering students, young women made up only 36% of the total. Based on the structure of the sample, which correctly represents the population of students in these two faculties, it is logical that more attention should be paid to the observed differences by faculty and gender (as shown in table 3). Apart from these main characteristics, it is not possible to determine whether individuals with certain additional characteristics opt for a particular faculty. When colouring the results culturally, traditionally more young women tend to be enrolled in economics and more young men choose to study engineering.

Their later career in terms of commitment to entrepreneurship can largely be determined by the choice of degree programme itself.

Differences by year of study were tested on a combined sample of students from both faculties, as only 126 students from the first two years of study were included in the sample (n=616). The results are reported in Table 4. First and second-year students reported a higher average score, but the differences are only statistically significant for entrepreneurial intentions observed by effort ($p<0.05$) and career goal ($p<0.10$). Significant differences in the students' attitudes can be seen in the career choice ($p<0.05$) or the advantages offered by this profession ($p<0.10$).

Table 4: Differences by years of study

Variable	Differences by years of study 1st & 2nd *vs* 3rd & 4th
y_{i1}	m_1=2.8, m_2=2.7, d=0.1
y_{i2}	m_1=2.9, m_2=2.7, **d=0.2**
y_{i3}	m_1=2.9, m_2=2.6, d=0.3*
y_{i4}	m_1=3.0, m_2=2.9, d=0.1
y_{i5}	m_1=2.9, m_2=2.8, d=0.1
y_{i6}	m_1=2.9, m_2=2.8, d=0.1
x_{i1}	m_1=3.9, m_2=3.7, **d=0.2**
x_{i2}	m_1=3.7, m_2=3.4, d=0.3*
x_{i3}	m_1=4.0, m_2=3.9, d=0.1
x_{i4}	m_1=3.7, m_2=3.5, d=0.2
x_{i5}	m_1=2.9, m_2=3.0, d=-0.1

*Notes: m1 and m2 denote the average values for the corresponding group of students, whereby the indices 1 and 2 stand for the faculties of economics and electrical engineering respectively; d is the difference between m1 and m2. * Statistically significant at 5%; bold values at 10%.*
Source: research by the author.

Table 5 shows the correlations between personal attitudes and the variables on entrepreneurial intention, which were estimated separately by faculty, gender, and year of study. The results indicate a moderately high but statistically significant correlation between entrepreneurial intention and personal attitudes in all subgroups of students. Male electrical engineering students and students in higher years of study show a stronger attitude towards entrepreneurship than other groups of students.

Table 5: Correlation analysis

Subgroup (sample)	Correlation coefficient
$Faculty_1$ (n=309)	0.672*
$Faculty_2$ (n=307)	0.704*
$Faculty_1$ & Female (n=237)	0.691*
$Faculty_1$ & Male (n=72)	0.629*
$Faculty_2$ & Female (n=111)	0.667*
$Faculty_2$ & Male (n=196)	0.710*
Year of study (1^{st} & 2^{nd}) (n=126)	0.689*
Year of study (3^{rd} & 4^{th}) (n=490)	0.697*

*Notes: * Statistically significant at 5%.*
Source: research by the author.

Table 5 shows the correlations between personal attitudes and the variables on entrepreneurial intention, which were estimated separately by faculty, gender, and year of study. The results indicate a moderately high but statistically significant correlation between entrepreneurial intention and personal attitudes in all subgroups of students. Male electrical engineering students and students in higher years of study show a stronger attitude towards entrepreneurship than other groups of students.

Conclusion

This paper is thematically devoted to the study of entrepreneurial intentions of students from two faculties within the same university in Serbia, which are oriented towards the education of young people of different scientific and vocational directions. Assume that the conclusions are drawn based on the mean scores expressing the degree of students' agreement with a positive attitude towards entrepreneurship and revealing their intention to engage in this profession. In this case, electrical engineering students are more inclined towards entrepreneurship but lack knowledge that would help them in entrepreneurial orientation. This paper revealed several important findings that can only be generalized to the student population. The research findings show that young people understand the importance of entrepreneurship and the knowledge gap, so they could be relevant to the development of entrepreneurship programs. In addition, in countries that have recognized the role of entrepreneurship in economic development and job growth, surveys of the student population are regularly conducted to determine their entrepreneurial vigilance and develop policies to encourage active entrepreneurs. The conclusions of this study are as follows:

1. The share of self-employed in total employment in Serbia is decreasing, with a significant gender gap.

2. Female students of both faculties are less interested in a career as an entrepreneur than their fellow students. However, female economics students are more inclined towards entrepreneurship than female electrical engineering students.
3. There are no significant differences in university students' personal attitudes and entrepreneurial intentions depending on the study year. However, the correlation analysis shows that there is a higher degree of consent between personal attitudes and entrepreneurial intentions in the responses of third- and fourth-year students.

Of course, it can be assumed that the economics students have more prior knowledge about entrepreneurship than the electrical engineering students. However, the students were selected in such a way that the economics students opted for business major, while the electrical engineering students have acquired some prior knowledge of management through the courses in their final years of study. In addition, electrical engineering students find opportunities to enter entrepreneurial careers by developing projects on their own or with the support of their peers. Consequently, it is not possible to conclude based on prior theoretical knowledge of entrepreneurship alone to what extent this might influence students' attitudes. Further research on this topic would require an explicit investigation of the impact of entrepreneurship education on students' entrepreneurial intentions.

Potential weaknesses of the study may be that the generalizations used to predict entrepreneurial activity are based on the student population and cannot be applied to the working-age population. In addition, this real-time data was collected from a sample that cannot be transferred to the same sample of people. Therefore, the assessment of actual entrepreneurial activity among the selected young adults is impractical. In a country where the interest of young people in entrepreneurial careers is high and where the unemployment rate among young people is stable but high, it is recommended that a method of screening entrepreneurial intentions be conducted at regular intervals. These are the suggestions for further research on this important topic.

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Application of artificial intelligence in digital marketing

Примена вештачке интелигенције у дигиталном маркетингу

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Abstract: Contemporary digital technologies have significantly influenced the transformation of marketing activities in companies over the past decade. Artificial intelligence is considered one of the most disruptive modern technologies. Their implementation is the most significant challenge of digital marketing. Artificial intelligence can automate customer service, generate content, and enable targeted ad campaigns. The problem identified by the authors is that smaller companies and entrepreneurs lack the necessary knowledge and understanding of artificial intelligence techniques that could enhance digital marketing strategies. By reviewing current literature, this paper aims to explain the digital marketing strategies and the role and place of various artificial intelligence techniques for their improvement. In line with the defined goal, the paper presents three case studies on industry giants – Coca-Cola, Starbucks, and Nike – illustrating successful implementations of artificial intelligence and machine learning techniques in their digital marketing.
Keywords: artificial intelligence, machine learning, data science, digital marketing
JEL classification: C38, M31

Сажетак: Савремене дигиталне технологије значајно су утицале на трансформацију маркетиншких активности у компанијама током протекле деценије. Вештачка интелигенција сматра се једном од најдисруптивнијих модерних технологија. Њихова имплементација представља најзначајнији изазов дигиталног маркетинга. Вештачка интелигенција може аутоматизовати корисничку подршку, генерисати садржај и омогућити циљане рекламне кампање. Проблем идентификован од стране аутора јесте да мање компаније и предузетници недостају потребно знање и разумевање техника вештачке интелигенције које би могло унапредити стратегије дигиталног маркетинга. Проучавањем актуелне литературе, овај рад има за циљ да објасни стратегије дигиталног маркетинга и улогу и место различитих техника вештачке интелигенције за њихово побољшање. У складу са дефинисаним циљем, рад представља три студије случаја о индустријским дивовима – Coca-Cola, Starbucks и Nike – илуструјући успешне примене техника вештачке интелигенције и машинског учења у њиховом дигиталном маркетингу.
Кључне речи: вештачка интелигенција, машинско учење, наука о подацима, дигитални маркетинг
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Introduction

The Fourth Industrial Revolution has significantly influenced the intensive application of modern digital technology in all sectors of the economy. The introduction of contemporary digital technology into companies represents a process of digitalization. This process increases the efficiency and effectiveness of business operations, sales or productivity growth, innovation application in value creation, and entirely new forms of customer relationships. The digitalization process has also impacted the operation conditions, providing a competitive advantage in the market. The product and service lifecycle has become much shorter, and customer behaviours and expectations have become more demanding. Companies must proactively respond to future customer needs in the digital economy, where an unsatisfied customer can easily replace a product or service provider with a single mouse click (Ubiparipović et al., 2020). The need for digitization was particularly notable during the period of the COVID-19 pandemic, when circumstances required rapid digitization of services, including access to health care, education, and other essential services (Jovanović, Krstić, & Jovanović-Vujatović, 2023).

The digitalization process is closely related to the process of digital business transformation. Ismail, Khater and Zaki define the concept of digital business transformation as a process through which companies use the effects of the synergistic application of various digital technologies (the digitalization process), contributing to the achievement of better business results and a better competitive position in the market (Ismail, Khater, & Zaki, 2017). In other words, digital business transformation involves changes in the company's business due to the application and use of the advantages of modern digital technologies (Matt et al., 2015). The scope and content of the transformation depend on the industry and the degree of digitalization. Digital business transformation can encompass multiple business dimensions (Ismail, Khater, & Zaki, 2017): business model, customer experience during the consumption of digitized products and services, business processes, and decision-making methods, simultaneously influencing the necessary skills and talents of people in the company, organizational culture, and the overall value creation system.

Modern digital technology applications have been particularly prominent in marketing in the past decade. SMACIT (Social, Mobile, Analytics, Internet of Things) technologies have significantly influenced the transformation of marketing activities in companies and the emergence of so-called digital marketing. Digital marketing is a marketing subfield. It is an adaptive and technology-based process in which companies collaborate with customers and partners to co-create, communicate, and deliver value through digital channels for stakeholders (Bist et al., 2022). The current challenge for marketers and the digital transformation of the marketing business process is artificial intelligence (AI) technologies. Although many companies apply AI-based tools to support individual digital marketing tasks, only large innovative companies, such as Google, Netflix, Amazon, Microsoft, Coca-Cola, Starbucks, or Nike, have realized the complete and successful digital transformation of marketing activities based on the application of AI technologies. Smaller companies often lack the necessary knowledge and understanding of the possibilities of applying AI to improve digital marketing. Reviewing the current literature and successful examples from practice, the authors of this paper aim to answer the following research question:

IP. *How can artificial intelligence improve digital marketing strategies and activities?*

The paper is structured in four sections. The first section gives an overview of the key digital marketing strategies. The second section describes the foundations of AI, machine learning, and data science. It also describes the most prominent AI and machine learning techniques underlying digital marketing strategies. The third section presents three case studies on industry giants – Coca-Cola, Starbucks, and Nike – and successful implementations of AI and machine learning techniques in their digital marketing. Conclusions and directions for future work are summarized in the last section.

1. Digital marketing strategies

Digital marketing builds the digital identity of a company, through which it presents itself to a large number of users in the virtual world to achieve its business goals. Digital marketing involves the use of digital technologies in the process of attracting and retaining customers, building customer preferences, promoting brands, and increasing sales (Kannan & Hongshuang, 2017). Digital marketing influences consumer interactions, thereby developing an electronic word-of-mouth (eWOM) recommendation system among consumers (Marić et al., 2022). Digital marketing is a set of strategies and tactics for presenting, promoting, and selling products and services through digital channels, such as websites, social media, search engines, YouTube, and email marketing (Bist et al., 2022). The following chapter describes the most prevalent strategies in digital marketing.

Search Engine Optimization (SEO) Marketing Strategy is a digital marketing strategy that encompasses a set of techniques and practices designed to improve the visibility and ranking of a company's website on search engine results pages (SERP). The algorithm used by search engines considers various criteria, some publicly unknown, to determine the relevance of website pages and rank them. However, the crucial concepts of the SEO strategy include (Dumitriu & Popescu, 2020):

- Keyword Optimization involves researching keywords frequently used by users in search engines and related to the company’s business domain. Companies strategically place these keywords in the content of their website pages.
- On-page SEO refers to individual website page optimization to enhance their visibility in search results, including optimizing meta tags, titles, and content structure.
- Link Building involves acquiring high-quality backlinks from reliable, high-ranking websites, which is crucial for improving the website’s authority and ranking on search engines.
- Technical SEO focuses on optimizing the technical aspects of the website, including site speed, mobile responsiveness, and ensuring that web crawlers can access and index content.
- User Experience ensures that the website's user interface enables users to navigate and interact with the site easily, ensuring that content loads quickly and is mobile-friendly.

Search Engine Marketing (SEM) Strategy is a digital marketing strategy used to increase the visibility of a company's website on search engine results pages, similar to SEO. While SEO achieves this goal organically and free of charge, SEM involves a set of paid methods to promote websites to appear at the top of search engine results pages (SERP). Companies can implement SEM using one of three models: PPC (pay-per-click), CPC (cost-per-click), and CPM (cost-per-thousand impressions). Paid ads on the search results page always appear above organic search results. Each visitor from a paid ad gradually improves the website's ranking in organic search results. Therefore, the SEM strategy is excellent for quickly generating more traffic to a website, as search engines attract motivated potential customers like no other digital advertising channel (Terrance et al., 2018).

The SEM strategy involves conducting an ad auction. In other words, each Google ad goes through an ad auction before appearing on SERPs. To enter the ad auction process, a company must first identify keywords for which it wants to create ads and the budget it is willing to spend per click on each keyword (Barlas, 2004). The company enters the auction process when Google determines the user's search query contains the bid keywords. The auction process involves selecting the most suitable ad that Google will place on SERP for the keywords. In this process, Google considers two key factors: the budget the company offered for the keywords and the ad's quality. The more relevant the ad is to the user, the higher the likelihood that the user will click on it and have a pleasant experience on the landing page, thus indicating higher ad quality. Higher budgets and higher-quality ads win the best placement (Terrance et al., 2018).

Social Media Marketing Strategy. Social media marketing involves digitally presenting, promoting, and selling products and services through social media platforms. Various promotional and sales campaigns are utilized on social media to achieve different business objectives, such as increasing website followers, higher sales rates, increased customer interactions, and more. Additionally, social media marketing includes purpose-built data analytics that enables companies to track the success of their marketing efforts. There are also metrics on social media to monitor advertising costs, allowing an exact determination of return on investment (ROI) (Li et al., 2021).

The first step in defining a social media marketing strategy is selecting the appropriate platform based on the company's domain and business goals. According to authors Li et al. (2021), social media platforms are classified into four groups: social networking sites (e.g., Facebook, Google+), microblogging sites (e.g., Twitter), professional networking sites (e.g., LinkedIn), and content-sharing sites (e.g., YouTube).

Another crucial element of the strategy is targeting potential customers/users properly. Targeting can focus on individuals following the company's page on a specific social media or based on their past behaviour, interests, and recent purchases. Creating high-quality content is an essential strategy element, regardless of the social media platform used (Li et al., 2021).

Content Building Marketing Strategy involves creating and distributing both valuable and educational content in various formats to attract or retain customers (Vinerean, 2017). Jarvinen and Taiminen (2015) expand this definition, emphasizing the goal of increasing customer engagement in company relationships. Similarly, Du Plessis (2015) also highlights

the importance of engaging consumers in interactions with the company, introducing the concept of brand storytelling.

Rovlei (2008) identified three content groups: free, paid, and social content. Companies create free content to generate more customer engagement and build better relationships with them, aiming to sell products and services. In addition to increased engagement with paid content, the aim is also to sell digital content. Social content is created by brand/company community members expressing their views and opinions and exchanging knowledge and experiences with other members.

Companies can incorporate numerous tactics into their content marketing strategy. Some of the most common in practice are (Vinerean, 2017):

1. Blog posts published on the website's page and then shared on social media to target the desired audience. Blogs are also part of the SEO strategy, optimized and written for keywords or phrases users search for in search engines. Blogs aim to provide potential customers with valuable content, attracting them to the website and aiding the conversion.
2. Ebooks are valuable content for potential customers, containing comprehensive information on a specific topic of interest. Ebooks are a leading tool for lead generation, as potential customers typically need to provide their contact information to access this free resource.
3. Videos provide the highest audience engagement on social media and websites. Videos typically demonstrate products/services, explain a problem or present topics of interest to the target audience.
4. Guides are instructions containing steps to achieve a task/goal.
5. Podcasts are pre-recorded interviews and edited radio shows discussing topics attractive to the company's target audience. Podcasts are a good tactic for expressing the brand/company's expertise and credibility and for lead generation through audience subscriptions.
6. Webinars involve experts and leaders from specific fields discussing topics of interest to potential customers. Webinars contribute to building the brand/company's credibility.
7. Case studies are a content tactic that shares customer success stories, demonstrating how the company's products/services have helped a specific customer. The goal is to support the customer's decision to make a purchase.
8. User-generated content refers to texts, images, videos, or audio created by loyal customers. Such content is significant for companies, and they should redistribute it to increase its visibility to potential customers. It contributes to building the reputation of the brand/company.

2. AI, machine learning, and data science for digital marketing

AI represents a large set of methods, techniques, and approaches to data processing that enable the intelligent behaviour of computers or machines, hence the development of intelligent computer systems (Ng, 2018). It is an interdisciplinary field that comprises numerous sub-disciplines and requires their study, such as computer vision, sensors, robotics, and language synthesis (Kotu & Deshpande, 2019). It is closely related to machine learning and data science.

Machine learning represents the widest subset of AI. It is considered one of the AI tools enabling learning from experience without explicit programming (Goodfellow, Bengio, & Courville, 2016), (Ilić, Šijan, & Predić, 2023). In terms of computers and machines, experience comes in the form of data from which algorithms learn patterns, relationships, and variations. The ability of computers to acquire knowledge through the extraction of patterns from data is called machine learning (Goodfellow, Bengio, & Courville, 2016). Thanks to patterns extracted from data, machine learning also enables automated decision-making without instructions or pre-programming. Based on the way it learns from data, machine learning algorithms are classified into unsupervised learning, supervised learning, and reinforcement learning, which goes beyond the scope of this work (Goodfellow, Bengio, & Courville, 2016).

Unsupervised learning algorithms seek to discover patterns or natural groupings in data. It has no prior knowledge about the data reflected in the structure of the used datasets. The datasets are unlabelled, comprising only input attributes. The main task of the unsupervised learning algorithm is to discover hidden patterns and relationships in such datasets. The algorithm independently learns about the relevant characteristics of the set and its structure. Based on uncovered patterns, the algorithm identifies similar examples and groups data into meaningful segments with pronounced internal cohesion (Grljević, 2023). The results of unsupervised learning are segments, clusters, or groupings of related data, associations in data that indicate events that occur sequentially or simultaneously, sequences of data, etc.

In supervised learning, algorithms learn how to solve a specific task, i.e., they learn about the characteristics and data structures specific to a task. Supervised learning datasets consist of well-defined examples, each pre-labelled with a corresponding output or class attribute, facilitating clear distinctions in the learning process. Based on the available historical data, the supervised learning algorithm learns about the characteristics of input features, enabling it to map them to corresponding output values (Grljević, 2023). The goal is to determine the outcome (output attribute value) for a new, unknown instance based on what has been learned.

Data science is an interdisciplinary scientific research field combining methods, techniques, and approaches of machine learning and other quantitative fields, such as statistics, logic, and computing (Wing, 2020), (Kotu & Deshpande, 2019). The aim is to extract knowledge and insights from business data. The term ‘science’ in data science indicates that methods and techniques are grounded in evidence, empirical knowledge, and historical observations. Data science and machine learning are inconsistently used. They are

not clearly demarcated and are often equated. The main difference between machine learning and data science is reflected in the problems and tasks they address. Data science projects aim to develop an analytical model that will provide insights into the data and enable companies to make informed business decisions and take the necessary actions (Grljević, 2023). Machine learning applications aim to automate particular tasks.

A spectrum of diversified AI and machine learning methods and techniques support digital marketing. This section is restricted to clustering, classification, regression, and natural language processing (NLP). Clustering is one of the most prominent unsupervised machine learning approaches to marketing that underlies segmentation and user profiling. Classification and regression are the most prominent supervised learning approaches for marketing, underlying predictive analytics. NLP enables computers to understand and manipulate human language.

2.1 Unsupervised machine learning for customer segmentation and user profiling

To optimize digital marketing strategies, companies must understand target market characteristics (Indartoyo, Rahayu, Budiwan, Bismo, & Sadeghifam, 2016). The premise is that different consumers of services and products or website visitors exhibit not only various socio-demographic characteristics but also behavioural and psychological ones, and they use different keywords or vocabulary in content searches (Indartoyo, Rahayu, Budiwan, Bismo, & Sadeghifam, 2016). Therefore, the primary step of the marketing strategy is to understand consumer behaviour through the segmentation of the consumer base, user profiling, and analysis, which is achieved by applying clustering algorithms and interpreting the results. The main task of clustering is segmenting a heterogeneous dataset into subsets of elements with a high degree of mutual cohesion (Bošnjak, Grljević, & Bošnjak, 2019). Segmentation should ensure that one group, the so-called cluster or segment, comprises the most similar examples, which at the same time significantly differ from the examples belonging to other clusters (Grljević, 2023). In marketing, the dataset consists of data on the behaviour of consumers or website users. Based on the available data, the clustering algorithm derives patterns that describe different groupings and profiles of consumers according to similarities that clients exhibit in shopping behaviour, activities on the website, reactions to ads, preferences, socio-demographic data, or other characteristics. The resulting segments and consumer profiles provide intelligent and personalized recommendations to consumers based on discovered patterns in purchases, consumer behaviour on websites, or related products in the consumer basket (Grljević, 2023).

Clustering is an essential technique for segmentation and user profiling. As such, it is beneficial in various marketing strategies. Understanding user profiles enhances:

1. SEO strategy. User profiling enables the company to adjust keywords incorporated into the content of the website and to deliver results adapted to different segments, their behaviour on the site, and search patterns (Indartoyo, Rahayu, Budiwan, Bismo, & Sadeghifam, 2016).
2. Pay-per-click strategy. Understanding user profiles can help companies adjust and customize ads based on insights about different audience segments (Weideman & Neethling, 2006).

3. Social network strategy. User profiling underlies content personalization and campaign personalisation. It enables adjustments following the needs and interests of individual segments ((Kaushal, Ghose, & Kumaraguru, 2019), (Vasanthakumar, Sunithamma, Deepa Shenoy, & Venugopal, 2017)).

2.2 Supervised machine learning for predictive analytics

Predictive analytics forecast the likelihood of future events or patterns based on historical data (Ravi, Khandelwal, Shiva Krishna, & Ravi, 2018), (Sheikh, 2013), (Riahi, Saikouk, Gunasekaran, & Badraoui, 2021). They create a better future for the company by providing timely insights and knowledge about unwanted outcomes and making effective business decisions based on the probability of certain events (McKnight, 2014).

Predictive models use supervised machine learning algorithms for classification or regression and neural networks for time series analysis when predicting trends. Classification and regression are similar machine learning tasks. The goal of classification is to predict the output class. Based on the input attributes, the classifiers identify to which category, so-called class, a particular instance belongs. Examples of a classification task are predictions of customer behaviour, such as propensity to buy a product, identifying users who will click on an ad, or predicting visitors more likely to engage or converge into users. The goal of regression is to predict the numerical value of the output. Examples of regression tasks are predictions of the number of visitors, the number of clicks per ad or content, or the price of online ads. Prediction models undergo training and testing phases. During the training stage, the model learns from input data about the characteristics of input data and the most successful way of mapping them to output/target values (Grljević, 2023). During the testing phase, the model uses unseen data to assess the performance of the developed model, which, in a way, represents a simulation of how the model will perform during the deployment stage.

In this paper, we observe predictive analytics twofold: predictions of user behaviour or preferences and predictions of anomalies. Table 1 summarizes the role and place of predictive models that forecast user behaviour and preferences in digital marketing strategies. These models typically use historical data about a) user preferences of products, services, or content or b) user behaviour reflected in their engagement with the website, content, or ads.

Predictive analytics are also used to identify problems before they happen, such as anomalies and fraudulent activities. Anomaly detection is a machine learning task that examines events or objects and marks some as atypical examples (Grljević, 2023). It requires data with clearly distinguished and labelled non-fraudulent and fraudulent examples of activities or transactions from which the model learns differences in behavioural patterns (Grljević, 2023). In digital marketing, the detection of anomalies primarily refers to the identification of click frauds. Fraudulent online activities dishonestly deplete ad budgets and compromise the integrity of the online advertising industry (Choi & Lim, 2020). Click fraud significantly damages an advertiser's return on investment. Around 30% of ad revenue is wasted on click fraud (Haider, Iqbal, Rahman, & Rahman, 2018). Therefore, anomaly and fraud detection are particularly important for the optimization of social network strategy, targeted ads, search engine marketing, and pay-per-click strategy.

Table 1. The role of predictive analytics in digital marketing strategies

Data	***Digital marketing strategy***	***Goal***
User preferences	*Search engine optimization*	*Personalize results based on predicted search patterns.*
	Social network	*Anticipate trends and customize strategies based on user behaviour and preferences.*
User engagement	*Pay-per-click*	*Identify visitors more likely to engage with ads.*
Preferred content	*Content building*	*Create more effective and engaging content based on predictions of the content visitors are more likely to engage with.*

Source: the authors

2.3 Natural language processing

Textual data constitutes approximately 80% of the Internet's content (Dixon, 2023), (Anandarajan, Hill, & Nolan, 2019). For companies to thrive, understanding and processing texts becomes paramount. Unlike humans, comprehending natural language is a challenge to computers. Natural Language Processing (NLP) is a newer scientific research field that addresses this challenge, allowing computers to understand and generate text (Grljević, 2023). NLP combines computing, artificial intelligence, and linguistics knowledge to derive meaning from natural language (Farzindar & Inkpen, 2015). It stands out as the most trending and dynamic field within AI. Applications, such as text generators; chatbots and dialog agents that can automate customer support, order goods, or simulate sentience; written and spoken search; speech recognition programs that parse spoken language into words, and vice versa; or online advertisement matching, drive NLP. With its wide range of applications, NLP is beneficial for various digital marketing strategies described in the context of several NLP tasks: sentiment analysis, topic modelling, text generation, and speech recognition.

2.3.1 Sentiment analysis

Individuals perceive the world from their perspective, often focusing on diverse aspects of the same phenomenon or entity. These observations lead to the formation of opinions, attitudes, and expressions frequently shared on social media platforms. User-generated texts, encompassing comments, discussions, articles, and posts, represent the dominant form of expression of opinion and communication on social media, reflecting public sentiment, human interaction, and culture. While an individual's opinion reflects a subjective stance, the aggregation and analysis of numerous opinions offer a comprehensive view of public sentiment on specific topics, entities, persons, events, and more (Pang & Lee, 2008). Sentiment analysis forms the basis of such analyses, involving the identification of expressed sentiment polarity. Machine learning, particularly classification, serves as the underlying technique for sentiment analysis, typically categorizing sentiment into positive, negative, and sometimes neutral (Grljević, 2023). The application of sentiment analysis proves invaluable

in diverse business tasks, including market research for advertising, business intelligence, real-time understanding of consumer choices and sentiments, as well as market trend detection, technology discovery, and identification of markets in need of specific products (Grljević, 2016).

Sentiment analysis is relevant for social networking, content building, and SEM digital marketing strategies. Sentiment analysis strives to detect prevailing sentiment in user-generated content from social media. In social network strategy, sentiment analysis enables social listening through monitoring and analysis of social media conversations relevant to a company and its brand, as well as to competitors and the industry. Sentiment analysis insights help companies to understand public opinion and adjust marketing strategies by sentiments (Micu, Micu, Geru, & Lixandroiu, 2017), (Markić, Bijakšić, & Bevanda, 2016). Sentiment analysis enhances SEM strategy by enabling companies to understand the public perception of a brand and the public perception related to competitors. Insights help advertisers adjust messages and strategies based on sentiment analysis results (Fan & Chang, 2009). In content-building strategy, sentiment analysis allows companies to understand the public stance towards relevant topics, track changes in sentiment over time, and create content that resonates with the audience and is more contextually relevant (Salminen, Yoganathan, Corporan, Jansen, & Jung, 2019), which is closely related to topic modelling.

2.3.2 Topic modelling

Topic modelling is an unsupervised technique that identifies and extracts hidden thematic structures in texts (Maier et al., 2018). Topic modelling algorithms take a collection of documents as input and output a list of topics with assignments of proportions of each topic in the document. Topics are defined as lists of keywords. The main goals are to discover the leading topics that documents cover, to identify how the topics are interconnected, and to monitor the development and changes in current topics over time (Grljević, 2023). Thematically related conversation detection is relevant for business as it enables monitoring of trends, emotions, rumours, and triggers that drive people to particular actions. In commercial applications, topic modelling is used in the tasks of document classification, where categories are added to new documents based on the topics the document contains, information retrieval, and for improving sentiment analysis and decision-making in the field of marketing (Grljević, 2023). In addition, topic modelling is essential for content-building digital marketing strategy as identification of trending themes helps marketers create content that aligns with popular and relevant topics for targeted audiences.

2.3.3 Natural language generation

Natural language generation (NLG) is an aspect of NLP dedicated to creating texts similar to human-written texts. NLG can be observed twofold as an aid to autocomplete and chatbots. Autocomplete predicts the following word in a sequence. Industry autocomplete applications refer to predictions of search queries or content generation in different genres or formats, such as tweets or blogs (DeepLearning.AI, 2023). Chatbots automate conversation by supplying a database of questions and answers or by simulating dialogs with a human conversant.

NLG is particularly useful for SEO, content building, and social network digital marketing strategies. Traditional SEO projects involve labour-intensive and expensive

manual content creation. AI-assisted tools can help to address these costs by generating relevant and high-quality content for the websites' landing pages (Reisenbichler, Reutterer, Schweidel, & Dan, 2022), which is crucial for SEO strategy as search engines prioritize content aligned with user intent. Automation of content writing can aid in dynamic content creation and adaptation to user preferences, intentions, and sentiments, which personalizes the overall experience.

2.3.4 Automatic speech recognition

Automatic Speech Recognition (ASR) allows computers to convert human speech into text data. It analyses grammar, syntax, structure, and composition of audio and voice signals to comprehend and process human speech. ASR finds applications in voice commands, spoken questions, voice searches, virtual assistants, voice ads, personalized voice messages, and transcriptions (Yu & Deng, 2015). Developing ASR-based systems is particularly challenging due to variations in speech patterns influenced by factors such as gender, race, age, speech impairment (dysarthria, stroke survival, oral cancer, or cleft lip and palate), and accents (regional or non-native), as reported by authors (Feng, Halpern, Kudina, & Scharenborg, 2024). Feng et al. (2024) indicate that ASR systems favour female speakers and misrecognise the speech of African American speakers more often than of white speakers. According to the authors, recognition of child speech poses a greater challenge due to the shorter vocal tracts, slower and more variable speaking rates, and less precise articulation in children.

3. Case studies of the application of AI in digital marketing

This chapter presents three case studies of large, successful companies positioned as innovators in the market. The studies illustrate how specific AI techniques enhance digital marketing strategies.

3.1 Coca-Cola case study

The Coca-Cola Company is a renowned brand in the beverage industry, holding a position as an innovator in the market. With the advent of voice technology, the company recognized an opportunity to launch an innovative marketing campaign titled "Using Your Voice to Share a Coke," engaging consumers in an interactive and personalized manner. In this campaign, Coca-Cola utilized Voice AI technology for voice recognition and processing, allowing consumers to personalize the appearance of Coca-Cola labels on bottles. The campaign resulted in the participation of a large number of consumers, distinguishing itself from competitors by pioneering the use of voice technology for personalized marketing efforts. The innovative use of Voice AI technology set the campaign apart and demonstrated how AI can be leveraged to create unique and memorable customer experiences (Westwater, 2023).

3.2 Starbucks case study

Starbucks, one of the most renowned brands in the global coffee shop industry, recognized the need for innovative marketing strategies to stand out from the competition. The goal was to enhance the personalized experience for its customers worldwide by implementing

predictive AI and machine learning. For this reason, Starbucks developed the platform - Deep Brew. The platform enables data analysis on preferences, order history, and customer behaviour. Embedded algorithms allow the platform to suggest products tailored to customers' unique desires and needs based on the analysis results. Through personalized offerings, AI has enabled Starbucks to build deeper connections with its customers. Personalized recommendations, order predictions, and intuitive menu adjustments through the Deep Brew platform have increased user engagement and brand loyalty, leading to higher sales and an enhanced reputation for Starbucks. Thanks to this AI-based digital transformation of marketing activities, Starbucks saw its user base grow to nearly 18 million by the end of 2019 (Hyperight, 2021).

3.3 Nike case study

Nike, a sports apparel and footwear global leader, recognized the significance of leveraging AI to enhance customer engagement, build greater loyalty, and strengthen brand connections through highly personalized marketing experiences. Nike initiated a personalized design campaign using AI as a primary technology. The introduction of AI into marketing strategies involved several steps. The first step involved consumer segmentation based on data from customer interactions on the Nike app and social media. Segmentation enabled a deep understanding of user preferences, insights into past purchases, and identification of behavioural patterns. The second step involved the application of machine learning algorithms to create personalized design recommendations for each user. In the third step, digital marketing automation tools are implemented to distribute personalized marketing messages through various digital channels. The integration of these tools allowed Nike to automate many marketing activities, including targeted ad placements, to achieve broader campaign visibility. The fourth step utilized analytical tools to track key campaign performance metrics: user engagement rate, conversion rate, and revenue increase rate, enabling Nike to evaluate campaign effectiveness and adjust the strategy in real time (Westwater, 2023).

Through the systematic implementation of AI, Nike successfully harnessed the potential of artificial intelligence to enhance personalization and improve overall marketing efforts. The campaign resulted in a significant increase in customer engagement, improvement in retention rates, and overall revenue growth (Westwater, 2023).

Relevant success factors of this campaign lie in a deep understanding of the target consumer group and their needs, innovative application of AI technology, and effective integration with other marketing tools. Through their synergy, Nike demonstrated how AI can revolutionize the approach to personalization and enhance marketing strategies.

Conclusion

This paper explores the key ways in which AI transforms digital marketing strategies, including SEO, SEM, social media, and content-building. Through the analysis of various aspects of digital marketing and the use of data, machine learning, and AI, the authors revealed that AI plays a crucial role in enhancing personalization, data analysis, and the automation of marketing processes.

Coca-Cola, Starbucks, and Nike case studies provide concrete examples of AI applications to create innovative campaigns and deepen customer relationships. By applying technologies such as voice recognition, customer data analysis, personalized recommendations, and automation, these companies demonstrate the power of a holistic and integrated approach to technology in achieving marketing goals, such as increased customer engagement, loyalty, and improved marketing performance.

The case studies show significant implications for the broader application of AI in digital marketing. Lessons learned from these cases can guide other companies in harnessing the potential of AI for transformative marketing initiatives. The success of these case studies points to the importance of innovation in digital marketing. Companies that use AI for unique and personalized marketing campaigns, such as Coca-Cola, stand out in the market. Innovation becomes a powerful tool for market differentiation. AI-driven marketing strategies like Starbucks and Nike improve customer experience and drive brand loyalty. Increased engagement, such as the one achieved by Nike's personalized design campaign, leads to higher retention rates and sustained customer loyalty. Companies that use AI to analyse customer data, such as Starbucks, can make informed decisions about product offerings, marketing strategies, and overall business direction, in line with the broader trend of businesses becoming more data-centric. AI automation enables scalability and readability. Companies can streamline marketing activities, target specific audiences with personalized messages, and achieve broader campaign visibility, which can be especially valuable for globally operating companies.

Case studies illustrate how large enterprises leveraged AI to improve digital marketing strategies. To implement similar technologies, small and medium-sized enterprises might face limitations such as resource constraints in terms of limited data, budget limitations, high costs of acquiring necessary technology infrastructure, and shortage of expertise and talent as AI-driven campaigns require specialized knowledge and skills. In these terms, the research presented in this paper has limitations as it does not reflect on the possibilities of AI implementations in small and medium-sized enterprises and it does not address how these enterprises can overcome the challenges.

The research presented in this paper emphasizes that AI is a means of more efficient marketing and a driver of innovations that transform how brands communicate with their target audience. These conclusions underscore the importance of integrating AI into contemporary marketing strategies for companies to gain a competitive edge and remain relevant in the digital ecosystem.

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Enterprises' effectiveness: a study on structure, focus, and enterprises' outcomes

Ефективност предузећа: студија о структури, фокусу и исходима предузећа

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Abstract: To obtain and retain high performances enterprises are affected by various constituencies's' needs and expectations which are important part of their organizational operationalization. The research goal is to validate the psychometric properties of a widely used holistic view of enterprises performance defined by competing value framework in context of enterprises in transition economy such as Republika Srpska, Bosnia and Herzegovina. To fulfil the aim of the research, a quantitative, research design based on cross-section data was carried out to collect and analyses data from 224 organizational representatives. Covariance-based structural equations modeling was used to test the competing values approach and, if needed, to modify a measurement scale that identifies the extent to which sampled enterprises use the measurement criteria of each aspect of effectiveness to validate the effectiveness of enterprises. All models of effectiveness have acceptable reliability and convergent validity, and discriminant validity of each model was established. Model fit measures indicate acceptable goodness-of-fit. Academics and managers may consider using these measures of effectiveness to better understand the performance/effectiveness phenomenon and have better insight into possibilities for enhancement of different aspects of effectiveness. This study represents the first attempt to investigate and validate the presence of mutual dependence of certain aspects of effectiveness based on a competing values approach in a specific research context.
Keywords: effectiveness of enterprises; competing values approach; constituencies; covariance-based structural equation modelling
JEL classification: C39, D22, L20, L25

Сажетак: Како би постигла и одржала значајне перформансе предузћа су суочена са очекивањима и захтевима различитих конституената који су неизоставан дио функционисања предузећа. Циљ истраживања је вредновати психометријска обележја широко кориштеног свеобухватног приступа перформансама предузећа дефинисаног оквиром конкурентских вриједности у контексту предузећа Републике Српске, Босне и Херцеговине. Ради испуњавања постављеног циља, квантитативни упоредни истраживачки дизајн је употребљен ради прикупљања и анализе података добијених од 224 представника предузећа. Коваријансни приступ моделу структурних једначина је кориштен ради тестирања приступа конкурентских вредности, и, по потреби, извршено прилагођавање мерне скале која идентификује у којој мери узоркована предузећа користе мерне критеријуме сваког аспекта ефективности ради вредновања ефективности предузећа. Сви модели ефективности имају прихватљиве вредности поузданости и валидност садржаја и дискриминанта валидност свакод модела је успостављена. Мере подобности модела имају прихватљиве вредности. Академска заједница и менаџери могу размотрити употребу ових мера ефективности ради бољег разумевања феномена перформанси/ефективности и бољег увида у могућности унапређења различитих аспеката ефективности. Ово истраживање представља прво настојање да се

испита и вреднује присуство међусобне зависности одређених аспеката ефективности према приступу конкурентских вриједности у специфичном истраживачком контексту.
Кључне речи: ефективност предузећа, приступ конкурентских вредности, конституенти, коваријансни приступ моделу структурних једначина
ЈЕЛ класификација: C39, D22, L20, L25

Introduction

More than a century ago, numerous attempts to determine the origin of effectiveness of enterprises prevailed much of performance measurement stream (Taylor, 1911; Towne, 1886). Although intention to resolve the vague phenomenon of effectiveness has generated numerous attempts both among academics and the business community, the researchers made tremendous effort to organize in formal frame the criteria of enterprise effectiveness (Quinn & Rohrbaugh, 1983; Campbell, 1977). The most outstanding of these efforts has been the development of the competing values framework or approach to enterprise effectiveness (CVA) (Quinn & Rohrbaugh, 1983). Even though the CVA was originally developed to address the problem of identification of the effectiveness criteria, the CVA has been used in the examination of various enterprises' phenomena, such as enterprise culture, effectiveness and leadership styles, the development of the enterprise and human resources (Cameron & Freeman, 1991; Quinn & McGrath, 1985; Quinn & Spreitzer, 1991; Zammuto & Krakower, 1991). Some researchers used the CVA to study the stages of the enterprise development (Quinn & Cameron, 1983), compatibility between organizational culture values and business strategy (Bluedorn & Lundgren, 1993), the effectiveness of information systems used in management (Cooper & Quinn, 1993), and enterprise transformations (Hooijberg & Petrock, 1993).

According to the above, the CVA has a wide span of issues in contemporary organizational research stream and is a valuable methodology for better understanding of the conceptualization of effectiveness and measurement issues. To operationalize the CVA, Quinn and Spreitzer (1991) proposed the measurement scale for the CVA. According to their methodology, this research uses a covariance-based structural equations modeling technique (CB-SEM) to evaluate the structure of the CVA.

There has been limited empirical validation of the CVA as measurement instrument, especially in the cases of enterprises from transition economies. Some studies used different approaches such as multidimensional scaling, especially in the current research context (Zlatković, 2018), but they did not apply CB-SEM as an advanced modelling technique. Thus, the research aim is to assess viability of the previously psychometrically established CVA instrument. Therefore, it is important to understand if an organizational effectiveness instrument is reliable and valid when applied to the context of enterprises from Republika Srpska, Bosnia and Herzegovina. The research findings reveal that it would be more valuable to apply the proposed measure of the enterprises' effectiveness based upon the CVA, as a more complex and holistic measure of the effectiveness and performance, allowing for adjustments when dealing with heterogeneous enterprises' settings and contexts.

In the first part of the paper, theoretical background of enterprise effectiveness and the usage of the competing values approach are presented, which implies that the competing values approach represents a valuable way of operationalizing enterprises' effectiveness in many different research contexts. Next, the research methodology represents data collection procedure, structure of sample and applied econometric modeling technique, align with the steps of the performed data analysis and research results. The results reveal that the competing values approach to effectiveness of enterprises in the context of Republika Srpska, Bosnia and Herzegovina, are acceptable and viable. Also, certain suggestions made for the managers of the enterprises in the Republika Srpska, Bosnia and Herzegovina, are discussed.

1. Theoretical background

Enterprise effectiveness represents the central theme of the organizational performance stream. The significance of the enterprise's effectiveness is represented by the fact that "enterprise effectiveness is ultimate and the highest aim of any form of the organizational analysis "(Hall, 1980). Many scholars and researchers have different approaches to addressing enterprise effectiveness, which, consequentially, leads to tremendous conceptualizations and definitions of enterprise effectiveness. All of these definitions depend on the level of the complexity, varying from simple view that "activity is effective if it fulfils the specific objectively determined goal" (Barnard, 1938) to effectiveness understood as reflection of the precise focus and concept in applied science rather than abstraction in pure science (Hannan & Freeman, 1977). Some authors suggest that the construct of effectiveness is a "value concept". There are infinite numbers of values that can serve as basis of effectiveness and therefore there can be infinite numbers of models of effectiveness (Zammuto, 1984). The construct of enterprise effectiveness is based on judgement of individuals upon desirable outcomes of enterprise functioning, from different point of views of the stakeholders, which are directly or indirectly influenced by enterprise performance (Zammuto, 1984). Enterprise effectiveness represents a "society construct, an abstraction located in the minds of organizational scholars and researchers" (Quinn & Rohrbaugh, 1983). The complexity of the issues regarding the assessment of the enterprise effectiveness is revealed in the fact that, in final analysis, enterprise effectiveness represents a phenomenon defined by the relevant stakeholders of the enterprise (Campbell, 1977).

Conceptualization, interpretation and measurement of the enterprise effectiveness still represents a challenge (Eydi, 2015; Olivier, 2014; Oghojafo, Muo, & Aduloju, 2012). Many researchers concur that the unique definition of enterprise effectiveness does not exist because it represents various aspects to each constituent (Eydi, 2015; Martz, 2008). However, there is consensus that the construct of enterprise effectiveness is comprehensive and compositive in nature and it requires development of the different aspects and measuring various criteria, while process and ends need to be treated while evaluating the enterprise effectiveness (Fedajev et al., 2022; Eydi, 2013; Oghojafo et al., 2012).

To acknowledge the multidimensional and complex nature of the construct of effectiveness, enterprise effectiveness is addressed as a broader concept than enterprise performance and efficiency (Martz, 2008; Olivier, 2014). While establishing enterprise performance and efficiency measures represents the process point of view, the enterprise effectiveness models capture construct perspective (Martz, 2008). Enterprise effectiveness includes both measures of organizational performance and efficiency aspects (Martz, 2008; Venkatraman & Ramanujam, 1986) as well as other aspects of enterprise functioning important from the angles of different stakeholders (Richard, Devinney, Yip, & Johnson, 2009).

2. Enterprise effectiveness measurement

From the beginning of the early industrialization, defining and measuring enterprise effectiveness has represented a significant subject in organizational theory and research development. In earlier periods, the term "effectiveness" indicated efficiency or technological efficiency. (Taylor, 1911). In line with development of the concept of enterprise, the understanding of effectiveness and efficiency has changed. Meanwhile, more comprehensive concepts of effectiveness emerged that can differ regarding the idea of observing the effectiveness. Variety of these concepts could be understood only through acknowledging that nature of the concept does not possess limits and has numerous conceptualizations (Whetten & Cameron, 1984).

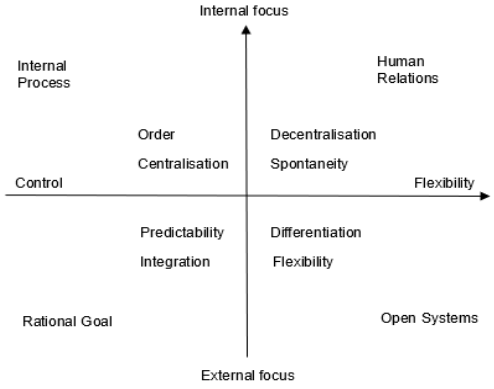
Traditional approaches to enterprise effectiveness measurement are characterized by partial and incomplete perceiving of the enterprise effectiveness. Further development of the concept of enterprise effectiveness revealed more complex and comprehensive approaches to assessing enterprise effectiveness. The mutual characteristic of the contemporary approaches to enterprise effectiveness represents the acceptance of the enterprise intention to achieve multidimensional objectives while executing various organizational activities and using available resources.

There are several most mentioned traditional approaches to enterprise effectiveness, such as goal attainment approach, internal process approach and system resource approaches (Eydi, 2013). The goal attainment approach suggests the determination of the goals to measure enterprise effectiveness. The criteria of effectiveness of internal process aspect reveal the significance of the intensity of relationships between individuals as criterion of effectiveness as well as confidence, integrated systems and procedures and continuous functioning as more precise measures of the enterprise effectiveness in comparison with goal attainment approach. The system resource approach indicates that ability of the enterprise is to draw near necessary inputs to establish viability and to measure resources and outcomes. Among others, the multiple constituencies approach and competing value approach are considered as contemporary approaches to enterprise effectiveness. The multiple constituencies approach is focused on determination of the crucial stakeholders and their views of the enterprises' effectiveness to reveal different and specific domains of interests in enterprise performance (Eydi, 2013).

2.1. Competing values approach to effectiveness

The competing values approach (CVA) to enterprise effectiveness is based on the identification of the fact that enterprises' objectives are managed by different expectations of multiple stakeholders with mutually competing views on effectiveness subject. The CVA represents the product of the theoretical and empirical contributions of organizational effectiveness research stream (Quinn, 1981; Quinn & Rohrbaugh, 1981). This approach is based on three axes or value dimensions: focus, structure and outcomes (Quinn & Rohrbaugh, 1983). The organizational focus includes external and internal focus. Internal focus is characterized by well-being and employee development, while external focus addresses condition and evolution of the enterprise. The organizational structure emphasizes control and flexibility. The dimension outcomes focus on planning and defining the enterprises' objectives in the form of means, while efficiency and productivity relate to ends (Quinn & Rohrbaugh, 1983). The four models of effectiveness according to CVA are presented in Figure 1.

Figure 1: The categorization of the effectiveness criteria - competing values approach



Source: adapted from Quinn and Rohrbaugh (1983)

According to CVA, the criteria of effectiveness are classified into four models of effectiveness: internal process, human relations, open systems, and rational goal model. The internal process model points out order, control, and communication and information processes. Enterprise's effectiveness is based on the process involved in the goods and services production (Muterera et al., 2012). Besides these characteristics, the internal process model includes measurement, identification of responsibilities and documentation, with emphasis on precise determination of roles and responsibilities. The criteria of effectiveness of human relations are focused on employee cohesion and morale as well as internal focus and flexibility. The aim is to fully develop and exploit the employees' potential and their commitment to enterprises' activities and operations. Consensus establishment and management conflict are also focal points of this model of effectiveness. The open systems model emphasizes that enterprises should acquire resources and use them productively to

achieve determined objectives. It is characterized by flexibility and external focus, enterprise's growth, and readiness to address environmental challenges. The open systems' criteria of effectiveness reveal the importance of the innovation and adaption of enterprises to external environment (Morais & Graça, 2013) as key aspects of effectiveness (Tregunno et al., 2004). The last among four models according to CVA, the rational goal model, is close to goal achievement model, and is directed towards stability and external focus. The model emphasizes the enterprises' ability to achieve precise goals determined by the stakeholders. Therefore, enterprises are assumed to be effective if they accomplish defined objectives such as profit or productivity (Morais & Graça, 2013).

According to CVA, characteristics of the four models of effectiveness reveal certain benefits of this approach. First, all issues regarding the multidimensional analysis of effectiveness are diminished because 16 criteria of effectiveness are included and sorted among four models of effectiveness. Second, problem of multiple criteria of effectiveness is resolved through deduction of the list criteria into narrow sets of discrete and well-defined criteria (Quinn & Rohrbaugh, 1981). Enterprise effectiveness is determined as value judgement of enterprise performance and therefore, "enterprise effectiveness definition determines the set of weighted criteria according to individuals' values, hierarchy, unit type, internal or external perspective and etc." (Quinn & Rohrbaugh, 1981).

The CVA is usable to visualize the possibilities to enhance the enterprise and to better understand effectiveness from different points of view. This approach encourages discussions on enterprise effectiveness measurement issues. The establishment of this approach provided an enormous contribution to better understanding of the enterprise effectiveness phenomenon because it simultaneously emphasizes the apparently contradictory values such as order and flexibility and internal and external focus, integrating the various concepts and theoretical fundamentals. The important contribution of the CVA is reflected in rising the awareness of the complexity effectiveness construct, revealing the emerged differences and connections of contradictory and competing values and their integration into comprehensive framework to help enterprises to deal with the issues of competing models. The value dimensions depicted in CVA indicate that effectiveness measurement is in line with various stakeholders' requirements. It enables inherent paradoxical nature of the effectiveness phenomenon to be represented in single framework, making it possible to balance between competing expectations regarding the identity of the enterprise as institution. The CVA emphasizes that the aim to determine the single criterion on effectiveness to be less likely to ensure higher value than the wider and more balanced approach as competing value view (Gulosino, Franceschini, & Hardman, 2016), which provides a holistic and compound view to measuring the effectiveness, allowing for adjustments in line with diverse enterprises' characteristics and backgrounds.

The CVA is widely used in many studies on organizational analysis to address various questions such as: enterprise culture and strategy (Bluedorn & Lundgren, 1993), transformation of enterprises (Hooijberg & Petrock, 1993), information systems management (Cooper & Quinn, 1993), employee participation (McGraw, 1993) and

cooperation (Rogers & Hilderbrandt, 1993). Some studies used competing value view to investigate enterprise culture (Cameron & Freeman, 1985; O'Neill et al., 2021; Zeb et al., 2021), quality of life (Zammutto & Krakower, 1991), and organizational transition (Quinn & Cameron, 1983). Compared to other approaches to measuring effectiveness, the CVA has an important role in applied studies as well as in psychometric investigation, with high validity scores and reliability like multidimensional scaling (Quinn & Spreitzer, 1991) and structural equation modeling (Kalliath, Bluedorn, & Gillespie, 1999). As mentioned earlier, the CVA is widely used to evaluate organizational culture, effectiveness and management styles.

2.2. Structural equation modeling – assessment of the viability of the CVA

The covariance based structural equation modeling (CB-SEM) technique is applied to investigate the CVA's viability in proposed research context. The CVA indicates that each latent construct of the enterprise's effectiveness shares two superordinate value dimensions: flexibility of control and internal of external orientation. This means that characteristic of each latent construct represents the distinctive ratio in which flexibility or stability and internal or external value dimensions are operating. According to theoretical framework of CVA, the human relations and open systems models of effectiveness have a common value dimension flexibility, the open systems and rational goal models of effectiveness have a common value dimension external orientation, the rational goal and internal process models of effectiveness share a value dimension order, and the internal process and human relations models of effectiveness share value dimension internal orientation, as shown in Figure 1. This conceptualization of enterprises' effectiveness indicates that CVA models of effectiveness that have common two superordinate dimensions (flexibility or control and internal or external orientation) are not orthogonal. Therefore, it is expected the models of effectiveness that have common superordinate value dimensions are more positively correlated, as follows. The research model according to CVA is presented in Figure 2.

Hypothesis 1: The correlation between the human relations and open systems CVA latent constructs is significant and positive.

Hypothesis 2: The correlation between open systems and rational goal the CVA latent constructs is significant and positive.

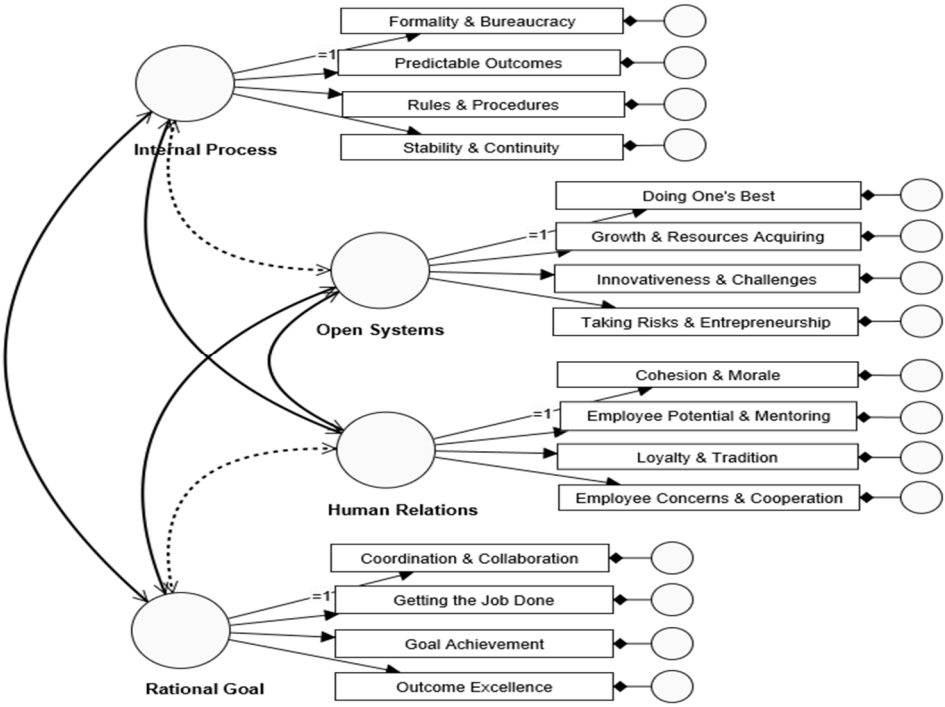
Hypothesis 3: The correlation between rational goal and internal process the CVA latent constructs is significant and positive.

Hypothesis 4: The correlation between internal process and human relations the CVA latent constructs is significant and positive.

According to competing value approach to enterprise's effectiveness, the two pairs of latent constructs of effectiveness placed in opposite quadrants in competing value framework do not share any common value dimension. Therefore, the value dimensions characteristic for human relations model of effectiveness such as high flexibility and internal orientation

does not share value dimensions with the effectiveness criteria of rational goal model, characterized by high level of control and dominant external orientation. In line with above-mentioned, it is expected that the relationship between these two models of effectiveness is to be orthogonal, i.e. to be uncorrelated. Similarly, the internal process model effectiveness, characterized with pronounced order and dominant internal orientation, and effectiveness criteria of open systems model, which suggest high flexibility combined with dominant external orientation, do not share any common value dimensions.

Figure 2: The conceptual research model of competing values approach to enterprise's effectiveness



Note: Rectangles represent measurement variables, and ellipses represent four latent dimensions of effectiveness according to competing value approach. Curved double-headed arrows depict correlations between these effectiveness models. The conceptual model is developed according to Quinn (1988), Quinn and Spreitzer (1991), and other organizational effectiveness literature.

Source: the author's analysis

It should be emphasized that defined hypothesized relationships exist within the structure of the competing value framework to enterprise effectiveness. Several studies have tested the viability of this framework in specific context. Therefore, the viability and content validity of the theoretical competing value approach to enterprise effectiveness should be tested in proposed research context of this paper. According to this, before investigating the significance and intensity of the relationships between effectiveness latent dimensions in research model, the overall fit of the theoretical competing value framework to enterprises

effectiveness was empirically verified (Hypothesis 5). Support for the overall fit of a theoretical model is obtained by the values of a several goodness-of-fit measures. Hence, it asssumed as follows:

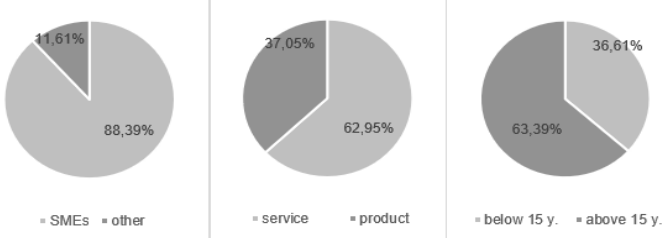
Hypothesis 5: As indicated by several goodness-of-fit indexes, there is an acceptable overall fit of the competing value approach to enterprise's effectiveness to the collected dat, as depicted in Figure 2.

3. Methodology and data

The data collection procedure is done via a well-structured survey questionnaire delivered to enterprises by email or in person. The feedback on quality of the questionnaire items and its content validity was obtained by conducting a pilot study. The final version of the questionnaire was created, with minor modifications according to pilot group's recommendations. The existing measurement scale was used to evaluate all latent constructs in the conceptual model. For this purpose, the original 16-item scale developed by Quinn and Spreitzer (1991) was used, with established psychometric characteristics. To measure latent constructs the seven-point Likert-type scale was used with range from "7 =strongly agree" to "1=strongly disagree". Respondents were asked to indicate to what extent they agree or disagree with the measurement items of each latent construct.

The questionnaire instrument was delivered to enterprises operating in different sectors in the Republika Srpska, Bosnia and Herzegovina. Along with the questionnaire, cover letter with all necessary information was delivered. Survey questionnaire written in native language was delivered to 500 organizations out of 3,838 organizations, using random sampling technique, registered at that moment in the Business Register of the Chamber of Commerce of Republika Srpska. The 243 enterprises chosen to participate in the survey and sent fulfilled questionnaires. After data cleansing procedures to detect the presence of missing values, pattern responses and outliers, several questionnaires were excluded from sample. Finally, the 224 enterprises represented the final sample used for data analysis procedures. The structure of the sample by following characteristics: transformation process, size and age, is presented in Figure 3.

Figure 3: Sample structure by size, age and transformation process



Source: the author's analysis

As presented in Figure 3, the final sample of the research consists of 84 (38%) and 140 (62%) product-oriented and service-oriented enterprises, respectively. Majority of the enterprises are SMEs (88.39%) older than 15 years (63.39%).

Additionally, majority of the product-oriented organizations belong to the following industries: construction, metallurgy and metal processing, agriculture, fishing, food, and tobacco industry. Among service-oriented organizations, majority of them are from communal and service, trade, and ICT sectors.

Structural equation modeling techniques allow defining the number of latent constructs in a research model. Also, it allows defining the number of items expected to associate with each latent construct in proposed conceptual model. The connection from one latent construct to the measurement indicators of another are constrained to have value zero (Bollen, 1989). These relationships in the conceptual model can be tested empirically for measures of the goodness-of-fit. The several goodness-of-fit indexes define the degree of correspondence between the implied and observed covariance matrices. These indexes characteristics represent a unique feature of the SEM technique compared to other techniques used in previous research to evaluate the CVA suitability. The suitability of a common-factor measurement model and the number of latent constructs known as latent constructs in the structural model cannot be determined completely (Kim & Mueller, 1978). However, the SEM techniques rise the level of confidence that the conceptual model is consistent with the parameters of the population. As second generation of the multivariate analysis techniques, SEM combines characteristics first generation techniques like principal component analysis and linear regression (Fornell & Bookstein, 1982) and it is assumed as useful technique in process of development and investigation of the theories which made this technique as "quasi-standard in novel research" (Hair, Ringle, & Sarstedt, 2012; Ringle, Sarstedt, & Straub, 2012). The CB-SEM can be considered as confirmatory approach by nature and very useful to further test established theory in various contexts.

4. Empirical analysis and discussion

Research model of enterprise effectiveness was evaluated using software SmartPLS version 4.0.9.8 (Ringle, Wende, & Becker, 2022), using CB-SEM technique. The performed analysis of the reflective measurement models revealed that an acceptable level of internal consistency, indicators' reliability and convergent validity and discriminant validity were established. For comparison purposes, the indicator of constructs' reliability Cronbach's α (1951) were calculated for all four constructs: internal process model (0.858), the open systems model (0.841), the rational goal model (0.795), and the human relations model (0.867). These coefficients compared favorably to those reported by Quinn and Spreitzer (1991): internal process model (0.77), open systems model (0.81), rational goal model (0.78), and human relations model (0.84), and those reported by Kalliath et al. (1999): internal process model (0.80), the open systems model (0.83), the rational goal model (0.83), and the human relations model (0.90).

The internal consistency analysis reporting the values of constructs' convergent validity and reliability as well as discriminant validity are presented in Table 1. The values

of indicators of internal consistency - Cronbach's α and composite reliability (ρ_c) (Churchill, 1979; Jöreskog, 1971) are considered high reliability and acceptable indices (above recommended thresholds of 0.6 (0.7) (Hair, Babin, & Krey, 2017; Nunnally & Bernstein, 1994). Internal consistency of the constructs is established.

Table 1: Competing values measurement scales of effectiveness – reflective measurement models

Panel a: Convergent validity and reliability			
Human relations	Internal process	Rational goal	Open systems
Cronbach's α			
0.867	0.858	0.795	0.841
Composite reliability (ρ_c)			
0.870	0.875	0.800	0.846
AVE			
0.623	0.618	0.503	0.593

Panel b: Discriminant validity - HTMT criterion			
	Human relations	Internal process	Open systems
Human relations			
Internal process	0.406		
Open systems	0.709	0.372	
Rational goal	0.319	0.524	0.516

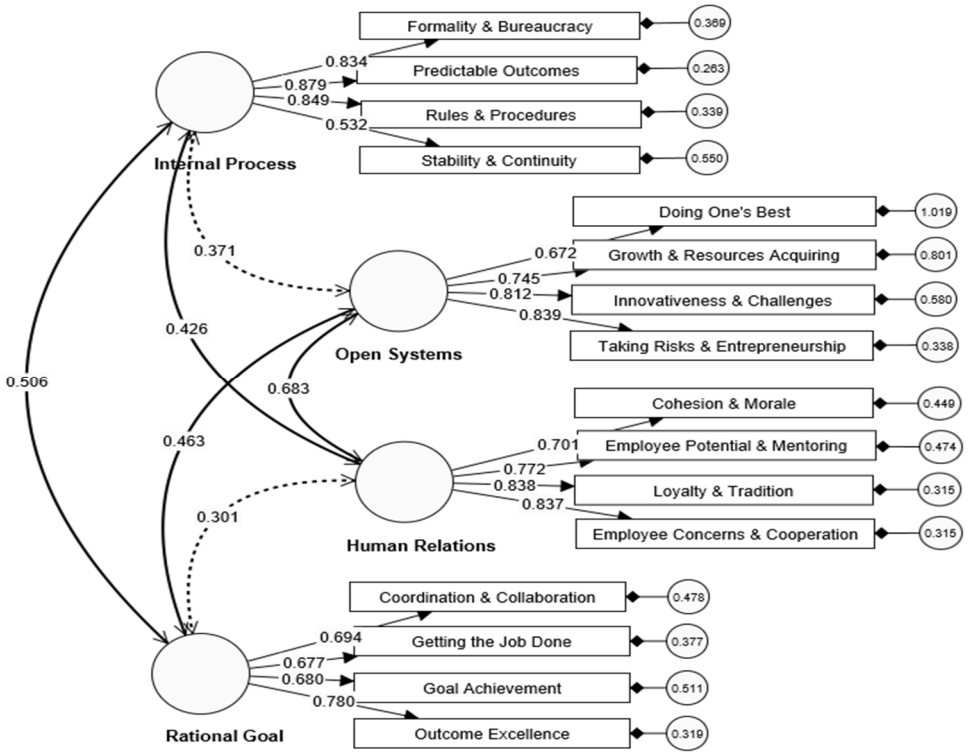
Source: the author's analysis

The values AVE exceed the threshold proposed in literature (0.5) (Hair et al., 2017). The indicators and constructs' reliability and validity assessments are presented in Table 1. Constructs' discriminant validity is checked using a recent criteria heterotrait-monotrait ratio (HTMT) (Hair et al., 2017). As more sensitive technique for detecting discriminant validity issues, HTMT criteria indicate HTMT values below more conservative HTMT threshold of 0.85 (Kline, 2023) suggesting that discriminant validity of constructs is established as shown in Table 2. The results of measurement model assessment are shown in Table 2, therefore, revealing that the measurement model was acceptable which provides a good foundation for testing the adequacy of goodness of fit of the proposed model.

The research findings suggest a good fit for the common-factor model as shown in Figure 4. A good fitting model is accepted if the value of goodness of-fit index is above threshold value of 0.9 (Hair et al., 2017). The estimated CB-SEM model has value of GFI = .93. Additionally, the estimated structural model has values of CFI = 0.96 (Bentler, 1990) and TLI = 0.95 (Tucker & Lewis, 1973), which are above threshold value of 0.9 indicating the adequate-fitting model is accepted. CFI is one of the most popular indices used in SEM. Root Mean Square Error of Approximation (RMSEA) (Steiger & Lind, 1980) takes the square root of the resulting ratio of the given population (Browne & Cudeck, 1992). It is considered the best informative fit index. Practical experience showed that a value of the RMSEA of about 0.08 or less would indicate a reasonable error of approximation and researchers would not want to use a model with a RMSEA greater than 0.1 (Browne & Cudeck, 1992; Hair et al., 2012; Shi & Maydeu-Olivares, 2020). Value of RMSEA of

estimated model is 0.05. To conclude, the fit indexes suggest that the measurement models is appropriate.

Figure 4: Results of structural equation modelling – competing value framework



Note: The numbers shown in the diagram, from right to left, are: standardized error term, standardized outer loadings, and correlations between latent constructs.

Source: the author's analysis

Figure 4 depicts the estimates of the model's parameters. The standardized outer loadings are consistently large, mainly above value of 0.708. Some indicators have outer loadings slightly lower than 0.708 (doing one's best for open systems model; coordination & cooperation, getting the job done and outcome excellence for model rational goal) or have values between 0.4 and 0.6 (indicator of model internal process - formality & bureaucracy), which are considered as acceptable (Hair et al., 2017). Additionally, these indicators should be omitted only if their omitting increases the AVE values. The decision is made to retain them to increase the constructs validity content (Hair et al., 2017). The results shown in Figure 4 indicate an acceptable fitting measurement model that suggests the existence of the four aspects of the enterprise effectiveness in line with competing value approach. According to the defined hypotheses 1-4 there are significant and positive correlations between all four models of the enterprises effectiveness as follows: between criteria of effectiveness of internal process and human relations, between human relations and open systems

effectiveness models, between open systems and rational goal effectiveness models and between rational goal and internal processes effectiveness models. Obtained data support these four positive relationships between all four latent constructs of enterprise effectiveness. However, obtained results indicate the two surprising results opposite to hypothesized relationships between internal process and open systems, and between human relations and rational goal. The obtained values of correlations between these constructs of effectiveness are lower than between constructs that share common value.

Theoretically based insignificant relationships between effectiveness models in opposite quadrants of the competing value framework, namely, between internal process and open systems and between human relations and rational goal, are not supported by the findings of the evaluated model, as shown in Figure 4 (0.371 and 0.301, respectively).

The obtained results indicate the adequacy of the CVA using CB-SEM according to the defined hypotheses 5. Thus, the performed examination of the competing values approach to effectiveness was very successful—with the exception of the findings on discovered significant relationship between opposite models of effectiveness. Apparently, the enterprises in Republika Srpska, Bosnia and Herzegovina, have simultaneously present value dimensions such as stability, flexibility and adaptability. Explanation for obtained results could be found in the assumption that these enterprises are finding themselves in period characterized by many market changes and, thus, aware of need to act quickly and adapt promptly internal as well as external in line with other enterprises. Enterprise have become more proactive in their actions to respond in time to predicted changes through development of creative changes in the organizational structures (Shortell, Morrison, & Friedman, 1990).

There is possibility that these enterprises only have stability and order in turbulent and unpredictable environment, as characteristic of the internal process model, and are possible through problem solving using creative and innovative approach and acknowledging new ideas, which depicts characteristics of the open systems model (Mirić, Aničić, & Petrović, 2023; Momčilović, Vujičić, & Doljanica, 2022). It would not be advisable to sort these enterprises as those characterized by only open systems criteria of effectiveness which would automatically eliminate the present values of the internal process model. To conclude, these enterprises are simultaneously flexible and stable. The presence of those enterprises that emphasize simultaneously several dimensions of the effectiveness, even contradictory ones such as characteristics of the internal process model and open systems model, as well as human relations and rational goal model, represents the paradox in line with nature of the competing value approach to effectiveness as one of the strengths of this approach (Quinn, 1988; Quinn & McGrath, 1985).

Even though some models of effectiveness are opposite to each other in the coordinate system that depicts the CVA, and paradox by nature, which does not imply that these models of effectiveness are empirically opposed, mutually exclusive in real organizational environment (Kalliath et al., 1999).

Also, there is significant positive correlation between human relations and rational goal models in investigated enterprises. The research findings imply that these enterprises

are simultaneously internally focused taking into account demands of the external settings. Enterprises attempt to obtain cohesion and employee morale, nurture atmosphere of mutual understanding and employee satisfaction, and to establish individual and collective goals compliance. However, employee loyalty and close connection among enterprises' members to establish stable and predictable environment is possible if these values are incorporated into enterprises' corporate strategy. Achievement of organizational goals has to be aligned with individual goals. Satisfied employees, close interaction and dedication to enterprise support the achievement of the organizational goals such as productivity and efficiency (Miletić, Aničić, & Gračanac, 2023).

Suggestions made by the CVA do not have to be treated as contradictory; rather, it is necessary to investigate the possible contradictions in every organizational setting (Kalliath et al., 1999; Quinn & Rohrbaugh, 1983). The question of what makes one enterprise more effective than another is continuously present in the organizational analysis. This dilemma is, in some respects, gradually answered with each research on effectiveness in specific settings using particular methodology providing new insights. The multidimensional scaling technique also supported the established latent constructs' items of CVA in this research context (Zlatković, 2018). However, in developing wider strategy for scale development of the CVA, this research employed CB-SEM, the most powerful statistical technique, which as that allows purification of the measurement variables from the measurement error which is not possible to do using technique such as multidimensional scaling. The research findings for the CVA to address effectiveness of enterprises in this specific research context represents an attempt to enrich the present organizational effectiveness research stream.

Conclusion

The research results suggest that it would be more appealing to adopt CVA to measure enterprise effectiveness as an indicator of the complex concept of effectiveness and performance. Using CVA, managers are able to identify the existence of the various value dimensions of the enterprises which are in line with distinct stakeholders' values in order to successfully manage enterprise effectiveness in different aspects. Managers are able to understand the magnitude of the simultaneous relationships between even seemingly contradictory values in order to effectively and efficiently manage overall enterprise performance. The use of CVA reveals to managers that direct attempts made to improve particular effectiveness criteria can consequentially lead towards rise of other effectiveness aspects. Even though the four latent constructs were obtained as unique constructs, it appears that they are correlated whether or not the proposed models of effectiveness have common value dimensions. Therefore, future research attention has to be made onto investigation of the measurement models of defined latent constructs cross various types of enterprises and countries. Additionally, it could be interesting to examine the relative importance of each effectiveness model according to CVA in evaluated enterprises. However, if the examined enterprises want to determine the overall effectiveness and performance, the unidimensional structure should be applied. Meanwhile, to address various aspects of the effectiveness and possibilities to enhance it, the four-dimensional conceptualization should be addressed. As literature suggest close relationship between certain models of effectiveness and phases of

the life cycle of the enterprises, future research should empirically test and validate the presence of criteria of effectiveness in each phase of enterprise development.

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Stagflationary Pressures in the Condition of Global Economic Shocks[1]

Стагфлаторни притисци у условима глобалних економских шокова

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Abstract: This paper analyses the key macroeconomic repercussions of the global pandemic and geopolitical crisis in terms of growing recessionary and inflationary pressures, and finally, the potential occurrence of stagflation. The subject of the econometric analysis is aimed at seeing how global energy price movements, unemployment rates, interest rates and money supply affect: (1) real gross domestic product; and 2) the movement of the inflation rate in the sample of 18 countries (EU-15, USA, Norway and Switzerland) in the period 2020q1-2023q1. Using Panel-corrected standard errors method (PCSE), two panel models are estimated in which the dependent variables are: (a) the real gross domestic product, showing potential recessionary pressures, and (b) the inflation rate, determining inflationary pressures. Results indicated that in the observed period, inflationary and recessionary pressures existed in the sample of 18 developed economies, as well as that these pressures can be characterized as the phenomenon of stagflation. The most profound impact on recessionary circumstances was caused by the rise in global energy prices in the second and third quarters of 2022, which can be considered as an exogenous shock and trigger of recessionary pressures, while inflationary pressures are dominantly determined by global oil price growth during the analysed period.
Keywords: stagflation, global economic shocks, Panel-corrected standard error method.
JEL: E31, E62, C23.

Сажетак: У овом раду анализирају се кључне макроекономске реперкусије глобалне пандемије и геополитичке кризе у смислу растућих рецесионих и инфлаторних притисака, и коначно, потенцијалне појаве стагфлације. Предмет економетријске анализе има за циљ да сагледа како кретања глобалне цене енергије, стопе незапослености, каматне стопе и новчане масе утичу на: (1) реални бруто домаћи производ; и 2) кретање стопе инфлације на узорку од 18 земаља (ЕУ-15, САД, Норвешка и Швајцарска) у периоду од

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првог квартала 2020. до првог квартала 2023. године. Користећи метод Панел-коригованих стандардних грешака (PCSE), оцењена су два модела панела у којима су зависне варијабле: (а) реални бруто домаћи производ, приказујући потенцијалне рецесионе притиске, и (б) стопа инфлације, осликавајући инфлаторне притиске. Резултати су показали да су у посматраном периоду постојали инфлаторни и рецесиони притисци на узорку од 18 развијених економија, као и да се ови притисци могу окарактерисати као феномен стагфлације. Најдубљи утицај на рецесионе околности имао је раст глобалних цена енергената у другом и трећем кварталу 2022. године, што се може сматрати егзогеним шоком и покретачем рецесионих притисака, док су инфлаторни притисци доминантно детерминисани растом глобалних цена нафте у анализираном периоду.
Кључне речи: стагфлација, глобални економски шокови, метод Панел-коригованих стандардних грешака.
JEL: E31, E62, C23.

Introduction

For the creators of economic policies, it is of primary importance to observe and improve three fundamental macroeconomic indicators that manifest the success of an economy: stable growth of gross domestic product (GDP), low unemployment rate and low inflation. It has been assumed that it is almost impossible to ensure a strong pace of GDP growth without reducing unemployment or without inflationary pressure. Namely, conducting an anti-inflationary monetary policy implied lower GDP with a higher unemployment rate. However, the current circumstances, which are a reflection of the exogenous health shock -global pandemic crisis (2020) and the current geopolitical crisis due to Russian-Ukraine war (2022), resulted in far more complex situations for the global economy. Economic policymakers could be faced with the pressure of inflation and recession, and if these phenomena are simultaneously present, then stagflationary pressure could be recognized in an economy (Malenković, 2023).

Stagflation occurs at the moment when the economic environment experiences: 1) economic recession - decline in production, followed by increase in unemployment, and 2) high inflation, at the same time. In other words, three key macroeconomic indicators are going in the wrong direction, and the economy is simultaneously threatened by inflationary and recessionary adjustments. The focus of this research is assessment of the functioning of the global economy in crisis conditions from the moment the emergence of Covid-19, until the escalation of geopolitical crisis between Russia and Ukraine, with the intention of identifying crucial pressures. Namely, the aim of this paper is twofold: (1) to present an overview of stagflationary shocks in 1970s and stagflatory pressures after 2020, (2) to apply econometric analysis in order to detect stagflationary pressures in a sample of 18 developed countries (EU-15, USA, Norway, Switzerland), in the period 2020q1-2023q1. The hypotheses analyzed in the paper are:

(H1) Recessionary pressures as a consequence of global energy price growth are present in a sample of 18 developed countries in the period 2020q1-2023q1;

(H2) Inflationary pressures as a consequence of global energy price growth are present in a sample of 18 developed countries in the period 2020q1-2023q1;

(H3) Stagflationary pressures as a consequence of global energy price growth are present in a sample of 18 developed countries in the period 2020q1-2023q1.

The research shows that the presence of stagflation pressure, high inflation and a stagnant economy can fully coexist, and were present in the period 2020q1-2023q1 in the sample of 18 developed economies.

The remainder of this paper is organized as follows. After this introduction, the first chapter presents a review of the literature, the second chapter discusses the stagflationary shocks during the 1970s and current stagflationary pressures. The third chapter elaborates the methods and data used, and finally the fourth chapter provides an empirical analysis of the influence of independent variables on the real GDP and the inflation rate (dependent variables), whose movements systematize the appearance of stagflation.

1. Literature review

The emergence of stagflationary pressures is a current and increasingly present topic that is being discussed at the global level. With reference to this, it directly reflects on the functioning of the state, the development of the economic environment, but also on the economic standard of individuals. This paper relies on the different views of economists who point to the harmfulness of the presence of stagflationary pressures, but also economists who pointed out that the appearance of stagflation is not the only possible scenario for the global economy, i.e. those economies did not reject the possibility of independent inflationary or recessionary pressures. Torry (2022) analyses the emergence of stagflation in the 1970s as one of the worst economic experiences of the last century, indicating that the economic environment needed more than a decade to revitalize its economic constructs. Author pointed out that the appearance of stagflation in the 1970s was something completely new, far more complex for the functioning of the entire macroeconomic system and required a completely different approach: a new solution with comprehensive analyses and different implementation of economic policies. Koegh (2022) explains the phenomenon of stagflationary pressures as a nightmare faced by economies, which has a sharp impact on key macroeconomic variables. Baltussen et al. (2023) indicate that high inflation has always caused great concern among investors, but in the last few decades it has almost never exceeded monetary targets. However, the emergence of the pandemic crisis, prolonged by geo-political turbulence, directly affected the increase in inflation and consumer prices, creating pressure and risk on investment premiums, which resulted in a change in investment strategy and a reduction in production. Pejčić, Beljić and Glavaški (2022) indicate in their research that a descriptive empirical analysis showed that similar dynamics of GDP growth and the inflation rate occurred in the USA, Germany and France in the period January 2020 - July 2022. More precisely, during the pandemic crisis, there were present recessionary pressures, as GDP growth declined until the first quarter of 2021 in the analysed economies, while inflation rates were stable, below 2%. On the other hand, with the recovery of the economy in the second quarter of 2021, inflationary pressures become stronger in each quarter until July 2022. Therefore, the conclusion is that inflationary and recessionary pressures existed in the USA, Germany and France in the period January 2020 - July 2022,

however, those pressures could not be identified as stagflation, because it did not happen simultaneously. Hawkins (2022) argues that the emergence of stagflationary pressures creates chronic problems at the global level, emphasizing the high degree of fear among economic policymakers when revitalizing economic life. Accordingly, only those countries that "today" make extremely difficult decisions regarding economic policy will be able to overcome the crisis situation.

Baqaee and Farhi (2022) emphasize the world's number one problem, when it comes to the macroeconomics is the rapidly growing inflation, describing its distorting effect on the purchasing power of the population. Namely, it is explicitly reflected in the reduction of demand on the goods market, which spills-over into the drop in demand on the labor market and consequently lowers the entire aggregate supply, introducing the economy into a deeper crisis. Consequently, problems of such proportions should be suppressed at the moment of creeping growth, and not at the moment when they assume galloping proportions. Chakraborty (2023) also points out that currently the biggest problem of the global economic system is the growing inflation, because people with fixed incomes, such as pensioners, then the population whose income is generated by social assistance, become increasingly poorer. Namely, as inflation rises, their purchasing power declines. Bobeica and Hartwig (2023) expand the scope of analysis of current macroeconomic problems generated by Covid-19 and geopolitical challenges. In their work, authors use vector autoregression (VAR) model and discuss the results focusing on Eurozone inflation. Indicating that the Eurozone in particular has struggled with low inflation to the extent that inflation expectations have become less rooted in the ECB's inflation target. Inflation continued to surprise during the pandemic, starting in 2020. Initially, while energy inflation fell rapidly, the response of Eurozone core inflation was modest relative to the decline in activity. From the middle 2020 of the year onwards, headline inflation declined further as core inflation increasingly reflected disinflationary tendencies and headline inflation went downwards. Starting in 2021, the situation completely reversed and inflation once again took centre stage in the economic debate. surprise. In this context of very atypical economic circumstances - economic closure and subsequent reopening - the key question is which tools can be used for inflation modelling to ensure the clearest possible picture of inflationary developments.

Hunt (2022) believes that "inflationary psychology" is a phenomenon that currently underlies macroeconomic problems, and therefore the expected rise in prices tomorrow accelerates consumption today, automatically reflecting on harmful aggregate demand and price accumulation. Therefore, the reaction of the economic authorities, which is "required" in order to curb inflation through higher interest rates and reduction of state spending, only pushes the economy into recession. Diego (2021) points out that the decline in economic activities is the key problem, considering that the shape of the recession cannot be accurately predicted. However, it is certain that the recovery will not be quick and that the economies will have to make a lot of efforts to return the level of economic activity to level before the emergence of Covid-19. Ozili and Arun (2023) indicate that the current global macroeconomic situation indicates the emergence of recessionary pressures, but also that the current recession produced by the coronavirus has created a new type of recession that differs from previous ones. They point out that the financial crisis of 2008 was created by loose

monetary policy, creating a bubble, followed by weak regulatory structures and high leverage in the banking sector. The reason for today's crisis is far more complex, caused by a break in the energy supply chain that is the generator of today's production growth. Eti et al. (2023) indicate that the possible continuation of the tightening of relations between Russia and Ukraine would lead to an increase in the price level of oil derivatives, which would result in an increase in global inflation, moreover, a gradual entry into the phase of recession, i.e. the possible occurrence of stagflation. Huang and Liu (2005) explain that the presence of inflation is a huge problem that can arise for two reasons. The first reason is an increase in demand resulting in an increase in the price level, while the second reason is related to disruptions in the supply chain. Furthermore, he points out that the limited supply of oil derivatives, electricity or agricultural inputs can be recognized as a generator of stagflation, pointing out the fact that people today buy less at higher prices. Bluedorn et al. (2022) point out that a possible increase in the level of interest rates by central banks in response to an increase in the price level would have a devastating effect on household budgets. He also cites two crucial reasons that preceded the current state of the global economy, firstly, the sharp drop in industrial production caused by the emergence of Covid-19, and secondly, the effects of military interventions on the territory of Ukraine, which directly complicated the global economic situation. The expected contribution of our paper is to fill the gap in the literature concerning the simultaneous analysis of inflationary and recessionary pressures in 18 developed countries (EU-15, USA, Norway, Switzerland), in the period 2020q1-2023q, using modern robust econometric techniques.

2. Stagflatory shocks of the 1970s and current stagflationary pressures

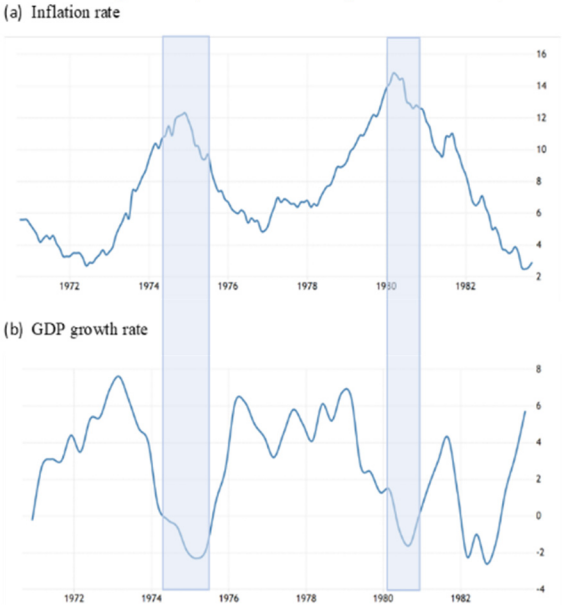
The key question in this paper is: what is the precondition for the emergence of stagflation? Stagflation occurs most often when there is a so-called shock on the supply side. If the supply structure of a production factor that is key to existence further growth, development of the economy is disrupted in different segments, such as the supply of labor on the labor market, electricity or oil supply.

The last time such a situation, which economists call a "nightmare", happened in the United States of America (USA) in the 70s of the last century. Namely, it was a period in which the prices of energy products (petroleum derivatives) rose incredibly and directly affected the rapidly growing inflation rate and the sharp decline of the entire production. If the supply of oil on the market decreases, as it did, it would automatically lead to an increase in the price level (inflation), while, on the other hand, producers would reduce the aggregate supply. Furthermore, a reduction in supply would lead to a decline in national production, with a rapid rise in the unemployment rate. Rising energy prices fuelled a spiral in wage and cost prices, which directly resulted in widespread price increases across the spectrum of economic activity. Frequent recessions have raised unemployment without cooling inflation. The Federal Reserve was focused on stimulating growth and powerless to „tame" rising prices. Faced with external economic shocks, economic policymakers allowed inflationary expectations to settle, discouraging investment (Zarić, 2022). Unemployment exceeded the

standards set in the previous two decades, and growth was completely uneven. The US economy was in recession from December 1969 to November 1970 and again from November 1973 to March 1975. When US economy was not in recession, the economy grew with real GDP growth above 5% in 1972-73 and mostly above 5% in 1976-78. However, in the 1970s, lower living standards and declining confidence in economic policy were commonplace. Grzegorz et. al (1987). In a short period of time, the American economy simultaneously experienced an increase in the consumer price index above 10% (such an increase in the US has not been recorded since World War II), while unemployment rose from 4.6% in 1973 to 9% in 1975, and the GDP fell. OPEC countries continued to increase the price of oil and in the following period, so this was automatically reflected in the fact that inflation grew from year to year, and the economy sank into recession. Beginning with a recession, the 1970s were a decade of pessimism and ended painfully with the Vietnam War. Memories of the Great Depression made economic policymakers reluctant to use restrictive monetary and fiscal policies to curb inflationary pressures, as it was believed that an increase in unemployment would be completely unacceptable, meaning that the American population would experience additional deflationary adjustment (Mansur, 1988).

Figure 1, (panel a) shows the movement of the inflation rate, while (panel b) shows the movement of the GDP growth rate in the United States of America in the time interval 1969-1982. The conclusion is that the American economy faced simultaneous inflationary and recessionary pressure twice, the first time in the period 1974-1975, while the second time was in 1980, which indicated the presence of stagflation.

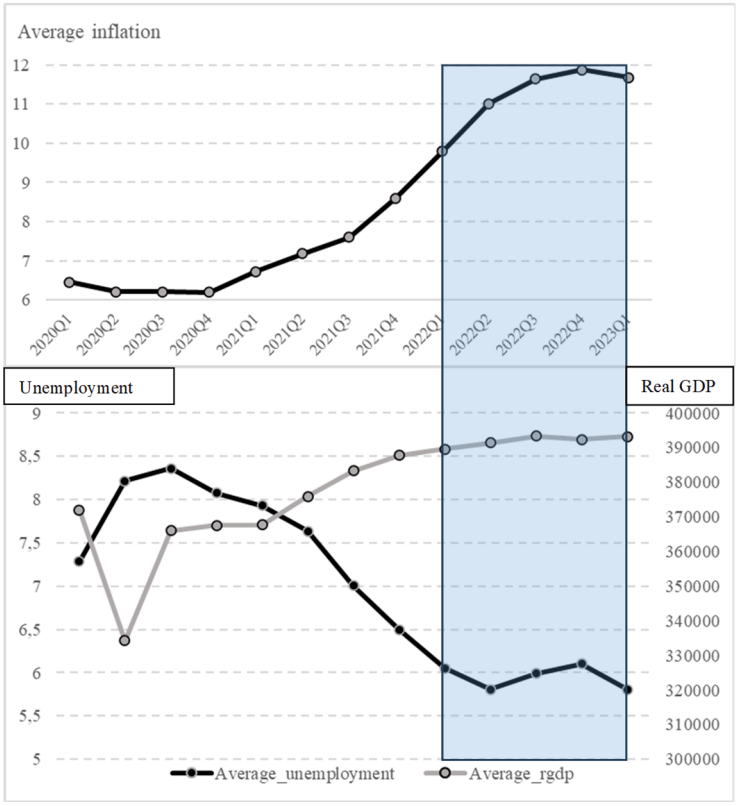
Figure 1: Two stagflationary shocks in USA (period 1969-1983)



Source: Pejčić, Beljić and Glavaški (2022).

Most analysts and economists, including the IMF, do not expect a repeat of the bad old days of the 1970s decade of economic crisis. But just as the oil crisis reverberated throughout the global economy in the 1970s, so the double whammy of pandemic and Russia-Ukraine war has put unprecedented pressure on the supply of goods and services around the world today. What is certainly an essential question both for the creators of economic policies at the global and national level, as well as for political exponents, is how to reduce the unwanted economic repercussions of Covid-19 and geopolitical-military operations on the territory of Ukraine (Vidal, 2016). Border closures to prevent the capillary spread of the virus lead to a drop in production and demand in the short term. As in the case of an increase in the price of oil, the reduction in potential production may be temporary if production were to return to the projected level. However, if the lockdown decision is extended, it could lead to a much slower return of current production levels to projected levels (Rebić, & Antić, 2022).

Figure 2: Inflationary and recessionary pressures in 18 developed economies (2020q1-2023q1)



Source: authors.

The potential possibility of a return to stagflation is causing fear among economic policymakers because there are little monetary / fiscal policy tools for the solution of stagflation (Cvetković, Simonović, & Đorđević, 2022). As it is indicated in the introduction part, stagflation means that three key macroeconomic indicators are going in the wrong direction (inflation, real GDP and unemployment rate). Figure 2 shows pressures represented through average movements of inflation rate, real GDP and unemployment rate in the sample of 18 developed economies (EU-15, Norway, USA and Switzerland) in the period 2020q1-2023q1. Inflationary pressures are detected and intensified after the first quarter of 2021 (Figure 2, panel (a)), meaning increase of average inflation rate. On the other hand, recessionary pressures occurred in the same period measured through unemployment rate, while decrease of real GDP is not detected in the analysed period (Figure 2, panel (b)). Therefore, Figure 2 indicates potential stagflationary pressure which will be checked using panel model econometric framework (Zarić, 2022).

3. Methodology and data

With the aim of a detailed analysis of stagflationary pressures using PCSE (Panel-corrected standard error) econometric techniques, with the inclusion of 18 countries in the analysis, during the crisis period, the paper used panel data. The subject of the econometric analysis will be aimed at looking at how global energy price movements, viewed through the prism of energy and oil prices, and other control variables: unemployment rates and money supply, affect the movement of the inflation rate and real GDP in a sample of 18 countries (EU-15, USA, Norway and Switzerland) in the period 2020q1-2023q1 (quarterly presentation of data). What is characteristic of micro panels is a short time series (T), homogeneity is assumed, while individual time effects include all heterogeneity, which can be estimated and presented within a fixed and stochastic specification. When we talk about the specification with the heterogeneous free term and the homogeneous regression parameters, it is important to point out that the free term varies by units, while the regression parameters are constant. The specification of the model implies heterogeneity in the free term, but according to the principle that only variations according to comparative data are included in the analysis, while the regressors along with the coefficients remain unchanged. If we are talking about variables that vary only by units of observation, but not over time, then it is a model with fixed individual effects. The specification of the observed model with fixed individual effects, using a dummy variable is as follows:

$$\boldsymbol{y_{it} = b_0 + b_1 X_{it} + b_2 X_{it} C_i + \mu_i + \lambda_t + u_{it}} \quad (1)$$

where y_{it} is dependent variable of country *i* in year *t*. X_{it} contains regressors which vary over *i* and *t*, while C_t is dummy variable for the time *t*. This general specification contains individual (unobservable country-specific) effects μ_i, along with time effects λ_t, and stochastic disturbance term u_{it}. In order to test differentiated effects of specific period of time (oil prices), group effects are encompassed by the interaction term, $X_{it}C_i$.

The procedure used in order to select the optimal panel model specification, as well as its estimation method, involves several steps in the research. After the analysis of descriptive statistics and potential transformation of variables, two models have to be

estimated: (1) RE model (random effects - stochastic individual effects), and (2) FE model (fixed effect - fixed individual effects). It is also important to highlight the Hausman specification test, which is based on the difference between the estimates of the regression parameters of the model with fixed and stochastic effects. The Hausman test is widely used even in methods with heterogeneous regression parameters. Assuming that the Hausman test shows us that the long-term coefficients are homogeneous (in the case of accepting the null hypothesis), then it is necessary to evaluate a given model using the method of combined group means, because it is unjustified to introduce heterogeneity for both short-term and long-term coefficients, i.e. otherwise, the method of group means should be applied.

Furthermore, in the event that the RE (random effects - stochastic individual effects) or FE (fixed effect - fixed individual effects) model does not provide appropriate parameter estimates that have an adequate level of statistical significance and are in line with economic logic, as well as in the presence of autocorrelation and/ or heteroskedasticity, then during the econometric analysis, the robustness of the estimates will be checked. Namely, the application of PCSE methods enables the calculation of panel-corrected standard error estimates for linear cross-sectional time series models where the parameters are estimated using OLS or Prais-Winsten regression. When calculating the standard error and estimating the variance and covariance, the PCSE method assumes that there is heteroskedasticity in the model and at the same time correlation of the panel data. It is important to point out that unfulfilled assumptions refer to heteroskedasticity or the presence of autocorrelation within panels, where the autocorrelation parameter can be constant across panels or different for each panel. Although PCSE allows for other disturbance covariance structures, the term PCSE, as used in the literature, refers specifically to models that are both heteroskedastic and simultaneously linked across panels, with or without autocorrelations.

Described procedure is used and repeated two times in order to estimate two models, one, where dependent variable y_{it} is real GDP growth (*rgdp*), and the second one, where dependent variable is inflation rate (*inflation*). Following the main results in the empirical studies, a set of determinants, X_{it}, are employed: *unemployment, global energy price, M1, real interest rate*. One of the most significant independent variables, *global energy price*, which rose sharply from the first quarter of 2021, to reach its maximum in the third quarter of 2022, had a strong impact on the dependent variables. The increase in the price of energy caused a direct negative impact in both panels on the dependent variables (decrease in real GDP and increase in the inflation rate). The analysis of the available data used in the econometric analysis was taken from the Federal Reserve Economic Data database (FRED).

The aim of this paper is to use econometric analysis to detect stagflationary pressures in a sample of 18 developed countries (EU 15, USA, Norway, Switzerland), in the period from the first quarter of 2020 to the first quarter of 2023 (2020q1-2023q1). Therefore, the baseline model, derived from theoretical framework, to test Hypothesis 1, could be specified as:

$$rgdp_{it} = b_0 + b_1 unemployment_{it} + b_2 inflation_{it} + b_3 real\ interest\ rate_{it} + b_4 M_1 + b_2 oilprice_{it} q_2 q_3 2022_i + \mu_i + \lambda_t + u_{it} \quad (2)$$

while model to test Hypothesis 2, is specified as:

$$inflation_{it} = b_0 + b_1 unemployment_{it} + b_2 real\ interest\ rate_{it} + b_3 M_1 + b_4 globalenergyprice_{it} + \mu_i + \lambda_t + u_{it} \quad (3)$$

4. Empirical analysis of stagflation in developed economies

Table 1 shows a summary analysis that provides descriptive statistics (mean value, standard deviation, minimum and maximum) of dependent and independent variables. The number of observations covered by the panel is 234, where the variable variable *rgdp* represents real gross domestic product, with a mean value of 378053.3, where there are large differences in the case of minimum versus maximum values of real GDP. The lowest level of *rgdp* was recorded in the 2nd quarter 2021 in Spain, while the highest level of GDP was achieved by the United States of America. The variable *inflation* refers to the inflation rate, whose mean value is far above the target, 8,551 in the observed sample. The stated inflation rate occurred in Great Britain in the third quarter of 2022. The *M1* money supply is shown by the variable of the same name, showing the monetary expansion during the pandemic crisis. The variable *realinterestrate* refers to the real interest rate, with a mean value of 0.447 and reaching a maximum value of 4.51 to combat inflation. In the United States, the real interest rate in the first quarter of 2023 was 4.51. The unemployment rate is indicated by *unemployment* with a mean value of 6.982, but also reaching a maximum during the analysed period of 19.44. Such a high unemployment rate was dominantly present in the second quarter of 2020 in Greece. Finally, the variable *dummy globalenergyprice* is defined as a dummy variable for the price of energy, but in the period of global shock from the point of view of the price of energy - the second and third quarters of 2022. It is defined as the interaction between energy prices and a specific time interval (II and III quarters of 2022) with the aim of covering the shock due to the increase in *global energy prices*.

Table 1: Summary analysis for independent and dependent variables

Variables	Obs	Mean	Std. Dev.	Min	Max
Rgdp	234	378053.3	318652.2	12205.8	1160831
Inflation	234	8.551047	27.46308	-2.0510	144.2952
M1	234	1.11e+13	2.06e+12	4.07e+12	2.06e+13
Real interest rate	234	0.447124	0.7876848	-0.35627	4.51455
Unemployment	234	6.98287	3.551175	2.66667	19.4333
Globalenergyprice	234	192.3762	87.48073	68.76653	350.1239
Dummy golbalenergyprice	234	0.3076923	0.4625278	0	1

Source: Author's calculation.

4.1. Analysis of recessionary pressures using the panel model

In order to detect recessionary pressures, the next step in the analysis of the panel model is to check whether there are significant individual effects in the model and whether they are of a fixed or stochastic character.

***Table 2**: Fixed vs random individual effects model for recessionary pressures*

Fixed effect Model				**Random effect**		**Model**
Dep. variable: Rgdp	Coef.	Std. error.	P>(t)	Coef.	Std. error.	P>(t)
M1	2.97e-09	1.072-09	0.006	2.99e-09	1.06e-09	0.005
Inflation	787,694	384,614	0.042	795,727	380.6095	0.037
Unemployment	74.17224	1023.26	0.942	22.6127	1020.785	0.982
Dummy golbalenergyprice	10043.75	3057.369	0.001	9957.003	3051.332	0.001
Real interest rate	8292.447	2043.176	0.00	8225.45	2035.807	0.00
Cons	331018.6	14429.25	0.00	331186	78768.65	0.00
R2	0.1337			0.1337		
Wald chi ^{2}	23.79		0.000			
Breuch-Pagan test				119.56		0.000
Httest3	1277.82		0.000			
Autocorrelation	12.217		0.028			
Hausman test	0.59		0.946	0.59		0.946
Number of observations	234			234		

Source: Author's calculation.

Based on Table 2, we come to the conclusion that variables *M1, inflation rate, global energy price* and *real interest rate* are statistically significant, while other independent variables included in the model are not statistically significant in Fixed specification of the model. The F-test of fixed individual effects checks whether there are fixed individual effects in the model. The null hypothesis is that all individual effects in the model except for one equal individual effect are equal to 0. If the null hypothesis is not rejected, we choose the OLS estimation method. In our case, the *p*-value of the F test is less than 0.05 and we conclude that there are fixed individual effects in the model. The next step is to test random individual effects with the Breusch Pagan LM test, namely in Random effects specification. It is necessary to clarify the hypothesis in terms of acceptance or rejection. We come to the conclusion that the variables *M1*, the *inflation rate*, *global energy price* and the *real interest rate* are statistically significant, while the other independent variables included in the model are not statistically significant. The Breusch Pagan LM test determines whether there are stochastic individual effects in the model. Null hypothesis: the variance of the individual effects is equal to 0. If the null hypothesis is not rejected, we choose the OLS estimation method. In our case, the *p*-value of the Breusch Pagan LM test is less than 0.05, which is why we conclude that there are stochastic individual effects in the model. If the existence of fixed individual effects (FE model) and stochastic individual effects (RE model) is determined, the choice between these two models is made using the Hausman test. Null hypothesis: regression parameter estimates obtained using RE methods are consistent and efficient, while

regression parameter estimates obtained using FE methods are consistent. Alternative hypothesis: regression parameter estimates obtained using FE methods are consistent, while regression parameter estimates obtained using RE methods are inconsistent. In our case, the *p*-value of the Hausman test is greater than 0.05 and we conclude that the stochastic specification (RE model) is better, because the RE model gives more efficient estimates compared to the FE model. However, if heteroskedasticity and autocorrelation are present in the model, it is necessary to switch to robust estimates. The null hypothesis assumes homoscedastic errors *p*-value greater than 0.05, while if the *p*-value is less than 0.05 it indicates that the errors are heteroskedastic. Based on the obtained results, we conclude that the null hypothesis is rejected and that there is the presence of heteroscedasticity and autocorrelation. In order to check the robustness of the estimates, the PCSE method can be applied.

Table 3: PCSE method – recessionary pressures

Panel-corrected standard error (PCSE)			
Dependent variable *Rgdp*	Coef.	Std. Error.	P>(t)
M1	3.42e-08	6.39e-09	0.000
Inflation	443.4615	83.86798	0.000
Unemployment	-25110.48	2327.709	0.000
Dummy globalenergyprice	-51511.85	1432.44	0.000
Realinterestrate	-21617.67	11044.37	0.050
Cons	195917.5	70601.73	0.006
R2	0.1337		
Wald chi2	358.11		
Number of observations		234	

Source: Author's calculation.

Based on Table 3, we conclude that all independent variables included in the model are statistically significant, and we consider the specified specification to be optimal. Given the estimation using PCSE methods, problems of heteroskedasticity and autocorrelation in panel data are eliminated, and robust estimates are considered relevant. The estimated model indicates that if *M1* increases by one unit, the assumption is that there will be an increase in the dependent variable by 3.43. This result is in line with macroeconomic theory, because the growth of money supply generates the growth of demand, which further stimulates the growth of real GDP. If the *inflation* rate increases by one unit, the assumption is that there will be an increase in the dependent variable by 443.46, whereby the theoretical interpretation is similar to the case of *M1* growth. If the *unemployment* rate increases by one unit, the assumption is that there will be a decrease in the dependent variable by 25110.48, which is justified, based on the assumption that the crisis circumstances affected the growth of the unemployment

rate, and consequently the decline of the real GDP. If the real interest rate increases by one unit, the assumption is that the dependent variable will decrease by 21617.67, confirming recessionary pressures as a consequence of the contractionary monetary policy. If the dummy variable (*dummy globalenergyprice*) increases by one unit, the assumption is that the dependent variable will decrease by 51511.85. When analyzing the impact of the variable *dummy globalenergyprice* on the dependent variable, it was detected not only that the increase in the price of energy affects the reduction of the real GDP, but it was also determined that the negative impact of the increase in energy prices on the real GDP is most pronounced in the second and third quarters of 2022, which is identified as the key shock and determinant of recessionary pressures. Based on the conducted analysis, we conclude that the hypothesis (*H1*) can be accepted, i.e. that recessionary pressures are present in the sample of 18 developed countries in the period 2020q1-2023q1, and that they are determined by the variable energy price growth, as well as by the variables *M1*, *inflation*, *unemployment rate*, *real interest rate*. We emphasize that the most profound impact on recessionary circumstances was caused by the increase in energy prices in the second and third quarters of 2022, which can be considered an exogenous shock and trigger of recessionary pressures.

4.2. Analysis of inflationary pressures using the panel model

In order to detect inflationary pressures, again, first step is to estimate the panel model, and to check whether there are significant individual effects in the model and whether they are of a fixed or stochastic character.

Table 4: Fixed vs random individual effects model for inflationary pressures

Fixed	**effect**	**Model**			**Random**	**effect**	**model**
Dep. variable: *Inflation*		Coef.	Std. Error.	P>(t)	Coef.	Std. Error.	P>(t)
M1		-1.29e-13	2. 17e-13	0.552	-1.32e-13	2.16e-13	0.541
Unemployment		0.1098026	0.179833	0.542	0.0904	0.179038	0.613
Globalenergyprice		0. 0246315	0.003656	0.000	0.02447	0.0 0364	0.000
Cons		4.47766	2.617883	0.089	4.6772	7.151441	0.513
R2		0.0853		0.000			
Breuch-Pagan test							0.000
Httest3		6757.24		0.000			
Autocorrelation		157,980		0.000			
Hausman test		1.38		0.946	1.38		0.946
Number of observations		234			234		
Wald chi ^{2}		27.70		0.000			

Source: Author's calculation.

Based on table 4, Based on Table 4, we come to the conclusion that only the energy price variable is statistically significant, while the other independent variables included in the model are not statistically significant. The F-test of fixed individual effects checks whether there are fixed individual effects in the model. The null hypothesis is that all individual effects in the model except for one equal individual effect are equal to 0. If the null hypothesis is not rejected, the OLS estimation method would fail. In our case, the *p*-value of the F test is less

than 0.05 and we conclude that there are fixed individual effects in the model. The next step is to test random individual effects with the Breusch Pagan LM test. It is necessary to clarify the hypothesis in terms of acceptance or rejection. The Breusch Pagan LM test determines whether there are stochastic individual effects in the model, with null hypothesis that the variance of the individual effects is equal to 0. If the null hypothesis is not rejected, we choose the OLS estimation method. In our case, the *p*-value of the Breusch Pagan LM test is less than 0.05, which is why we conclude that there are stochastic individual effects in the model.

Finally, it is necessary to compare the FE and RE models and explain the hypotheses in terms of acceptance or rejection. The *p*-value of the Hausman test is greater than 0.05 and we conclude that the RE model gives more efficient estimates compared to the FE model. However, due to the presence of heteroskedasticity and autocorrelation in the model, it is necessary to switch to robust estimates. The null hypothesis assumes homoscedastic errors: *p*-value greater than 0.05, while if the *p*-value is less than 0.05 it indicates that the errors are heteroskedastic. Based on the obtained results, we conclude that the null hypothesis is rejected and that there is the presence of heteroscedasticity and autocorrelation. In order to check the robustness of the estimates, the PCSE method is applied.

Table 5: PCSE method – inflationary pressures

Panel-corrected standard errors (PCSE)			
Dependent variable *Inflation*	Coef.	Std. Error.	P>(t)
M1	-1.29e-12	2.65e-13	0.000
Unemployment	-2.207421	0.16328	0.000
Globalenergyprice	0.013205	0.0 0418	0.000
Cons	35.68235	3.44475	0.000
R2	0.0853		
Wald chi2	211.49	0.000	
Number of observations		234	

Source: Author's calculation.

Based on the Table 5, we conclude that all independent variables included in the model are statistically significant. If *M1* increases by one unit, the assumption is that the dependent variable will decrease by 1.29, which is not in accordance with economic logic. The assumption is that monetary expansion and an increase in the money supply lead to an increase in the level of inflation. If the unemployment rate variable *increases* by one unit, it is estimated that the dependent variable will decrease by 2.207, confirming the economic logic and the existence of a relationship typical of the Phillips curve. If the growth of *global energy prices* increases by one unit, the assumption is that there will be an increase of the dependent variable by 0.013, pointing to the conclusion that the growth of energy prices is one of the key generators of inflation. Based on the conducted analysis, we conclude that the hypothesis (*H2*) can be accepted, i.e. that inflationary pressures are present in a sample of 18 developed countries in the period 2020q1-2023q1, and that they are determined by the variable *global energy price* growth, as well as by the variables *M1* and the unemployment rate. Taking into account the acceptance of hypotheses *(H1)* and *(H2)*, we indirectly conclude that stagflationary pressures as a consequence of energy price growth are present in a sample

of 18 developed countries *(H3)*, considering the detected recessionary and inflationary pressures in the period 2020q1-2023q1.

Conclusion

Based on the described and empirically documented problem of stagflation, taking into account the experiences of the 1970s, it can be concluded that the global economy is currently in an unenviable situation. During the analyzed time period 2020x1-2023x1, we identified an unstable global economy, complicated by the Covid-19 epidemic and geopolitical conflict. Global inflation has risen sharply since the mid-2020s, fueled by disruptions in supply chains and rising food and energy prices, particularly since the Russian Federation's invasion of Ukraine. Based on past developments, inflation peaked in mid-2022 and then began to decline (Marjanović, Mihailović, & Dimitrijević, 2021). Global growth is moving in the opposite direction: it has fallen sharply since the start of 2020 and is expected to remain below the 2010s average for the rest of the decade. The unemployment rate is increasing in the analyzed period, which indicates recessionary pressures.

The econometric analysis used in the work, based on robust estimates, showed that the independent variable global energy price had a dominant role, which inversely reflected on the dependent variable real GDP (increase in energy prices - decrease in real GDP) and proportionally another dependent variable, inflation rate (increase in the price of energy - increase in the inflation rate). Namely, on the basis of the conducted analysis, we conclude that the hypothesis (H1) can be accepted, i.e. that recessionary pressures are present in a sample of 18 developed countries in the period 2020q1-2023q1, and that they are determined by the variable global growth in energy prices, as well as by the variables M1, inflation , unemployment rate, real interest rate. We emphasize that the most profound impact on recessionary circumstances was the increase in energy prices in the second and third quarters of 2022, which can be considered an exogenous shock and trigger of recessionary pressures. Additionally, the hypothesis (H2) is accepted, i.e. that inflationary pressures are present in a sample of 18 developed countries in the period 2020q1-2023q1, and these effects are determined by the variable of global energy price growth, as well as the variables of M1 and the unemployment rate. Finally, taking into account the acceptance of hypotheses (H1) and (H2), we indirectly conclude that stagflationary pressures as a consequence of the global increase in energy prices are present in the sample of 18 developed countries. A close examination of stagflation shows that it is directly related to slow economic growth, higher unemployment and inflation. Rising inflation has dire social consequences. An increase in the price level of basic essential products causes an automatic decrease in purchasing power and a decline in living standards. Combined with depressed economic activity and rising unemployment, significant social hardship has been created for many workers in the economies under review (Rebić & Antić, 2022). The mentioned result can be considered a warning for economic policy makers because history is likely to repeat itself, and stagflation is one of the most undesirable episodes in the economy.

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The impact of ISO 14001 standards and non-financial reporting on companies' financial performance

Утицај ISO стандарда 14001 и нефинансијског извештавања на финансијске перформансе компанија

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Abstract: In today's dynamic business environment, companies increasingly understand how important care for the environment is for the success of their operations. There is an increasing number of companies that implement the ISO 14001 standard in their operations. The main research objective is to examine whether the implementation of the ISO 14001 standard and non-financial reporting affect the financial performance of companies. The research is conducted using induction and deduction methods, while the practical part focuses on statistical data analysis using non-parametric tests. The main conclusion of this research is that there is no statistically significant difference in financial performance in the period from 2019 to 2021, among companies that have implemented the ISO 14001 standard and companies that have not implemented the standard, as well as companies that disclose and companies that do not disclose non-financial statements.
Keywords: ISO 14001 standard, financial performance, environmental performance, non-financial reporting.
JEL classification: Q51, Q56, Q57, M14

Сажетак: У данашњим динамичним условима пословања, компаније све више схватају колико је значајна брига о животној средини за успешност пословања. Све је већи број предузећа која у своје пословање имплементирају стандард ISO 14001 и обелодањују нефинансијске извештаје. Основни циљ истраживања у раду је испитивање да ли имплементација ISO 14001 стандарда и нефинансијско извештавање утичу на финансијске перформансе компанија. Истраживање се спроводи методама индукције и дедукције, док се практични део рада заснива на статистичкој анализи података применом непараметарских тестова. Као главни закључак овог истраживања истиче се то да не постоји статистички значајна разлика у финансијским перформансама, у периоду од 2019. до 2021. године, између предузећа која имају имплементиран стандард ISO 14001 и предузећа која немају имплементиран стандард, као и предузећа која обелодањују и предузећа која не обелодањују нефинансијске извештаје.

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Кључне речи: ISO 14001 стандард, финансијске перформансе, еколошке перформансе, нефинансијско извештавање
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Introduction

Environmental management has increasingly become a key focus for companies because of rising concerns over the effects of their activities on natural resources (Arocena, Zouaghi & Orcos, 2023). The ISO 14001 standard sets up an environmental management system that enables companies to create their own policies and objectives and to access all critical environmental information they require. As a result, companies integrate environmental strategies into their business plans to reap various benefits from effective environmental management. These benefits include reduced environmental costs and waste, increased employee motivation and customer satisfaction, improved product quality and enhanced public relations (Gadenne, Kennedy & McKevier, 2009). Reducing negative environmental impacts and improving environmental performance cannot be achieved if companies do not recognize the strategic importance of the environmental management process and do not integrate the environmental management process and environmental protection policy into their business strategy (Jovanović, Todorović & Medved, 2022). The objectives of environmental protection should be in accordance with the environmental policy, monitored, updated, constantly improved and occupy a significant place in the company's business policy. Consequently, a growing number of companies are adopting EMS, with ISO 14001 being the most widely recognized international standard in the field of environmental protection (Jovanović, 2023). The implementation of the ISO 14001 standard can be an investment to improve the company's reputation (Jovanović & Janjić, 2018). ISO 14001 is not a performance standard, i.e. it does not specify the level of environmental performance organizations must achieve. Instead, it outlines a system that assists organizations in reaching their own environmental goals (Blyde, 2021). Implementation of the ISO 14001 standard is not a simple and easy task. A study by Babakri, Bennett & Franchetti (2003) indicates that most firms typically take 8 to 19 months to become officially certified. The question of whether "green" is good for profit is the subject numerous scholars have addressed. Some argue that "green" costs more because existing systems need to be changed, while some argue that the market values environmentally responsible companies, suggesting that strong environmental performance can positively impact financial performance (Sarumpaet, 2015; Ong, The, Goh & Thai, 2015; Moneva & Ortas, 2009).

The rising importance of environmental protection has made it necessary for companies to provide non-financial information alongside financial data to evaluate their environmental impact. Non-financial reporting refers to environmental, social and governance issues (Environmental, Social and Corporate Governance – ESG), then corporate social responsibility, internally generated intangible assets such as intellectual property, knowledge, brand reputation and other drivers of value that are not usually reported in monetary units (Todorović, Savić & Jovanović, 2020). Given that current non-financial reporting relies on various standards and frameworks, the European Commission adopted the first set of European Sustainability Reporting Standards (ESRS) in June 2023, as a unique non-financial reporting framework for European companies. These standards will be in use

in the reporting year 2024, and companies are required to disclose statements in 2025. The goal of these standards is to establish a framework that will bring sustainability reporting to the same level as financial reporting, in terms of reporting standardization, and facilitate the comparability of sustainability information disclosed by different companies. European sustainability reporting standards are based on four reporting areas, namely: corporate governance, strategy, impact, risk and opportunity management, as well as metrics and goals (Serbian Chamber of Commerce, GIZ, 2023).

Efforts to disclose non-financial information can yield both advantages and expenses for companies. Consequently, depending on whether the benefits outweigh the costs or vice versa, such disclosure can have either a positive or negative effect on financial performance (Borodin et al., 2019; Asuquo, Dada & Onyeogaziri, 2018; Vitale, Cupertino & Riccaboni, 2022).

Given the above, the primary research objective is to investigate how the adoption of the ISO 14001 standard and non-financial reporting impact companies' financial performance.

The issue of ISO 14001 standard implementation and non-financial reporting is very popular around the world. However, it has not been sufficiently researched in Serbia and developing countries. There being few empirical papers related to this area, this paper fills the gaps in domestic literature and aims to expand the related knowledge base. The paper aims to raise awareness among domestic companies about the potential benefits of adopting the ISO 14001 standard and the significance of integrating non-financial information into their decision-making processes. The research is significant because it indicates the current situation Serbian companies face when it comes to ISO 14001 standard implementation and non-financial reporting. In addition, this paper is significant because it allows drawing conclusions that can help companies improve their environmental management process.

Theoretical research was conducted using induction and deduction methods, while the practical part included statistical data analysis using non-parametric tests and SPSS (Statistical Package for Social Sciences). In addition to the methods mentioned above, analysis, synthesis and comparison were used to interpret results and draw conclusions.

The paper consists of five parts. After the introduction, the paper presents an overview of previous research. The third part describes research methodology. The fourth part gives research results and their analysis, while the final part of the paper presents the final research conclusion.

1. Overview of previous research and development of research questions

1.1. The link between ISO 14001 and financial performance

Sarumpaet (2005) investigates the link between environmental and financial performance in Indonesian companies. Environmental performance is assessed using the environmental rating given by the Ministry of the Environment, while financial performance is gauged by the rate of return on assets. The study's findings reveal no significant relationship between the environmental and financial performance of the companies examined.

Moneva & Ortas (2009) explore the significance of the relationship between corporate environmental performance and financial performance, to make managers aware that adequate environmental management can affect companies' financial success. They analyze the connection between environmental and financial performance using a second-order partial least squares (PLS) model, on a sample of 230 European companies, extending the traditional approach with individual countries. The research results indicate that companies with better environmental performance also achieve better financial performance.

Ong, The, Goh & Thai (2015) examine the relationship between ISO 14001 certification and financial performance in Malaysia, on a sample of 68 listed companies. Firm size (large, medium, and small firms) and ownership status (local or foreign ownership) are used as control variables. The results of the analysis reveal that financial performance of listed companies in Malaysia, judging by ROA and ROE, improved after ISO 14001 certification. This significant indicator indicates that investors in Malaysia, as a developing country, prefer to invest in companies that improve environmental management. In addition, the adoption of environmental management accounting benefits companies through cost reduction, performance improvement, and increased brand awareness and publicity. As a result, companies in Malaysia are motivated to adopt standards such as ISO 14001 in order to improve ROA and ROE.

Amores-Salvadó, Martin-de Castro & Navas-López (2015) investigate the complementarity between environmental management systems and environmental innovation capabilities, as well as the impact of this relationship on company performance. They test the proposed theoretical model on a sample of 157 metal production and transformation companies in Spain, with 100 or more employees. Since literature lacks consensus regarding the actual contribution of these systems and since it is not clear whether they encourage or prevent environmental innovation and whether they improve company performance, authors use this analysis to produce adequate answers. Their results indicate that environmental management systems positively influence the relationship between environmental innovation and companies' market performance.

The relationship between corporate environmental performance and financial performance has been thoroughly examined in developed countries, but less so in developing countries. For this reason, Manrique & Martí-Ballester (2017) conduct an analysis with the main objective to investigate how corporate environmental performance influences corporate financial performance during the global financial crisis, taking into account the economic development of the country. They focus on a sample of 2,982 large companies in the period

from 2008 to 2015. The results demonstrate that adopting environmental practices significantly enhances corporate financial performance in both developed and developing countries. Nevertheless, this positive effect is more pronounced in firms based in developing countries compared to those in developed countries.

Hang & Geyer-Klingerberg (2018) investigate the relationship between corporate environmental performance and financial performance. Given the mixed and varied results in existing literature, their research aims to clarify the causality between environmental and financial performance. The findings indicate that this causal relationship varies depending on the time period examined.

Budiharjo (2019) conducts a study to evaluate the effect of environmental and financial performance on company value, using secondary data from 2015 to 2017. The study employs the T test and multiple linear regression analysis. The results indicate that while environmental performance positively affects company value, the impact is not statistically significant.

In China, Wang & Zhao (2020) analyze the impact of ISO 14001 certification on financial performance on a sample of 63 companies listed on the stock exchange in the period from 2003 to 2018. They also explore how certification affects exports and the influence of company size and age. The results reveal that ISO 14001 certification initially has a negative effect on financial performance, though this negative impact decreases over time. Additionally, larger and older firms experience a more positive relationship between ISO 14001 certification and non-financial performance. The study highlights a nuanced view of ISO 14001 certification: while it may initially harm financial performance, its effects improve with time and contribute positively to a company's international competitive advantage. The findings suggest that, overall, ISO 14001 certification can ultimately benefit China's economy, though this impact requires careful evaluation.

Wu (2020) conducts a case study to investigate the relationship between environmental and financial performance in China, focusing on a sample of 29 manufacturing companies from 2012 to 2018. The regression analysis results show that environmental performance significantly positively affects the company's financial indicators. These findings suggest that for manufacturing enterprises in China to achieve long-term growth and gain recognition from various stakeholders, under increasingly strict control over the environment, it must attach importance to environmental performance, make resource utilization more efficient, improve technological innovation, and this improve financial performance.

Based on the aforementioned considerations and research, the research question in this paper is:

Does the implementation of the ISO 14001 standard affect the financial performance of companies in Serbia?

1.2. The relationship between non-financial reporting and financial performance of companies

McWilliams & Siegel (2001) conducted research to explore the relationship between corporate social responsibility (CSR) activities and financial performance. Their findings indicate that there is a neutral relationship between corporate social responsibility activities and financial performance.

Murray, Sinclair, Power & Gray (2006) investigate the connection between social and environmental disclosures and the financial market performance of major UK companies. Their study employs two data sets: the CSEAR database for social and environmental disclosures and data on stock market returns for these companies. The findings indicate that there is no direct correlation between non-financial disclosures and stock market returns.

Niskala & Schadewitz (2010) conducted a study to examine how the disclosure of non-financial information influences the value of companies in Finland. Their analysis, covering the period from 2002 to 2005, utilized a traditional valuation model with non-financial reporting as the independent variable. The measurement of non-financial reporting was based on whether companies provided financial reports in line with GRI (Global Reporting Initiative) standards. The authors found that a company's communication with stakeholders through non-financial reporting is a significant factor affecting its value. They attribute these findings to the fact that such reporting enhances communication channels, thereby reducing information asymmetry between managers and investors.

Research conducted by Angelia & Suryaningsih (2015) investigates the influence of environmental performance and CSR reporting on financial performance. The study sample includes 17 publicly listed companies. The findings reveal that environmental performance significantly affects both ROA and ROE. However, while CSR reporting has a significant impact on ROE, it does not affect ROA.

Asuquo, Dada & Onyeogaziri (2018) conducted research in Nigeria to explore the impact of sustainability reporting on the corporate performance of brewery companies. The study found that disclosures related to environmental, economic, and social performance do not have a significant effect on ROA of the selected listed companies in Nigeria.

Borodin et al. (2019) conducted a study examining the impact of non-financial disclosures on the financial performance of Russian companies. The findings indicate that non-financial disclosures have a long-term effect on ROA. Additionally, the study reveals intersectoral differences: non-financial disclosures significantly positively impact the growth of Tobin's Q ratio in the basic materials and utilities sectors, while ROA growth is observed in the energy, industrial, and similar sectors. Conversely, non-financial disclosures do not significantly affect financial indicators in the financial sector, which appears to be less focused on social issues such as environmental sustainability and social welfare.

Research conducted by Singh & Chakraborty (2021) in India finds no statistically significant relationship between financial performance and the quality and quantity of corporate social responsibility disclosures. The data on corporate social responsibility is sourced from the annual reports of the sampled companies. The study constructs a multidimensional measure of corporate social responsibility disclosure based on stakeholder

theory, encompassing various stakeholder groups such as: employees, customers, investors, the community, and the environment. Multiple regression analysis is employed to explore the relationship between corporate social responsibility disclosure and financial performance.

Vitale, Cupertino & Riccaboni (2022) conduct research focusing on the agricultural and beverage sectors to examine the impact of mandatory non-financial reporting on financial performance. They perform a regression analysis using a sample of 180 listed companies over an 8-year period. Additionally, the study explores the moderating effects of non-financial reporting regulations on the relationship between sustainability and financial performance. The findings reveal a positive direct effect of mandatory non-financial reporting on operational performance, while non-financial reporting regulations negatively influence the relationship between sustainability and financial performance.

Based on the aforementioned considerations and research, the starting research question in this paper is:

Does non-financial reporting affect the financial performance of companies in Serbia?

2. Research sample and methodology

Proceeding from the defined research objective and research questions, empirical research in this paper relies on quantitative methodology. Empirical research focuses on a sample of 56 companies in the National Register of Pollution Sources. The research includes secondary data collection and analysis. The data is taken from reports available on the website of the Business Registers Agency (www.apr.gov.rs), as well as from company websites. The empirical part of the paper focuses on statistical data analysis using the non-parametric Mann Whitney U test and SPSS (Statistical Package for Social Sciences). The results obtained using the methods of analysis, synthesis and comparison point to relevant conclusions.

Table 1: Sample characteristics

	Frequency	%
Legal form		
JP	6	10,7
AD	15	26,8
DOO	35	62,5
Size		
Micro	2	3,6
Small	7	12,5
Medium	20	35,7
Large	27	48,2
ISO 14001 standard implementation		
Yes	33	58,9
No	23	41,1
Non-financial disclosure		
Yes	39	69,6
No	17	30,4

Source: Author

According to the Environmental Protection Agency, 179 companies are obliged to submit data on the sources of environmental pollution to the National Register of Pollution Sources. In this research, the sample includes 56 companies, which is 31.28% of the total number of companies that submit data to the National Register of Pollution Sources. As shown in Table 1, the sample mostly includes limited liability companies (62.5%), joint stock companies are in the second place (26.8%), while public companies are the least (10.7%). According to the company size, the sample includes large companies the most, followed by medium and small companies, while micro companies are the least included. If the sample is viewed according to the number of companies that have implemented the ISO 14001 standard, it can be seen that there are more companies that have implemented the standard than those that have not implemented the standard. When it comes to the criterion of disclosure of non-financial information, the sample includes a larger number of companies that disclose non-financial information than those that do not disclose this type of information.

3. Research results and analysis

The following part of the paper presents the results of the empirical research, where the non-parametric Mann-Whitney U test is used to answer the question of whether there is a difference between companies that have implemented the ISO 14001 standard, used in this paper as a measure of environmental performance, and companies that have not implemented the standard, when it comes to financial performance, as well as the question of whether there is a difference between companies that disclose and companies that do not disclose non-financial information, both in terms of financial performance. Based on the previous research it is assumed that companies that have implemented the ISO 14001 standard have better financial performance than those that have not implemented the standard (Ong, The, Goh & Thai, 2015; Moneva & Ortas, 2009; Amores-Salvadó, Martin-de Castro & Navas-López, 2015; Wu, 2020; Manrique & Martí-Ballester, 2017). Also, it is assumed that companies that disclose non-financial information have better financial performance than companies that do not disclose non-financial information, similar to the results of previous research (Borodin et al., 2019; Vitale, Cupertino & Riccaboni, 2022; Niskala & Schadewitz, 2010).

3.1. Finding a statistically significant difference between companies that have implemented the ISO 14001 standard and companies that have not implemented the standard in terms of financial performance

Financial performance is measured using two indicators, the rate of return on assets (ROA) and the rate of return on equity (ROE). The analysis was performed using the non-parametric Mann-Whitney U test.

Table 1: The result of Mann-Whitney U test

Research dimension	ISO 14001	N	Mean Rank	Mann-Whitney U	Z	Sig.
ROA-2019	Implemented	33	29.82	303,000	-1.031	0.303
	Not implemented	22	25.27			
ROA-2020	Implemented	33	29.79	337,000	-0.708	0.479
	Not implemented	23	26.65			
ROA-2021	Implemented	33	31.21	257,000	-1.821	0.069
	Not implemented	22	23.18			

Source: the authors

The results of the Mann-Whitney U test in Table 1 show that, when 2019-2021 ROA, i.e. return on assets, is taken into account, there is no statistically significant difference between companies that have implemented the ISO 14001 standard and companies that have not implemented the standard, since in 2019 p>0.05 (U=303,000, Z=-1.031, p=0.303), in 2020 p>0.05 (U=337,000, Z=-0.708, p=0.479), while in 2021 p>0.05 (U=257,000, Z=-1.821, p=0.069).

Table 2: The result of Mann-Whitney U test

Research dimension	ISO 14001	N	Mean Rank	Mann-Whitney U	Z	Sig.
ROE-2019	Implemented	32	23.78	233,000	-0.819	0.413
	Not implemented	17	27.29			
ROE-2020	Implemented	32	24.41	253,000	-0.399	0.690
	Not implemented	17	26.12			
ROE-2021	Implemented	32	26.17	202,500	-1.170	0.242
	Not implemented	16	21.16			

Source: the authors

The results of the Mann-Whitney U test in Table 2 show that, when 2019-2021 ROE is taken into account, there is no statistically significant difference between companies that have implemented the ISO 14001 standard and companies that have not implemented the standard, since in 2019 p>0.05 (U=233,000, Z=-0,819, p=0,413), in 2020 p>0.05 (U=253,000, Z=-0.399, p=0.690), while in 2021 p>0.05 (U=202,500, Z=-1.170, p=0.242).

Based on the above, when the three-year ROA and ROE are taken into account, we see that the results of the Mann-Whitney U test point to no statistically significant difference between the financial performance of companies that have implemented the ISO 14001 standard, used in this research as a measure of environmental performance, and companies that have not implemented the specified standard. Hang & Geyer-Klingeberg (2018) conclude that higher environmental performance does not affect companies' financial

performance in the short term. However, they find that, over the long term, companies experience significant benefits from improved environmental performance. This suggests that the relationship between environmental and financial performance is contingent upon the period of observation. Sarumpaet (2005) points to the absence of a significant relationship between financial and environmental performance, which is in line with the results of the research conducted in this paper. Finally, it should also be noted that Budiharjo (2019) states that environmental performance, expressed in the form of ISO 14001 standard implementation, does not have a significant impact on the sales value of companies. The results obtained in this research can be explained by the fact that companies in Serbia still do not recognize the importance of ISO 14001 standard implementation. In addition, the reasons for such results may be a relatively small sample and the lack of information on when companies implemented the ISO 14001 standard, specifically the time elapsed from its implementation to the monitoring of financial performance, means that we cannot accurately assess how the duration of adherence to the standard influences financial outcomes.

3.2. Finding a statistically significant difference between companies that disclose and companies that do not disclose non-financial information in terms of financial performance

The second part of the research examines the relationship between companies that disclose non-financial information and companies that do not disclose non-financial information, in terms of financial performance.

Table 3: The result of Mann-Whitney U test

Research dimension	Non-financial information	N	Mean Rank	Mann-Whitney U	Z	Sig.
ROA-2019	Discloses	39	29.74	244,000	-1.260	0.208
	Does not disclose	16	23.75			
ROA-2020	Discloses	39	29.58	289,500	-0.748	0.454
	Does not disclose	17	26.03			
ROA-2021	Discloses	39	28.46	294,000	-0.334	0.739
	Does not disclose	16	29.74			

Source: the authors

Based on the results of the Mann-Whitney U test in Table 3, when considering 2019-2021 ROA, it can be concluded that there is no statistically significant difference between companies that disclose non-financial information and companies that do not disclose this type of information, since in 2019 $p>0.05$ ($U=244,000$, $Z=-1.260$, $p=0.208$), in 2020 $p>0.05$ ($U=289,500$, $Z=-0.748$, $p=0.454$), while in 2021 $p>0.05$ ($U=294,000$, $Z=-0.334$, $p=0.739$).

Table 4: The result of Mann-Whitney U test

Research dimension	Non-financial information	N	Mean Rank	Mann-Whitney U	Z	Sig.
ROE-2019	Discloses	37	25.08	219,000	-0.070	0.944
	Does not disclose	12	24.75			
ROE-2020	Discloses	37	25.04	213,000	-0.209	0.834
	Does not disclose	12	24.25			
ROE-2021	Discloses	36	25.32	186,500	-0.702	0.482
	Does not disclose	12	22.04			

Source: the authors

Based on the results of the Mann-Whitney U test in Table 4, when taking into account 2019-2021 ROE, it can be concluded that there is no statistically significant difference between companies that disclose non-financial information and companies that do not disclose this type of information, since in 2019 $p>0.05$ ($U=219{,}000$, $Z=-0.070$, $p=0.944$), in 2020 $p>0.05$ ($U=213{,}000$, $Z=-0.209$, $p=0.834$), while in 2021 $p>0.05$ ($U=186{,}500$, $Z=-0.702$, $p=0.482$).

Based on the analysis of three-year ROA and ROE, the Mann-Whitney U test results indicate no statistically significant difference in financial performance between companies that disclose non-financial information and those that do not. These findings partially align with the results of Angelia & Suryaningsih (2015), which also found that corporate social responsibility reporting does not impact financial performance when measured by return on assets, but does have a significant effect when measured by return on equity. Singh & Chakraborty (2021) conclude that there is no statistically significant relationship between financial performance of companies and corporate social responsibility disclosure. Borodin et al. (2019) believe that non-financial disclosures in the financial sector do not have a significant impact on financial indicators. Murray, Sinelair, Power & Gray (2006) use stock returns as a measure of financial performance and conclude that there is no direct relationship between the disclosure of non-financial information and stock returns. The results obtained in this research can be explained by the fact that non-financial reporting includes voluntarism and freedom when drafting statements and non-financial indicators, but also by the fact that non-financial reporting relies on regulations that are not fully harmonized with the global ones.

Conclusion

The main research objective has been to check whether the implementation of the ISO 14001 standard and non-financial reporting affect the financial performance of companies. The paper assumes that companies that have implemented the ISO 14001 standard have better financial performance than companies that have not implemented it and that companies that disclose non-financial information have better financial performance than companies that do not disclose this type of information.

Research results show a higher percentage of companies in the National Register of Pollution Sources that disclose non-financial information, more precisely 69.6%, while 30.4% of observed companies do not disclose non-financial information. The results of the research indicate no statistically significant difference, in terms of financial performance, between companies that have implemented the ISO 14001 standard and companies that have not implemented this standard. Also, the results point to no statistically significant difference, in terms of financial performance, between companies that disclose non-financial information and companies that do not disclose non-financial information. Financial performance is assessed using the return on assets and the return on equity in three consecutive years, i.e. in 2019, 2020 and 2021. Most previous research conducted around the world indicates the existence of a positive relationship between environmental and financial performance (Ong, The, Goh & Thai, 2015; Moneva & Ortas, 2009; Amores-Salvadó, Martin-de Castro & Navas-López, 2015; Wu, 2020; Manrique & Martí-Ballester, 2017) and the existence of a positive relationship between non-financial reporting and financial performance of companies (Borodin et al., 2019; Vitale, Cupertino & Riccaboni, 2010). The reasons for the results obtained in this paper may be: misunderstanding the importance of the implementation of the ISO 14001 standard by domestic companies, the use of a relatively small sample, the use of a qualitative measure of environmental performance such as the adoption of the ISO 14001 standard and the disclosure of non-financial information, voluntarism in non-financial reporting and regulations that are not fully aligned with the global ones.

Given that the research has come to the conclusion that there are not enough papers in Serbia dealing with the impact of ISO 14001 standard implementation and non-financial reporting on the financial performance of companies, its theoretical implications complete domestic literature in this area. It is expected that this paper will improve knowledge about the importance and benefits of ISO 14001 standard implementation, as well as knowledge regarding non-financial disclosures. Comparison of the results obtained by authors around the world and the results obtained in this research points to the current situation with Serbian companies. Also, the results obtained in this paper help draw significant conclusions about developing countries. In terms of its practical implications, the paper indicates the importance of implementing the ISO 14001 standard and non-financial reporting, so that results can be used as recommendations for domestic companies to improve environmental management processes.

The research presented in the paper has several limitations that could provide a valuable foundation for future studies in this field. Some of the limitations observed during data analysis and processing are: a relatively small research sample that included 56 companies in the National Register of Pollution Sources, the use of only secondary data available on the website of the Business Registers Agency and data available on sampled companies' websites, as well as the fact that the research does not use advanced statistical methodology but a non-parametric test, namely Mann-Whitney U test.

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Key determinants of firm value: evidence from Serbian listed companies

Кључне детерминанте вредности компанија: искуство акционарских друштава у Србији

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Abstract: The valuation of a firm is a major issue, scrutinized by all stakeholders, and serves as an indicator of the worth of the core business. The goal of this research is to analyze, from both academic and empirical point of view, how key financial determinants influence firm value. In more detail, this analysis strives to explain the relationships between company value of listed companies on Belgrade Stock Exchange (BELEX) as a dependent variable, determined through Tobin's Q, and independent variables that include leverage, size, liquidity, growth, asset structure and profitability. The objective of this study is to present an evaluation of the impact of firm-specific determinants on the company value of Serbian stock companies, across several industries using panel data analysis. The sample consists of 38 active companies that actively operated from 2019 to 2021, resulting in 114 observations. The results of panel data analysis show that on the one hand, liquidity and asset tangibility have positive and statistically significant influence on firm value, while on the other hand, leverage and profitability have negative and statistically significant influence on the value of the firm. Company size and growth showed no statistically significant impact on Tobin's Q.
Keywords: Tobin's Q, valuation, BELEX, panel analysis
JEL classification: C23, G32

Сажетак: Процена вредности компаније је значајно питање које разматрају све заинтересоване стране и служи као показатељ вредности пословања. Циљ истраживања ове студије је да се спроведе анализа како би се открило, из теоријске и из емпиријске перспективе, како кључне финансијске детерминанте утичу на вредност предузећа. Детаљније, ова студија има за циљ да испита односе између вредности котираних компанија на Београдској берзи (BELEX), као зависне варијабле мерене путем Tobin's Q и независних варијабли које укључују левериџ, величину компаније, ликвидност, раст, структуру активе и профитабилност. Циљ овог рада је да пружи процену утицаја специфичних карактеристика предузећа на вредност акционарских компанија у Републици Србији, у неколико привредних грана, употребом панел анализе података. Узорак се састоји од 38 активних компанија које су пословале од 2019. до 2021. године, што је резултирало са укупно 114 опсервација. Резултати панел анализе показују да, с једне стране, ликвидност и материјалност имовине имају позитиван и статистички значајан утицај на вредност предузећа, док са друге стране, левериџ и профитабилност имају негативан и статистички значајан утицај

на вредност фирме. Величина и раст компаније нису показали статистички значајан утицај на Tobin's Q.
Кључне речи: Tobin's Q, вредновање, BELEX, панел анализа
ЈЕЛ класификација: Ц23, Г32

Introduction

The total worth of a business is a question of great significance not only among researchers, but also investors, creditors, and other stakeholders inside and outside a corporation. This matter is best recognized in theory and practice as firm or company value. According to Adiputra & Hermawan (2020), a firm's value is one of the significant indicators for the third parties in assessing the core business of the company, because if the firm's value is high, the market would believe that the firm is performing well and could guarantee the sustainability of the shareholders' interest in the future. Reschiwati et al. (2019) highlight that firm value is a benchmark for investors to assess the success of a company. Moreover, Sondakh (2019) asserts that companies undergoing an initial public offering want to increase the overall worth of their company. This is primarily driven by the recognition that a higher value of company presents a compelling incentive for investors to allocate their financial resources. Furthermore, Husna & Satria (2019) agree that firm value is the selling price of a company that is considered feasible for prospective investors. This is a matter of great importance since, according to Marković & Savović (2022), foreign investors have to restructure targets quickly and radically, in order to improve targets' business performance.

The primary aim of this research is to analyze, from both theoretical and empirical point of view, how key financial determinants influence firm value. In more detail, this study tends to examine the relationships between firm value as a dependent variable explained through Tobin's Q and independent variables. In this paper, leverage, size, liquidity, growth, asset structure and profitability will be empirically examined as key determinants of firm value of listed corporations on Belgrade Stock Exchange (BELEX). The review of existing research literature showed that there are very few studies that focus on the examination of influence of financial determinants on firm value in Serbian stock market, in particular. Therefore, this study will contribute to this academic field to a large extent. Additionally, discovering the determinants of firm value and forming a regression model could improve several activities, both for management within the company and, externally, for consultants and auditors in the digitalization process (Vuković et al., 2023), as well as for investors and other stakeholders. In the light of rapid technological advancements, there have also been significant changes in all parts of corporate processes, as well as the creation of new business opportunities (Ljumović et al., 2021).

This manuscript involves three main sections. The first section contains the theoretical background and review of prior research results of different authors regarding the effect of key firm-related determinants on value of listed corporations in various markets worldwide. According to literature overview, the main hypotheses were made. The following part presents the observed sample and methodology applied in this research, in more detail. The last section shows empirical findings and the discussion of results with the aim to confirm or reject the research hypotheses.

1. Theoretical background

In order to value the company adequately and give a signal to stakeholders whether a firm's stocks are being overvalued or undervalued in the market, Tobin's Q is a primarily used concept. According to Ishaq et al. (2021), Tobin's Q is a widely used proxy for the operating performance in studies of corporate governance. Tobin's Q ratio is a tool that measures the link among market and book value of the firm. According to Ganguli & Agrawal (2009), the Tobin's Q model includes inherent finance risk, resulting in a more forward-looking valuation of the firm. Fisher and McGowan (1983) states that by combining stock market data with accounting data, Tobin's Q produces a more accurate measure of firm rent. This paper employed Tobin's Q as a dependent variable to assess the impact of selected economic variables.

The examination of the influence of leverage on company valuation is in a special focus of academic researchers in the last decade. The significance of this function remains a subject of debate, leading to continuous interest and investigation among scholars. In this paper, debt-to-asset ratio is applied for calculation of impact on firm value. According to Vatansever & Hepsen (2013), debt-to-asset ratio is performed to measure how much a company's assets are financed by debt or how much the company's debt affects its asset management. In corporate finance, the impact of financial leverage on firms' strategic decisions is of crucial importance (Shilpa & Amulya, 2020). By analyzing 96 companies belonging to metals and metal products industries publicly traded on the National Stock Exchange (NSE) in India, Shilpa & Amulya (2020) conclude that debt ratios have negative impact on market-to-book value of firm which is contrary to traditional trade-off theory. The study from Gharaibeh & Qader (2017), who empirically investigate the determinants of firm value on a sample of 40 companies listed on the Saudi Stock Exchange (TADAWUL), resulted in the conclusion that there is no statistically significant relationship between firm value and its leverage. Considering previous research findings and the aim of this study, the hypothesis that would be examined during this research is the following:

Hypothesis 1 (H1): Financial leverage, as the debt-to-asset ratio, has a negative and statistically significant impact on firm value.

The financial variable of great influence on company value, which measures a corporate ability to create income, is return on assets (ROA). As Hendrani & Septyanto (2021) highlight, ROA is a ratio for measuring profitability that is very often used by financial managers to evaluate overall effectiveness in generating profits with available assets. According to Tica et al. (2023), ROA could assess the performance of both publicly traded and non-publicly traded companies, which makes it suitable for research on different markets. Moreover, Reschiwati et al. (2019) state that the higher profits generated by a company would increase the creditor's confidence to provide loans and could increase investor confidence to invest capital, so it could be said that profitability influences capital structure. On the one hand, Reschiwati et al. (2019), based on research performed on banks listed on the Indonesia Stock Exchange for the years 2014 to 2018,

concluded that profitability does not significantly affect the value of the company. Also, Rahmantari et al. (2019) indicated that the profitability increase is not accompanied by the stock prices growth, which leads to a decrease in the company value. On the other hand, profitability is found to have a significant and positive relationship with firms' value of quoted manufacturing firms in Nigeria, according Igbinovia & Ogbeide (2019) that made research on the sample of fifteen manufacturing companies in Nigeria from the Nigerian Stock Exchange covering five sub-sectors and including the period of 2012 to 2017. This could be interpreted as an indication that increased ability for profit generation accelerates corporate value. Markonah et al. (2020) obtained the assumption that profitability has a positive and significant influence on firm value, based on the sample of 14 industrial corporations from food and beverage industry registered at Indonesian stock market in the period 2010-2016. Furthermore, in the research performed by Gamayuni (2015) it is concluded that ROA has positive and significant impact on firm value, measured through Tobin's Q, based on manufacturing companies in Indonesia listed on IDX (2007-2009). Similar studies conducted by Afinindy et al. (2021), Mardiyati et al. (2012), Sukmawardini (2018) and Rizqia et al. (2013) also agree with those findings. Based on available research evidence and the scope of this paper, the hypothesis that would be examined in this study is the following:

Hypothesis 2 (H2): Profitability as the return on assets has a positive and statistically significant impact on firm value.

The impact of firm size on company value, often mentioned as the 'size effect', is merely one of several factors taken into consideration while examining the influence on firm value. This is supported by the research of Oktaviarni & Suprayitno (2018), which shows that the size of the company affects the value of the company because the larger the company, the easier it is to obtain sources of funding. On the contrary, according to Reschiwati et al. (2019), firm size has a negative and significant effect to the value, following the results of research conducted on banks listed on the Indonesia Stock Exchange for the period 2014-2018. Igbinovia & Ogbeide (2019) conducted research on the sample of fifteen manufacturing companies in Nigeria from the Nigerian Stock Exchange covering five sub-sectors and including the period of 2012 to 2017 and concluded that size is negative and statistically insignificant with firms' value of quoted manufacturing firms in Nigeria. Djashan & Agustinus (2020) included 180 non-financial companies listed on the Indonesian Stock Exchange in the period of 2015-2017 in their research and confirmed that size of the company has no significant effect on firm value. The insignificant influence of firm size on firm value is also confirmed a the study by Gharaibeh & Qader (2017), who empirically investigated the determinants of firm value of a sample of 40 companies listed in the Saudi Stock Exchange (TADAWUL). Moreover, the research of Afinindy et al. (2021) came with a conclusion that that firm size has no effect on firm value, which means that large firm size is not always followed by an increase in firm value, according to the study of food and beverage companies listed on the Indonesia Stock Exchange for six periods (2013-2018). In accordance with previous research and the aim of this paper, the hypothesis that would be examined in this study is the following:

Hypothesis 3 (H3): Firm size has a negative and statistically significant effect on firm value.

In this paper, liquidity is measured by current ratio, which, according to Husna & Satria (2019), is used to measure the ability of a company to meet its short-term liabilities that are due by using the total current assets available. Janaćković et al. (2022) underline that the three important elements that include liquidity are time, means of payment and financial obligation. Reschiwati et al. (2019) clarify that when a company is highly liquid, it could pay the short-term debt, reducing total debt and turning capital structure more towards its own sources. Hence, it could be said that liquidity has great affect to capital structure. Djashan & Agustinus (2020) highlight that high liquidity could affect the investor's decision to invest in a company, which causes the demand for the company's stock, consequently rising the stock price. Markonah et al. (2020) conclude that the higher the current ratio, the greater firm's capacity to promptly fulfill its financial responsibilities. Based on the research of Reschiwati et al. (2019), conducted on banking companies listed on the Indonesia Stock Exchange for the period 2014-2018, liquidity has a positive and significant effect to the value of the company. However, the results of high ratio, not necessarily imply the high liquidity of the firm. The findings of the study by Markonah et al. (2020) showed that the current ratio does not have significant impact on the firm value, based on the sample of corporations in food and beverage industry registered on Indonesian stock market in the period 2010-2016. Moreover, Afinindy et al. (2021) concluded as well that either high or low liquidity have no effect on firm value, based on a study of food and beverage companies listed on the Indonesia Stock Exchange for six periods (2013-2018). Based on prior research results and the purpose of this paper, the hypothesis that would be examined in this study is the following:

Hypothesis 4 (H4): Liquidity, as a current ratio, has a positive and statistically significant impact on firm value.

The growth of the firm, as another important metric, could be explained as a company's ability to expand by comparing sales from the current year with previous. Moreover, Afinindy et al. (2021) explain that from an investor's point of view, sales growth shows a positive signal where a firm is able to increase profits through its sales and has a positive impact on firm value. In this paper, growth is defined as annual percentage change of sales. According to Hestinoviana (2013), sales growth rate is calculated as the sales in the second year minus the sales value in first year and then divided by the sales value in the first year. Vuković et al. (2022) clarify that all internal and external stakeholders will be provided with insight into the reality of growth plans and opportunities for future sustainable growth, which creates a basis for measuring a company's business prosperity and predicting its long-term performance. However, the research of Hestinoviana (2013) envisaged that growth measured through turnover has no impact on corporate value. Furthermore, the results of Afinindy et al. (2021) based on food and beverage companies listed on the Indonesia Stock Exchange for six periods (2013-2018) indicate that sales growth has no effect on firm value, meaning that the level of sales growth does not affect firm value. This finding indicates that the determinant

regarding sales growth is not always considered by stakeholders, because different sales levels do not ensure the expected rate of return to shareholders. Relying on previous research findings and the main objectives of this paper, the hypothesis that would be examined in this research is the following:

Hypothesis 5 (H5): Growth has a positive and statistically significant impact on firm value.

Asset structure is another independent variable of great importance and influence on firm value. As a condition for survival in modern markets, companies regularly invest in the acquisition of new technology and use them to gain yield (Tica, 2022). Aggarwal & Padhan (2017) state that high compositions of fixed assets offer more collateral value, hence providing a safety cushion backup. With the increased level of tangibility of assets, the company has more guarantee to deal and therefore, has more power to invest in various projects due to available funds. Gamayuni (2015) highlights that value of intangible assets is more volatile than the value of tangible assets. According to the study performed by Igbinovia & Ogbeide (2019), on the sample of fifteen randomly selected manufacturing companies in Nigeria based on data availability from the Nigerian Stock Exchange covering five sub-sectors and including the period of 2012 to 2017, tangibility of assets is found to have a significant positive relationship with firms' value of quoted manufacturing firms in Nigeria. This could be an implication that effective allocation of assets would empower company value, especially when those assets are valuable for enhancement of value of stocks. On the contrary, in the research conducted by Gharaibeh & Qader (2017), which empirically investigated the determinants of firm value of a sample of 40 companies listed in the Saudi Stock Exchange (TADAWUL), the conclusion was made that there is no statistically significant relationship between firm value and its asset tangibility. According to literature review and the aim of this paper, the hypothesis that would be examined in this study is the following:

Hypothesis 6 (H6): Asset structure has a positive and statistically significant impact on firm value.

2. Data and methodology

The goal of this research is to provide an empirical and theoretical evaluation of the influence of firm-specific characteristics on the firm value of listed companies in Republic of Serbia, across several industries. The sample consists of 38 active companies that operated from 2019 to 2021, resulting in a total of 114 observations. The TP Catalyst database was used as a primary data source for this research (Bureau van Dijk, 2022). The details of the model's variables are specified in Table 1.

Table 1: Summary of variable specification

Variable	Designation	Calculation	Literature
Dependent variable	Tobin's Q	(Market value of equity/Book value of assets)	Hestinoviana, 2013; Gamayuni, 2015; Gharaibeh & Qader, 2017; Al-Slehat, 2020; Ishaq et al., 2021;
Independent variables	Leverage	Sum of liabilities/Total assets	Gharaibeh & Qader, 2017; Husna & Satria, 2019; Shilpa & Amulya, 2020.
	Profitability measured by ROA	Net income/ Total assets	Gamayuni, 2015; Igbinovia & Ogbeide, 2019; Reschiwati et al., 2019; Sondakh, 2019; Husna & Satria, 2019; Djashan & Agustinus, 2020; Afinindy et al., 2021; Hendrani & Septyanto, 2021.
	Company size	Ln Total assets	Gharaibeh & Qader, 2017; Husna & Satria, 2019; Igbinovia, & Ogbeide, 2019; Reschiwati et al., 2019; Adiputra & Hermawan, 2020; Al-Slehat, 2020; Djashan & Agustinus, 2020; Umar Abbas, 2020; Afinindy et al., 2021; Hendrani & Septyanto, 2021.
	Liquidity	Current assets/ current liabilities	Gamayuni, 2015; Husna & Satria, 2019; Reschiwati et al., 2019; Sondakh, 2019; Adiputra & Hermawan, 2020; Djashan & Agustinus, 2020; Markonah et al., 2020; Afinindy et al., 2021.
	Company growth	Relative change in sales revenue	Hestinoviana, 2013; Djashan & Agustinus, 2020; Afinindy et al., 2021.
	Assets tangibility	Fixed assets/ Total assets	Gharaibeh & Qader, 2017; Igbinovia & Ogbeide, 2019; Al-Slehat, 2020; Djashan & Agustinus, 2020.

Source: the authors' research

The sample comprises enterprises from several sectors, according to NACE Rev. 2 (Eurostat, 2008). The overall structure of enterprises categorized by industries is displayed in Table 2.

Table 2: Summary of sample structure by industry

Section	Title	No. of companies	% Share
A	Agriculture, forestry and fishing	2	5.3%
B	Mining and quarrying	1	2.6%
C	Manufacturing	17	44.7%
F	Construction	5	13.2%
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	3	7.9%
H	Transportation and storage	3	7.9%
J	Information and communication	1	2.6%
K	Financial and insurance activities	2	5.3%

L	Real estate activities	1	2.6%
M	Professional, scientific, and technical activities	1	2.6%
N	Administrative and support service activities	1	2.6%
P	Education	1	2.6%
	Total	38	100,00%

Source: the authors' calculation

In the study, panel data analysis is employed to assess the impact of financial factors on the company value, measured by Tobin's Q of stock corporation and based in Serbia. Tobin's Q indicator involves market evaluations, which are derived from the prices at which a company's assets could be sold in the stock market. It presents investor anticipations regarding the potential prosperity of the firm. Tobin's Q is a forward-looking metric that takes into consideration the expected future expenses associated with property replacement. Tobin's Q serves as a standardized metric for evaluating value, enabling comparisons to be made across various organizations and industries. The primary constraint related to Tobin's Q is its reliance on market value data, which may not be easily accessible for every company or in all markets. Consequently, this limitation restricts its applicability in some circumstances. Due to this reason, many companies were excluded from the sample. In this paper, the following model will be evaluated:

$$TOBINQit = \beta it + \beta 1\ LEV + \beta 2\ ROA + \beta 3\ SIZE + \beta 4\ LIQ + \beta 5\ GR + \beta 6\ TANG + uit$$

where the abbreviations are as follows: i - firm (i = 1,2,3…, n), t - year (t = 1,2,3), TOBINQ - Tobin's Q (firm value), LEV - financial leverage, ROA - return on assets, SIZE - firm size, LIQ - liquidity, GR - company growth, TANG - assets tangibility.

3. Results and discussion

Before employing a detailed empirical analysis, it is necessary to perceive the variables of the sample using descriptive statistics. According to the findings reported in Table 3, the Tobin's Q value has a notable variation, ranging from 0.004 to 1.341. The Tobin's Q ratio, which relates the market worth of the firm to its substitution value, generally ranges between the range of 0 to 1. When the ratio is closer to 0, it implies that the cost of replacing the assets surpasses the shares value, indicating a relatively low company value. In contrast, it may be observed that when the Tobin's Q ratio exceeds 1, it indicates that the valuation of a company's assets surpasses its replacement cost, implying that they may be overpriced. Moreover, it is observed that the median debt-to-assets ratio is 0.383 for Serbian stock corporations. This suggests that, on average, these companies tend to depend more on equity funding, with a minor inclination towards utilizing borrowed sources for operational activities. The low values of this indicator may suggest a minimal level of investment risk. The profitability, shown by the median of ROA, is found to be 1%. This figure falls below the conventional target of 10%. If subsequent examination indicates that profitability is an important variable in examining the value

of a firm, it should be advisable for firms to improve their ability to generate earnings. The current ratio revealed a mean value of 1.142, presenting a significant range from 0.047 to 7.180. In comparison to the target value of 2, the median value indicates that a significant proportion of the studied companies are unable to fulfill their immediate financial obligations by utilizing their current assets. Therefore, there are expressed worries regarding the maintenance of liquidity, despite the inclusion of highly liquid enterprises in the sample. When examining the potential for sales growth, it is observed that the median of sales growth values 0.040, with a range spanning from -0.992 to 1.541. These statistics suggest that the company's assets possess the ability to yield earnings in the form of sales. The median value representing the level of tangibility is 0.655. Therefore, it could be observed that, on average, organizations own asset structures that are mostly fixed assets. This implies that the companies included in the sample are predominantly distinguished by a high intensity of capital.

Table 3: Summary of descriptive statistics

Variable	No. of observations	Median	Mean	St. dev.	Min.	Max.
Tobin's Q	114	0.184	0.262	0.255	0.004	1.341
Leverage	114	0.383	0.429	0.355	0.048	1.735
ROA	114	0.010	0.01	0.075	-0.227	0.281
Firm size	114	9.640	9.835	1.600	6.255	15.086
Liquidity	114	1.142	1.804	1.708	0.047	7.180
Growth	114	0.040	0.04	0.327	-0.992	1.541
Tangibility	114	0.655	0.633	0.235	0.032	0.980

Source: the authors' calculation

Since we have time dimensions from 2019 to 2021, as well as the spatial dimensions in the form of firms, panel data analysis should be applied. Fixed-effect and random-effects panel regression analysis was estimated and used the Hausman test to indicate the adequate type of model for the analysis. The Hausman test results were significant ($p = 0.0365$), so we rejected the null hypothesis that envisages using the model with stochastic specification.

Table 5: Test of autocorrelation, heteroscedasticity, and cross-section dependence

Test	Test statistics value	p
Wooldrige test	2.030	0.163
Breusch-Pagan / Cook-Weisberg test	21.40	0.000
Pesaran cross-section independence test	0.377	0.706

Source: the authors' calculation

After estimating the model, it proves appropriate to test the main assumptions for applying panel data analysis (autocorrelation, heteroskedasticity, and cross-section dependence). The presence of autocorrelation in data is examined using the Woldridge test. Since the findings of the Woldridge test do not show significance ($p = 0.163$), we confirm the null hypothesis that there is no first-order autocorrelation. Breusch-Pagan/Cook-Weisberg test is implemented to test the existence of heteroskedasticity. The results were significant ($p = 0.000$), so we reject the null hypothesis of

homoscedasticity. Pesaran cross-section independence test was used to examine whether there is a cross section-dependence between panels. The results were not significant (p = 0.706), so we accepted the null hypothesis of cross-sectional independence. Table 6 shows the findings of the evaluation of multicollinearity among the independent variables, utilizing the Variance Impact Factors (VIF) and 1/VIF (TOL) coefficients. The VIF parameters for all variables are under 10 and the TOL parametres are above 0.1. Thus, the lack of multicollinearity in the model could be confirmed. Based on the results, one of four assumptions for applying panel regression analysis have not been met.

Table 6: Test of multicollinearity

Variable	VIF	TOL (1/VIF)
Leverage	2.21	0.45
ROA	1.91	0.52
Liquidity	1.62	0.62
Assets tangibility	1.53	0.65
Company growth	1.13	0.89
Company size	1.07	0.93
Mean VIF	1.58	

Source: the authors' computation

To overcome the assumption violation for applying panel regression analysis, an alternative model specification with panel-corrected standard errors was used. The findings of the model with panel-corrected standard errors are presents in Table 7.

Table 7: Results of evaluation of regression model with panel-corrected standard errors results

Variable	PCSE model
Leverage	-0.273* (0.061)
ROA	-0.529** (0.246)
Company size	-0.011 (0.012)
Liquidity	0.041* (0.013)
Company growth	0.009 (0.050)
Assets tangibility	0.121** (0.053)
C	0.350** (0.150)
R^2	0.4143
Wald χ^2	103.58*
p < 1%*; 5%**	

Source: the authors' computation

The findings of regression analysis with panel-corrected standard errors show that financial leverage has negative and statistically significant impact on corporate value, whereby hypothesis 1 is accepted. Increasing levels of debt have the potential to constrain a company's financial maneuverability. The company might be required to dedicate a substantial proportion of its cash flows towards servicing its debt, so reducing the available funds for dividend distributions, share repurchases, or investments in its operations. Moreover, high amounts of debt might give rise to agency expenses and potentially enhance the credit risk of the organization. These are all factors that indirectly lead to a decrease in firm value. These results have been empirically confirmed by Shilpa & Amulya (2020). Furthermore, panel analysis findings revealed that profitability

negatively impacts firm value, denying hypothesis 2. Although this direction of influence is unexpected, there are some reasons why it is present. Investors may express concern regarding a company's capacity to retain its profit margins over a long time if the firm's profitability is mostly driven by short-term indicators or unsustainable practices, such as the implementation of aggressive cost-cutting measures. Moreover, the presence of very high profitability has the potential to draw the attention of regulatory and tax authorities, which may subsequently result in alterations or increases in the tax treatment. Provided that the company chooses to retain all its earnings without distributing dividends, investors who prioritize income might demonstrate a preference for corporations that offer earning opportunities through regular dividend payments. Similar findings were confirmed by Rahmantari et al. (2019). As the results revealed, company size is not a significant factor in firm value. It is possible for company size to develop a different impact on firm value in different industries. Investors and analysts frequently evaluate companies by considering their growth potential, profitability, market position and other aspects that may hold greater significance than mere size. Smaller enterprises frequently demonstrate enhanced efficiency, adaptability, and resilience in the face of dynamic market conditions when compared with their bigger counterparts. All things considered, hypothesis 3 is rejected. These results confirm the direction and significance of the firm size effect, as in research from Gharaibeh & Qader (2017), Djashan & Agustinus (2020) and Afinindy et al. (2021). Regarding liquidity, analysis envisages that the current ratio has a positive and statistically significant impact on company value and hypothesis 4 is confirmed. The presence of liquidity serves as a protective measure against potential financial difficulties and unexpected obstacles. Moreover, companies that possess sufficient cash could allocate resources towards research & development, investment initiatives, and growth efforts, so improving their competitive strength and overall profitability. In addition, liquidity enables corporations to distribute dividends to their shareholders. Researching a related subject matter, Reschiwati et al. (2019) and Djashan & Agustinus (2020) obtained similar results. If we recall descriptive analysis, firms from sample record a low liquidity. Hence, given that observed Serbian companies intend to achieve high firm values, it proves necessary to determine a means of accelerating the immobilization of funds and extending the repayment period of obligations. Considering further results, company growth measured by annual change in sales does not significantly affect firm value. If a company encounters a period of rapid sales revenue growth, it is important to consider that this may not necessarily result in an increase in firm value if its profit margins are narrow or decreasing. Consequently, hypothesis 5 is rejected. Such direction could also be found in study performed by Hestinoviana (2013) and Afinindy et al. (2021). Regarding tangibility of assets, empirical research shows that participation of the fixed assets in total assets positively and statistically significant impacts on Tobin's Q. Tangible assets possess the potential to serve as collateral for the purpose of obtaining loans and securing finance. Moreover, it is worth noting that tangible assets provide a higher degree of liquidity in comparison to intangible assets, as they may be easily transformed into cash. Considering descriptive statistics, sampled companies have an asset structure predominantly oriented towards fixed assets, which is

a great advantage in the process of valuing the corporation. Regarding the findings of the panel analysis, Hypothesis 6 is accepted. Also, the results are in accordance with the research conducted by Igbinovia & Ogbeide (2019).

Conclusion

Firm value presents a global focus of academic researchers in the present time. Moreover, the total worth of a business is a question of great importance not only among researchers, but also various stakeholders inside a company. In this paper, the authors seek to examine the relationships between firm value, expressed through Tobin's Q, and financial determinants such as leverage, size, liquidity, growth, asset structure and profitability, measured through specific financial ratios. The goal of this research is to deliver an econometrical and academic evaluation of the effect of determinants on the firm value of companies in Serbia, across several industries, listed on Belgrade Stock Exchange (BELEX). TP Catalyst database was used as a primary data source for this research (Bureau van Dijk, 2022). According to this database, the sample consists of 38 active companies that operated from 2019 to 2021, resulting in a total of 114 observations. The authors applied panel regression analysis to test the research hypotheses. The results of empirical analysis have shown that leverage and profitability have negative and statistically significant impact on firm value, while liquidity and asset structure showed positive and statistically significant influence on firm value. Additionally, firm size and growth resulted in statistical insignificance effect on the firm value.

Having in mind that the review of existing literature showed that there are very few studies testing the impact of firm-relevant determinants on company value particularly in Serbia, it could be said this study shall contribute to this academic field to some extent. However, there are some limitations of this research that are open for further investigation. It is necessary to point out that the sample contains only listed companies on Serbian stock market, which is a minor share of total number of enterprises of Serbian economy. Furthermore, the possible limitation of this study arises from the fact that for this type of analysis it is necessary to obtain market data, which is not publicly available for a great number of domestic companies. Also, more specific sector analysis could be a subject of future research. There is a global awareness of the financial consequences of COVID-19 on economies worldwide and regarding this matter, it would be possible to make a comparison of the influence of key determinants on firm value before and after the pandemic. Finally, beside the before mentioned main factors of influence on firm value, future research could extend the scope of this study by adding other potential internal and external determinants of influence to obtain an overall picture of a company's worth.

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Optimizing vehicle routing and scheduling under time constraints

Оптимизација рутирања возила и редоследа са временским ограничењима

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Abstract: The Vehicle Routing Problem is essential in logistics for optimizing customer routes, especially in time-sensitive variants. This paper presents a two-stage algorithm for Vehicle Routing Problem with Time Windows. It effectively minimizes the number of vehicles, with transportation costs resulting just 0,38% above the best solution found on Solomon test instances. The approach limits search time to about 10 minutes, effectively balancing complexity and solution quality.
Keywords: vehicle routing, scheduling, time windows
JEL classification: C61

Сажетак: Проблем рутирања возила представља један од основних проблема у логистици рутирања потрошача, посебно када се укључи временска компонента проблема.У овом раду представљамо алгоритам са две фазе за оптимизацију проблема рутирања возила са временским ограничењима. Алгоритам на ефектан начин минимизује број возила, чији квалитет потврђујемо на класичним Соломоновим тест проблемима. Транспортни трошкови су већи тек за 0,38% од најбољих резултата пријављених у литератури. Уз лимитирање рада алгоритма 10 минута, на ефектан начин смо балансирали између комплексности проблема и квалитета решења.
Кључне речи: рутирање возила, утврђивање редоследа, временски прозори
ЈЕЛ класификација: C61

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Introduction

Vehicle Routing Problems (VRP) are the essence of every logistic model tackling transportation decisions. Assigning customers' requests to routes and seeking the satisfactory sequence has become an inevitable ingredient of contemporary decision-making tools. The variations of VRP are numerous, each originating from real-life applications. Following the lifestyle of modern customers, the most distinguished problems are time-related. Information about the approximate shipment arrival time increases consumer satisfaction, thus enhancing the quality of distribution.

The Vehicle Routing Problem with Time Windows (VRPTW) is a significant optimization challenge in logistics and transportation. It involves determining the optimal routes for a fleet of vehicles to service a set of customers within specified time windows. The complexity of VRPTW arises from its combinatorial nature and the need to balance multiple constraints, such as vehicle capacity, route length, and service times. Over the years, various solution approaches have been developed, each contributing to the advancement of the field.

The foundational work by Solomon in 1987 introduced VRPTW, providing benchmark problems and heuristic algorithms that have become standard references in the field. Solomon's algorithms laid the groundwork for subsequent research, offering initial solutions that addressed time window constraints and vehicle scheduling in a structured manner.

Furthermore, Solomon's work not only laid the foundation for future research but also stimulated the development of new methods and techniques for solving VRPTW. His benchmark problems continue to be widely used for testing new algorithms, enabling consistent evaluation of the performance of different approaches. Over the decades, the evolution of technology and the increase in data availability have enabled advanced analyses and the implementation of sophisticated models that better respond to the challenges of modern logistics systems.

Today, solving VRPTW is not just an academic endeavor but has direct applications in the industry. Optimizing routes while considering time windows can significantly reduce costs, improve efficiency, and increase customer satisfaction. For example, delivery services, food distributors, and pharmaceutical companies often use these models to ensure timely and reliable delivery of their products.

The aim of this paper is to provide an overview of current approaches to solving Solomon's problems in VRP, identify the advantages and disadvantages of different methods, and propose potential improvements for future work. Special attention will be given to methods combining heuristics and metaheuristics with exact methods to achieve a better balance between solution quality and computation time. This paper will also explore how advances in computing and algorithmic theory can further enhance the efficiency and applicability of VRPTW in real-world conditions.

1. Literature review

During the early 1990s, Desrochers et al. (1992) made significant contributions by developing efficient algorithms for solving large-scale VRPTW. Their work emphasized the use of Lagrangian relaxation techniques and branch-and-bound methods to improve computational efficiency.

In the early 2000s, the research expanded to include metaheuristic approaches, which provided more flexible and robust solutions to VRPTW. Bräysy and Gendreau (2005) conducted a comprehensive survey of metaheuristic algorithms for VRPTW, highlighting the effectiveness of tabu search, simulated annealing, and genetic algorithms in finding high-quality solutions for complex routing problems.

The Clarke-Wright savings algorithm, introduced by Clarke and Wright in 1964, remains one of the most widely used heuristics for solving VRPTW. This algorithm constructs initial solutions by iteratively merging routes based on cost savings, and it has been enhanced and adapted in numerous studies. For instance, Toth and Vigo (2002) reviewed various extensions and adaptations of the Clarke-Wright algorithm, demonstrating its continued relevance in modern VRPTW research. In the late 2000s and 2010s, hybrid algorithms became prominent, combining different heuristic and metaheuristic techniques to solve VRPTW more efficiently. Goel and Maini (2018) introduced a hybrid algorithm combining Ant Colony Optimization (ACO) and Firefly Algorithm (FA), leveraging the strengths of both algorithms to enhance solution quality and convergence speed.

Macrina et al. (2019) explored energy-efficient solutions for VRPTW by incorporating mixed vehicle fleets and partial battery recharging. Their research highlights the practical applications of green logistics, addressing both environmental sustainability and operational efficiency. This dual focus is crucial in today's logistics environment, where there is a growing emphasis on reducing carbon footprints. Goel et al. (2019) addressed the issue of stochastic customer demands and service times, presenting models and solutions that account for real-world uncertainties. Their work improves the robustness of vehicle routing solutions, making them more adaptable to dynamic environments where demand and service times can vary unpredictably. Jiang et al. (2020) proposed a hybrid multiobjective evolutionary algorithm based on variable neighborhood search for solving VRPTW involving hazardous materials (HazMat). Their focus on safety and efficiency provides a comprehensive solution for complex routing problems.

The integration of machine learning techniques into VRPTW is a more recent development. Julie Poullet (2020) explored the use of clustering and reinforcement learning to solve large-scale VRPTW. By leveraging these advanced computational methods, her research demonstrated significant improvements in efficiency and solution quality, paving the way for future studies to incorporate machine learning in logistics optimization.

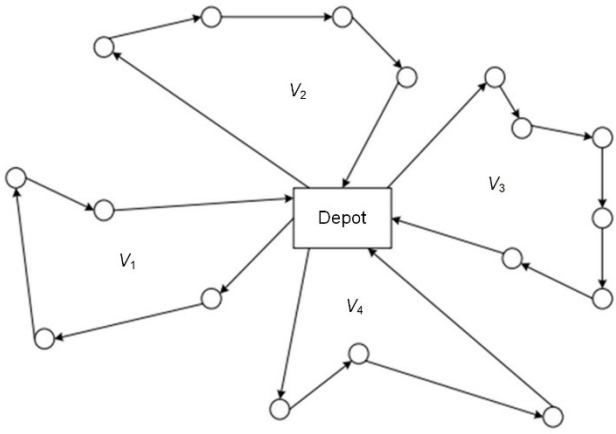
These contributions underscore the evolution of VRPTW solutions from foundational heuristics to sophisticated hybrid and machine learning-based approaches. As the field continues to advance, future research is likely to focus on integrating real-time data, further enhancing the adaptability and robustness of VRPTW solutions in diverse and dynamic

environments in the direction of a broader field – city logistics. City logistics is advancing towards the integration of multi-echelon distribution systems to enhance efficiency and sustainability in urban environments. This approach includes incorporating time constraints specifically to mitigate traffic congestion challenges (as explored by Rekabi, et al. in their study on pharmaceutical supply chain networks with perishable items). Additionally, it addresses the complexities of delivering perishable goods (as discussed by Bala et al., 2017) and managing biomass logistics (as highlighted in studies such as those by Cao et al. 2021.). These advancements aim to optimize the movement of goods within cities while considering operational limitations and environmental impacts, thus fostering smarter and more resilient urban logistics systems. For more details about literature on VRP and its variations, one can see Konstantakopoulos et al. (2022). Metaheuristic algorithms have been widely applied across various fields, not only transportation problems. Petrović et al. (2024) review the mathematical applications in economics. Andrijević et al. (2024) discuss the use of neural networks in energy consumption analysis, while Radak et al. (2024) illustrate the application of genetic algorithms for portfolio optimization.

2. Problem definition

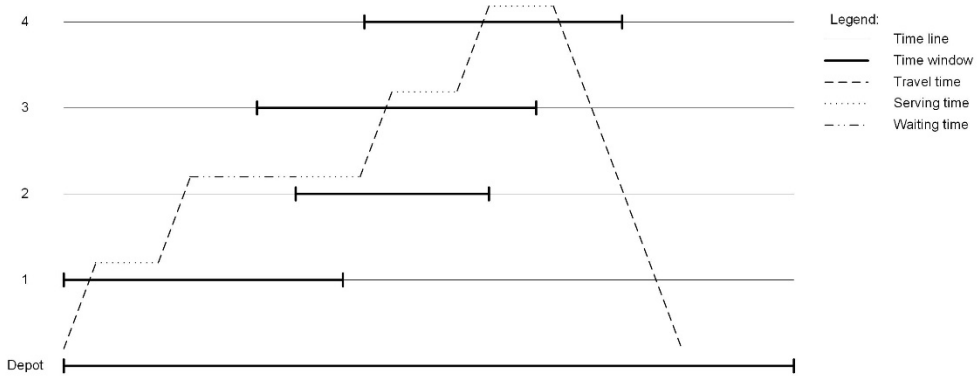
This section contains formal problem definition of VRPTW. Let D denote the depot and let $(a, b), a < b, a, b > 0$ be the time window of the depot. Denote with V a set of homogeneous vehicles of capacity C. With $\{1,2,\dots,n\}$ we will denote the set of customers, each of them with a time window $(a_i, b_i), a_i < b_i, a_i, b_i > 0$, quantity q_i, and a serving time $s_i, \forall i \in \{1,2,\dots,n\}$. Each route starts and ends at depot, with operating time between $[a, b]$. This means that total route time, including traveling, waiting and serving time, is at most $b - a$. Figure 1 depicts a depot, a set of 16 customers and four vehicles with accompanying routes.

Figure1: Vehicle routing scheme



Let t_i be the time of arrival of the vehicle at customer i. If it arrives before a_i, it will have to wait. Leaving time from customer i is $max\{t_i, a_i\} + s_i$. Total quantity of all customer requests on route must not exceed the vehicle capacity C. Number of all defined routes cannot be greater than the number of vehicles $|V|$. On Figure 2 we made an illustration of one possible route starting and ending at the depot and satisfying requests of four customers. We present time flow: the traveling, waiting, and serving time with lines of different shapes. Each object on this route is represented with a timeline and time window. In our example, waiting time occurs only at customer 2.

Figure2: Time flow on a route



3. The algorithm

In this section, we describe the algorithm for solving a VRPTW based on the metaheuristic Simulated Annealing (SA). It is a relatively simple, yet robust optimization technique for solving a range of optimization problems. SA is inspired by the cooling process in thermodynamics that imitates the process of metal cooling. Slower cooling transforms liquid metal into a crystal, which corresponds to the exploration of the solution space guided from feasibility to global optima. The papers of Kirkpatrick et al. (1983) and Černý (1985) are considered to be the introduction of the SA algorithm for optimization challenges. Both papers addressed a well-known problem of combinatorial optimization, the Traveling Salesman Problem (TSP). The use of SA is applied in many combinatorial optimization problems with single or multiple objectives, see Suman (2016).

Suppose that during the exploration of the solution space, the algorithm reaches some state s_1, and that state s_2 is a new candidate state. Given the evaluation function $E(\cdot)$, the algorithm moves to state s_2 with probability $exp(-(E(s_2) - E(s_1))/T)$. The temperature T decreases with running time. Consequently, the algorithm always moves to a cheaper solution and accepts the more expensive solution with a decreasing probability. The latter is particularly important for overcoming the local optima.

With the multicriteria nature of VRPTW, we propose a two-stage algorithm:

Stage 0. Forming the feasible solution.

Stage 1. Minimization of employed vehicles.

Stage 2. Minimization of total travel costs.

The solution space in all stages is explored following the SA principle. To reach a feasible solution, our evaluation function is guided with travel costs. Once the feasibility is achieved, we consider only states that satisfy the vehicle capacity and customer and depot time window constraints, throughout the algorithm execution. The evaluation function is composed of travel costs increased with a special ingredient in the first stage. Namely, after every k iterations, we randomly choose a route and expand the evaluation function with a logarithm of the number of customers on the route. The procedure is repeated several times, and when the stopping criteria are satisfied, we move to the second stage. The stopping criteria is defined via the specific temperature T^{crit}. Finally, in the second stage, given the number of vehicles, we explore the solution space with an evaluation function based only on total travel costs. Solutions with lower transportation costs, but a higher number of vehicles, are not considered.

Neighboring solutions are created using one of the four transformations:

T1. A customer is removed from the current route and inserted in a new position.

T2. Two customers interchange their positions.

T3. Let s and t be two different customers on the same route. Without loss of generality, suppose s precedes t, and denote s_1 and t_1 as the predecessors of s and t, respectively, and s_2 and t_2 as the followers of s and t, respectively. So, the current route has the following structure: $D, \dots, s_1, s, s_2, \dots, t_1, t, t_2, \dots, D$ with $s_2 \neq t_1$. The new route is obtained by combining segments: $D, \dots, s_1, s, t, t_1, \dots, s_2, t_2, \dots, D$, where sub-route $t_1, \dots, s_2$ has different orientation from initial setting.

T4. Let s and t be two customers on different routes, with followers s_2 and t_2 respectively. Route containing s has a structure $D, \dots, s, s_2, \dots, D$, and the one containing t is $D, \dots, t, t_2, \dots, D$. The new routes are obtained by combining segments: $D, \dots, s, t2, \dots, D$, and $D, \dots, t, s2, \dots, D$.

4. Results

We check the quality of the proposed approach on classical Solomon benchmark instances. Problem instances are defined in Solomon (1987) considering three dimensions. The first one is geographical distribution. The authors identify three characteristic situations for customer distribution: R – random uniform distribution, C – clustered, and RC – semi-clustered. The second dimension is the time horizon. Instances with narrow time windows for both customers and the depot, denoted with 1, imply a short scheduling horizon. On the other hand, instances with wider time windows, also for both customers and the depot, are denoted

with 2, and allow a long scheduling horizon. Finally, the third dimension is problem size, expressed by the number of customers: 25, 50, and 100 customers.

In this paper, we consider the problem instances with 100 customers with both short and long scheduling horizons, and all geographical settings. All experiments were performed on the i5-4440@3.10GHz. In Table 1, we summarize our findings. The first column represents the problem group, with the number of the test in parenthesis. The second column shows the number of successful experiments. We run each problem 10 times, and characterize the experiment as successful if the algorithm reaches the minimum number of vehicles reported in the literature. The best solution for each instance is compared with the best-known solution (bks) by calculating $(price - bks)/bks$, where $price$ is the price of the best-found solution and bks is the best-known solution for a particular instance (see https://www.sintef.no/projectweb/top/vrptw/100-customers/). Next, we calculate the average over the entire group, considering only successful experiments. Similarly, the last column contains the average using the same metric. However, instead of using only the best-found solution, we consider all results for a particular instance, and report the average of all experiments for the group.

Table 1: Results of the algorithm for Solomon test instances

Group	Number of successful tests	Best found gap	Average gap
C1 (9)	90	0.0072%	0.0084%
C2 (8)	80	0.0033%	0.0048%
R1 (12)	117	0.0000%	0.7738%
R2 (11)	109	0.0000%	0.5517%
RC1 (8)	80	0.0000%	0.3008%
RC2 (8)	80	0.0034%	0.4225%
Total:	556	0.0000%	0.3771%

We set the cooling scheme to obtain a working time of the algorithm of approximately 10 minutes. However, the time needed to reach the best solution varied across the instances. On average, 392 seconds was the time when the algorithm discovered the best solution. The number of successful experiments was 556, or 99,29%. Four experiments failed, meaning our algorithm failed to find the minimal number of vehicles. Those were the instances “r104” from group R1 in 3 out of 10 experiments and “r207” from group R2 in 1 out of 10 experiments.

Conclusion and future work

In this paper, we present a two-stage algorithm for VRPTW. The search procedure of the solution space is organized with a well-known metaheuristic procedure called Simulated Annealing. The approach leads to more than 99% success in matching the minimal number of vehicles, while lagging by an average of 0.38% from the best results in the literature. We have defined a cooling scheme to match approximately 10 minutes of working time. Although the working time does not look impressive by itself, we believe it is satisfactory

given the problem complexity and quality of solutions. Unfortunately, apart from comparisons with the best-known solutions obtained through different approaches, it is difficult to perform a head-to-head comparison with individual algorithms. Authors generally focus on the best solutions, making it very challenging to assess how individual algorithms perform in average cases.

The presented algorithm has no practical limitations in execution, unlike, for example, algorithms based on mathematical programming, which require many resources for large-dimensional problems. However, the tests performed on Gehring & Homberger benchmark instances with 200 customers showed that our approach does not provide successful tests in a number of instances. The algorithm loses efficiency, and additional heuristic improvements are necessary.

In future work, we will try to implement a few approaches that could lead to better performance of the algorithm. We believe that parallelization of the search procedure could lead to lower time consumption, a more thorough search of the solution space, and possibly overcoming the local minimum. Another direction could be the implementation of different objective functions throughout the working phases of the algorithm. Some ideas could include reducing the waiting time of customers, increasing/reducing the number of customers on a route, or a variation in quantifying the number of customers on a route using other than a logarithmic function.

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Investing in blockchain technologies and digital assets: accounting perspectives

Улагање у блокчејн технологије и дигиталну имовину: рачуноводствене перспективе

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Abstract: This paper examines the complex landscape of digital currencies, non-fungible tokens (NFTs), and distributed ledger technology (DLT), focusing on their implications within the accounting and financial reporting sector. The surge in popularity of these assets has brought about reporting challenges and complexities. The lack of comprehensive accounting standards and the digitization of financial reporting processes further compound the situation. These challenges underscore the need to update accounting practices to align with the security and transparency offered by DLT. The study examines the International Financial Reporting Standards (IFRS) for digital currency reporting, analysing their implications and potential solutions for the accounting community. Central to this exploration is the question: How can the accounting sector navigate the multifaceted challenges and harness the multifarious opportunities that stem from digital currencies, NFTs, and DLT? Using a comprehensive research approach, including a literature review, empirical analysis, case studies, and comparative analysis, this study identifies strategies for managing the reporting complexities of digital assets. It also highlights the importance of collaborative dialogue between stakeholders and regulators to ensure consistency in an evolving landscape. This paper guides the accounting and investment sector in making informed decisions, fortified by a nuanced understanding of the evolving digital asset terrain.
Keywords: non-fungible tokens, blockchain technology, digital currencies, financial reporting, International Accounting standards
JEL classification: M31, G32, O33, Q53

Сажетак: Овај рад испитује сложену слику дигиталних валута, нефунгибилних токена (NFT) и дистрибуиране технологије евиденције (DLT), фокусирајући се на њихове импликације у оквиру сектора рачуноводства и финансијског извештавања. Пораст популарности ових средстава донео је изазове и комплексности у извештавању. Недостатак свеобухватних рачуноводствених стандарда и дигитализација процеса финансијског извештавања даље усложњавају ситуацију. Ови изазови истичу потребу за ажурирањем рачуноводствених пракси у складу са сигурношћу и транспарентношћу које нуди DLT. Студија испитује Међународне стандарде финансијског извештавања (IFRS) за извештавање о дигиталним валутама, анализирајући њихове импликације и потенцијална решења за рачуноводствену заједницу. Централно питање овог истраживања је: Како рачуноводствени сектор може да савлада вишеструке изазове и да искористи разноврсне прилике које произилазе из дигиталних валута, NFT-а и DLT-а? Користећи свеобухватан приступ истраживању, који укључује преглед литературе, емпиријску анализу, студије случаја и компаративну анализу, ова студија идентификује стратегије за управљање

комплексностима извештавања о дигиталним средствима. Такође, она истиче важност колаборативног диалога између заинтересованих страна и регулатора да би се обезбедила конзистентност у еволутираном окружењу. Овај рад водич је рачуноводственом и инвестиционом сектору у доношењу информисаних одлука, утемељених на нијансираном разумевању еволутирајућег терена дигиталних средстава.

Кључне речи: нелефунгибилни токени, технологија блокчејна, дигиталне валуте, финансијско извештавање, Међународни рачуноводствени стандарди
JEL класификација: M31, G32, O33, Q53

Introduction

The integration of digital technology has become an essential aspect of our daily lives, influencing various systems and processes (Krivokuća et al., 2021; Kurtlu & Uçar, 2022). Every company must adapt to the changes in a digital environment. In the era of digital transformation, companies are increasingly aware of the importance of information technologies and are making structural changes to their businesses to accommodate them (Ljumović et al. 2021; Raković et al., 2022; Vuković et al., 2023; Jevtić & Milovanović, 2023). In recent years, the emergence of digital currencies, non-fungible tokens (NFTs), and distributed ledger technology (DLT) have ushered in a paradigm shift in the financial landscape (Vuković et al., 2023; Leibowitz, 2016; Narayanan et al., 2016). As these innovative technologies gain momentum, their implications extend far beyond their technological underpinnings, causing significant changes in accounting practices and investment strategies (Wu et al., 2019; Griffin, 2021; Chalmers et al., 2022; Wilson, Karg & Ghaderi, 2022; Guesmi et al., 2019).

Since the advent of Bitcoin in January 2009, cryptocurrencies have been in the focus of interest of the academic community (Tomić & Todorović, 2020, 13). The growing adoption of digital currencies, exemplified by the rise of cryptocurrencies such as Bitcoin and Ethereum, has captured the attention of diverse stakeholders, including investors, policymakers, and financial institutions (Leibowitz, 2016; Narayanan et al., 2016). The key driver of this phenomenon is the potential to revolutionize traditional financial transactions, improving efficiency, transparency, and accessibility (Wu et al., 2019). However, this transformation also introduces challenges in terms of their valuation, recognition, and reporting under existing accounting standards (Wu et al., 2019; Griffin, 2021).

NFTs, on the other hand, have gained attention for their ability to represent ownership of unique digital assets, such as digital art and collectibles, through blockchain (Griffin, 2021; Tomić et al., 2023). NFTs have seen a surge in interest, which highlights the evolving nature of ownership and the emergence of new investment opportunities (Chalmers et al., 2022; Wilson, Karg & Ghaderi, 2022). Nevertheless, the accounting treatment of these assets is still being developed, challenging established practices and raising questions about their categorization and valuation (Griffin, 2021; Grujić, 2022).

The DLT that underpins digital currencies and NFTs holds the promise of enhanced security, transparency, and efficiency across financial transactions (Griffin, 2021). The potential to increase efficiency and reduce costs introduces new avenues for cost savings and risk management (Guesmi et al., 2019). However, the transition to DLT-powered

systems is not without challenges, such as regulatory uncertainty, data privacy concerns, and the need to integrate with existing financial infrastructure (Guesmi et al., 2019).

Against this backdrop, accounting and investment professionals face the challenge of navigating this evolving landscape while adhering to established standards and regulations. This study aims to bridge the gap between technological advancements and financial expertise, exploring the intersection of digital assets, accounting principles, and investment opportunities (Vuković et al., 2023). Taking a holistic approach to these technologies, we seek to help practitioners make informed decisions and take advantage of the potential of these technologies.

In the subsequent sections, we explore the intricacies of accounting standards, investment considerations, and regulatory frameworks for these emerging technologies. Through our analysis of existing literature, empirical data, and case studies, we contribute to the ongoing dialogue surrounding the integration of digital assets into traditional financial practices, Financial Reporting Standards governing the financial reporting of digital currencies, analysing the associated implications and potential remedies for the accounting community. The central research question of this paper is: How can the accounting and investment community effectively navigate the challenges and capitalise on the opportunities presented by investing in digital currencies, NFTs, and DLT?

The introduction provides an overview of the research area, identifies the research gap, and presents the central research question. It sets the stage for the rest of the paper. Theoretical Background explores the theoretical foundations of the research and is subdivided into five subheadings. The section Methodology describes the research methods and approaches employed in the study, including literature review, empirical analysis, case studies, and comparative assessments. After that comes the section Results. This part presents the key findings of the research based on the methodology used. It highlights specific insights related to accounting challenges, investment considerations, and the role of blockchain technology. This section is followed by Discussion. This part provides an in-depth discussion of the research results, connecting them to the broader context of digital currencies, NFTs, and DLT. This section offers a nuanced exploration of the implications and significance of the findings.

Finally, the Conclusion summarizes the main contributions of the study, including addressing the research gap, offering insights for accounting and investment professionals, and suggesting avenues for future research.

There are some specific questions that we investigate in this paper:

- How are NFTs, digital currencies, and DLT currently being accounted for?
- What challenges and opportunities do these technologies pose for the accounting sector?
- How are accountants, regulators, and investors currently responding to these technologies?
- What are the best practices for accounting for NFTs, digital currencies, and DLT?
- How can the accounting sector collaborate with stakeholders and regulators to address the challenges and opportunities posed by these technologies?

The introduction provides an overview of the topic of the study, highlights the gaps in the existing research, and asks the following research question: How can accounting and investment professionals address the challenges posed by digital currencies, NFTs, and DLT? It provides a roadmap for the rest of the paper. Theoretical Background discusses the theoretical underpinnings of the research and is organized into five sections: (1) the nature of digital currencies, NFTs, and DLT; (2) the accounting challenges posed by these assets; (3) the investment considerations for these assets; (4) the role of blockchain technology; and (5) the regulatory landscape for these assets. Methodology explains how the study was conducted, including the literature review, empirical analysis, case studies, and comparative assessments. Results summarize the key findings of the study, discussing the implications of the findings for accounting, investment, and blockchain technology. The discussion discusses the findings in detail, situating them in the context of digital currencies, NFTs, and DLT. It discusses the implications and significance of the findings in depth. The conclusion summarizes the main contributions of the study, including addressing the research gap, offering insights for accounting and investment professionals, and suggesting avenues for future research.

1. Literature review

NFTs are digital assets that represent tangible items such as art, music, in-game items, or videos. “NFTs can be defined as digital certificates of ownership based on blockchain technology, the possession of which proves indisputable ownership of the acquired digital asset.” (Tomić et al., 2023, p. 60).

Instead of the centralised nature of traditional monetary systems, blockchain technology enables decentralised access with improved transparency and trust, based on peer-to-peer connectivity and cryptographic security. Blockchain has numerous possibilities and use cases in literature and practice (Fosso et al., 2020). Some examples are smart contracts (Kristoufek, 2015; Baek, 2015), cryptocurrencies (White, 2015), asset exchange systems (Yermack, 2015), remittance system (Yermack, 2015), voting system (Platanakis and Andrew, 2019), identity management (Katsiampa, 2017), the Internet of Things (Radivojac & Grujić, 2018), banking industry (Amor et al., 2023), insurance industry (Guesmi et al., 2019), clearing and settlement (Baur et al., 2018), securities trading (Dyhrberg et al., 2018), securities register of paper values (proxy voting) (Pieters et al., 2017), and blockchain or consensus as a service (Dyhrberg at al., 2018).

NFTs share an association with cryptocurrencies, underpinned by records upheld through blockchain technology. Diverging from cryptocurrencies, where each unit or coin can be exchanged for another of identical value, akin to real-world currencies, NFTs stand distinct due to their uniqueness (embodied through distinct identification codes to set them apart). Since each NFT is inherently unique, interchangeability or fungibility among them is absent. Instead, each represents an exclusive digital collectable, a one-of-a-kind asset that defies replication. Comparable to bona fide works of art, NFTs find their authenticity verified through DLT, which distinguishes authentic originals from imitative replicas. Consequently, NFTs are empowered as certified data carriers, serving as digital renditions of tangible assets, and standing in for physical properties, such as real estate, artwork, collectibles, and more. The potential of these digital assets extends to redefining the global

economy, enabling secure storage and transfer of real-world assets onto DLT. This technology also establishes traceability back to the originator of each item or artwork, potentially mitigating prevalent scams and manipulations prevalent in numerous markets. Furthermore, game players can own in-game assets or merchandise, which they can sell to generate income. The bulk of NFT tokens are generated utilizing two Ethereum standards, namely ERC-721 and ERC-1155 (Griffin, 2021). ERC-721 was harnessed for their development by the same individual overseeing the ERC-20 smart contract. ERC-721 outlines the requisite minimum interface for trading gaming tokens, encompassing details pertaining to property, security, and metadata. Conversely, the ERC-1155 standard was conceived to curb transaction and storage costs within a single contract, catering to NFTs and groups spanning various NFTs. Despite being a peripheral use case, it introduces a distinctly novel facet, harnessing the fundamentals of rarity and digital ownership to elevate them to unprecedented heights. While NFTs are still in a relatively nascent stage, they hold substantial potential for diverse applications in the future. The advent of digital asset exchanges introduces a novel form of liquidity previously beyond reach. Presently, the state of the NFT market echoes the early days of the digital currency sector. Definitions and classifications continue to spark debates, rendering the market an experimental arena. Although the integration of this technology into diverse applications will take time, its eventual assimilation appears inevitable. The familiarity of owning digital items like game assets, maps, and music albums has catalysed public acceptance of NFTs, setting the stage for increased adoption moving forward. As individuals become more accustomed to digital currency exchange platforms, the demand for NFTs is projected to rise. Various game developers have already embraced NFTs for in-game assets, providing players with assets for their preferred games. DLT oversees asset ownership, bolstering broader adoption. The subsequent section evaluates existing literature and theoretical background pertaining to the prospects and hurdles of investing in digital currencies, NFTs and DLT, spotlighting gaps and constraints. This section also appraises the regulatory framework that encompasses the financial reporting of digital currencies, focusing on the International Financial Reporting Standards and their relevance and appropriateness. The next section is the mythological part. After this part goes discussion. The subsequent part is the results. The last section concludes the paper, summarising the principal findings and outlining recommendations for future research.

The journey of digital currencies began with the publication of a ground-breaking paper in 2008 by an enigmatic figure known as Satoshi Nakamoto. Titled “Bitcoin: A Peer-to-Peer Electronic Cash System,” this paper laid the theoretical groundwork for a decentralized digital currency system. Bitcoin, introduced in early 2009, was the first implementation of Nakamoto's vision (Nakamoto, 2008; Mert & Timur, 2023).

However, Bitcoin's significance goes beyond its status as a pioneering cryptocurrency. It sparked a revolution in the financial world by offering a decentralized, trustless system of transactions. Unlike traditional currencies that rely on central authorities, Bitcoin relies on cryptographic proof for security. Millions of individuals participated in the Bitcoin network, with miners verifying transactions and securing the blockchain (De Vries et al., 2021).

2. Decoding digital frontiers: exploring NFTs, DLT, and cryptocurrencies

While cryptocurrencies like Bitcoin have garnered significant attention, NFTs are a transformative force in the digital realm.

NFTs, defined as cryptographic assets on blockchains with unique identifying information (Peres, et al., 2022), distinguish themselves from the homogeneity of traditional cryptocurrencies (Chohan, 2021; Bao & Roubaud, 2021; Franceschet, 2021). For example, NFTs are unique and cannot be divided, while traditional cryptocurrencies are fungible and can be divided into smaller units.

In contrast to the extensive literature on cryptocurrencies, NFTs have received relatively limited scholarly scrutiny (Chohan, 2021). Nevertheless, their potential impact cannot be understated. NFTs introduce digital scarcity, fundamentally altering the value proposition of digital assets (Franceschet, 2021). This newfound scarcity breathes life into various digital creations, ranging from art to music, by allowing for unique ownership and monetization (Chalmers, et al., 2022; Wilson, Karg & Ghaderi, 2022). In this context digital scarcity means that there is a limited supply of NFTs, which makes them valuable.

Moreover, NFTs have the potential to redefine how content creators interact with digital markets. They reduce barriers to entry, enabling creators to monetize their digital products directly. Additionally, NFTs offer the flexibility to customize contracts and minimize intermediary involvement, promoting efficiency and cost reduction (Wilson, Karg & Ghaderi, 2022).

However, with great potential come regulatory challenges. NFTs have raised concerns related to speculation, fraud, and volatility. There have been cases of people being scammed out of money by NFT projects. As a result, regulatory bodies are grappling with the need for oversight in this burgeoning sector (Maouchi, Charfeddine & El Montasser, 2022).

DLT serves as the foundational technology underpinning digital currencies and NFTs. Its significance lies in its ability to facilitate secure and transparent transactions through decentralization and immutability.

DLT's role in digital innovation extends beyond cryptocurrencies. It promises to revolutionize property management by providing permanent records of ownership and transactions. These records, internationally verifiable, have the potential to redefine the way we manage assets. DLT creates digital innovation and they make transactions secure and transparent. This could change how assets are managed. However, there are also potential misuse and legal issues. Development and regulation are important to mitigate these issues.

However, the unregulated development of DLT, particularly concerning NFTs, raises concerns about potential misuse. Legal issues may arise as this technology continues to evolve.

Cryptocurrencies represent a subset of digital currencies, primarily designed for use in real-world transactions. They offer advantages such as fast and low-cost transactions,

circumventing the need for traditional financial intermediaries like banks (Guadamuz and Marsden, 2015; Bação et al., 2018; Kfir, 2020). Many authors regard Bitcoin as a potential alternative to government-issued currency (Bouri et al., 2017; Hong, 2017). Since the inception of Bitcoin, several thousand cryptocurrencies have emerged. Today, Bitcoin is the world's largest digital currency by market capitalisation, surpassing all other major digital currencies such as Ethereum (ETH), Binance Coin (BNB), Cardano (ADA), and many others. But even with BTC's astronomical value and adoption, Satoshi Nakomoto's identity remained unknown.

Cryptocurrencies are a type of digital currency that can be used to purchase real goods and services in the real world, such as online shopping, hotel accommodation, movie tickets, or real estate agent services (Guadamuz and Marsden, 2015). Furthermore, cryptocurrencies represent a significant innovation in the design, management, and regulation of financial systems (Shahzad et al., 2018). However, some of the challenges and limitations that arise when using cryptocurrencies are price volatility, regulatory uncertainty, and technical issues. Cryptocurrencies are mainly defined as digital financial assets that rely on cryptographic decentralised technology to guarantee the ownership and transfers of the coins (Giudici, Milne & Vinogradov, 2020; Cui & Gao, 2023). One of the main differences between cryptocurrency and digital currency is related to encryption. Cryptocurrency is secured by encryption, which means that the transactions and ownership of the coins are protected by cryptographic algorithms.

However, cryptocurrencies also face challenges. Price volatility, regulatory ambiguity, and technical difficulties are among the obstacles they must overcome. Nonetheless, they have introduced innovative concepts into the financial landscape and continue to evolve.

In the next section, we explore the confluence of these digital assets, emphasizing their impact on both the accounting and investment sectors. Additionally, we consider the implications of these innovations and the regulatory challenges they pose. Interest in investing in digital currencies, especially Bitcoin, with the aim of achieving above-average returns, has not declined over the years. It is widely believed that Bitcoin is an extremely volatile and risky but potentially profitable financial instrument. Currently, digital currencies are not backed by any currency or asset and cannot be used to pay taxes. Digital currencies embody Hayek's dream of groups of people having their own money because "there is competition among private money rather than government monopoly" (Hayek, 1990).

A non-fungible token (NFT) can be defined as a digital certificate of ownership based on blockchain technology, the possession of which proves the indisputable ownership of the purchased digital asset (Tomić et al., 2023, p. 60). NFTs are digital assets that represent tangible items such as art, music, in-game items, or videos. They are stored on the blockchain, a distributed ledger technology that ensures their authenticity and ownership.

Unlike cryptocurrencies, NFTs are unique and cannot be exchanged equally. Their uniqueness is verified through blockchain, making them certified data carriers for real-

world assets like real estate and artwork. They offer new ways to invest and own digital content, with potential applications in various fields like gaming, virtual reality, and more.

Unlike cryptocurrencies, where each unit or coin can be exchanged for another of equal value, NFTs are unique (they have different identification codes to distinguish them from one another). Since each NFT is unique, they cannot be traded or exchanged at par with each other. Each represents a unique digital collectible, i.e., a unique asset that cannot be copied. NFTs are as unique as real works of art. DLT is used to verify their authenticity so that the difference between a replica and an original can be seen. This makes them certified data carriers that act as digital representations of real-world assets and are used to represent physical assets, such as real estate, artwork, collectibles, and more. Such digital assets have been touted as the next step for the global economy. They allow real-world assets to be securely stored and transferred onto the DLT. Any item or artwork can be traced back to the person who posted it. This can be used to avoid the scams and manipulations that are prevalent in many markets today.

Players can also own assets or goods in the game and sell them to earn money. Most NFT tokens are produced using two Ethereum standards: ERC-721 and ERC-1155 (Griffin, 2021). The ERC-721 standard was developed by the same person who manages the ERC-20 smart contract. ERC-721 is used to define the minimum interface required to trade gaming tokens. The interface includes property, security, and metadata information. The ERC-1155 standard is defined as reducing transaction and storage costs in a single contract as needed for NFTs and groups of various NFTs. Although this is a minor use case, it has proven to be something very new and unique. They have taken the basics of rarity and digital ownership to a whole new level.

Cryptocurrencies and distributed DLT face varying legal and regulatory landscapes globally. While some countries have embraced digital currencies, others have imposed bans or restrictions. For instance, El Salvador and Venezuela have authorized cryptocurrencies as legal tender, challenging traditional financial systems. Environmental concerns, particularly regarding the energy-intensive process of cryptocurrency mining, underscore the need for sustainable practices in the blockchain ecosystem. Furthermore, the social and cultural implications of cryptocurrencies require balanced approaches to harness their potential while addressing concerns about illicit activities and inequality.

Some countries ban or restrict their use, while others embrace them or create their own digital currencies. Environmental concerns about energy consumption due to cryptocurrency mining are significant, and potential social and cultural implications require responsible use and regulation. The European Union, for example, is working on a proposal for a common framework for regulating digital currencies and DLT, as well as exploring the possibility of launching a digital euro (European Commission, 2020). According to the International Accounting Standards Board (IASB), an investment property is a property that is held to earn income or for capital appreciation. Cryptocurrencies meet this definition because they are often held with the aim of making a profit from the growth of their value. However, they cannot be classified as an investment property or valued at fair value through profit or loss under IAS 40 due to their

intangible form, which does not meet the provisions of IAS 16 for property, plant and equipment.

The accounting treatment of cryptocurrencies involves addressing their unique characteristics within established International Financial Reporting Standards (IFRS). Cryptocurrencies' current status under IAS 7 (Cash Flow Statements) and IAS 9 (Financial Instruments) remains uncertain due to their limited acceptance as a means of exchange and volatility. The potential of cryptocurrencies as investment property, meeting the criteria set by the IASB, sparks discussions about their classification. Although cryptocurrencies' intangible form precludes classification under IAS 40 (Investment Property) or IAS 16 (Property, Plant and Equipment), their alignment with IAS 38 (Intangible Assets) offers a suitable framework for valuation (Griffin, 2021).

Cryptocurrencies' unique nature challenges their classification under various IAS standards. Under IAS 2 (Inventories), acquisition of cryptocurrencies for resale or mining aligns with the definition of inventory assets intended for sale, mandating measurement at the lower of cost or net realizable value. IAS 38 provides a platform for recognizing cryptocurrencies as intangible assets, due to their separability and contractual nature. This standard offers the flexibility to value cryptocurrencies using either the cost model or the revaluation model. However, practical challenges in applying the revaluation model may arise when an active market is absent.

The evolving landscape of cryptocurrencies and DLT requires a collaborative effort among regulatory bodies, businesses, and accountants to develop comprehensive standards that capture their complexities. While challenges in accounting treatment persist, the transformative potential of cryptocurrencies necessitates the establishment of responsible and coherent reporting frameworks. The COVID-19 pandemic's impact on digital transformation underscores the urgency of addressing these challenges to ensure financial reporting integrity and transparency in an increasingly digitized economy.

3. Methodology

A thorough literature search was conducted on various databases. However, some excellent works of literature were not included in the search criteria for different reasons. The literature search yielded about 100 results from Scopus and Wos databases, published before August 2023. Out of these, 37 were considered significant. The search string was developed based on the study domain and research topics. Relevant information was found and collected by searching for "cryptocurrencies", "NFT", "non-fungible token", "blockchain technology", "digital currencies", "financial reporting", "International Accounting Standards" and "investment opportunities".

Inclusion criteria are: research published at any time between January 2014 and August 2023; the keywords include "cryptocurrencies ", "NFT", "non-fungible token", "blockchain technology", "digital currencies", "financial reporting", "International Accounting Standards" and „investment opportunities" and the research scope is limited to the journals. Exclusion criteria are: the removal of articles in the press, articles that are not in English and exclusion of reviews, conferences, book chapters, dissertations,

monographs, and papers based on interviews. The only exceptions to the exclusion criteria are two works: Hayek (1990) and Nakamoto (2008).

This study adopts a multifaceted research approach, encompassing a literature review, empirical analysis, case studies, blockchain technology exploration, comparative analysis, and synthesis of findings to comprehensively analyse the opportunities and challenges associated with investing in NFTs, digital currencies, and DLT. A thorough review of academic papers, articles, and studies pertinent to NFTs, digital currencies, and DLT was conducted to gather a comprehensive understanding of the subject matter. Insights into historical evolution, applications, and challenges were gained. Key areas of focus included investment strategies, market trends, valuation models, and accounting standards. Empirical studies like Abid et al. (2014), Baek & Elbeck (2015), Guesmi et al. (2019) offered insights into portfolio diversification and risk management.

Relevant case studies, such as NFT valuations in art and gaming, were examined to comprehend financial reporting challenges and solutions. Blockchain technology and its role in NFTs and digital currencies issuance were explored. Comparative analysis of accounting standards IAS 38 and IAS 2 assessed their applicability. Synthesising findings from literature, empirical studies, case studies, and analysis, this research informs the discussion on NFTs, digital currencies, and DLT challenges and opportunities from accounting and investment perspectives. By employing this methodology, this research provides a comprehensive understanding of NFTs, digital currencies, and blockchain technology's implications for both accounting and investment. The accounting sector plays a crucial role in financial reporting and regulatory compliance, while the investment sector is focused on portfolio management and risk assessment. By exploring the implications of these emerging technologies in both sectors, this study aims to shed light on their potential impacts and contribute valuable insights to professionals and researchers alike.

4. Results: unravelling the complexities of cryptocurrencies: accounting, regulation, and environmental implications

The study showed different ways NFTs can be used. They can be used as data carriers in different industries, like art and gaming. This research provides a comprehensive understanding of NFTs, digital currencies, and their underlying DLT, highlighting the unique attributes, applications, and challenges of NFTs and digital currencies for accounting and investment professionals.

Through a review of the literature, empirical studies, and case studies, the research identifies specific accounting challenges posed by NFTs and digital currencies. It also proposes potential solutions and strategies to address these challenges, such as the classification, measurement, and valuation of these digital assets.

This research delves into the investment considerations of NFTs and digital currencies, emphasizing factors such as risk assessment, volatility, regulatory developments, and potential returns. It highlights the evolving investment landscape and the need for informed decision-making.

The study explores the role of blockchain technology in the issuance of NFTs and digital currencies, highlighting its impact on transparency, security, and traceability. It underscores the potential of blockchain in revolutionizing various industries beyond finance.

A comparative analysis of International Accounting Standards (IAS) 38 and 2 evaluates their applicability to NFTs and digital currencies. The research identifies challenges in aligning these standards with the unique attributes of these emerging assets and proposes considerations for financial reporting.

By synthesizing insights from literature review, empirical analysis, case studies, and comparative assessment, the study informs discussions on the challenges and opportunities of NFTs, digital currencies, and DLT in both accounting and investment sectors.

The research adds value by addressing the research gap related to the accounting and investment aspects of NFTs and digital currencies. It offers practical insights for professionals in both sectors, enhancing their understanding of the evolving landscape and facilitating informed decision-making.

Building on the findings, the study provides recommendations for policymakers, regulators, and industry stakeholders to address challenges related to accounting standards, regulatory frameworks, and investor protection. It also identifies avenues for future research, such as environmental impact assessment and broader blockchain applications. These technologies have the potential to revolutionize many industries, and it is important to consider the potential impact of this disruption.

In summary, the research contributes a nuanced perspective to the challenges and opportunities of investing in NFTs, digital currencies, and DLT within the realms of both accounting and investment. It bridges the gap between these two sectors and offers practical insights that can guide professionals and stakeholders in navigating this evolving landscape

5. Discussion

This research has provided a comprehensive exploration of NFTs and their relationship with cryptocurrencies, and their alignment with various accounting standards. NFTs, unlike cryptocurrencies, represent unique digital assets that cannot be duplicated.

The findings of this study provide valuable insights into the opportunities and challenges associated with investing in NFTs, digital currencies, and DLT within the accounting and investment sectors. The primary aim of this research was to shed light on the complex landscape of these emerging technologies and to examine their implications for financial reporting and investment.

By analysing the current landscape of NFTs, digital currencies, and DLT, this study offers a comprehensive understanding of the benefits and risks for accounting and investment professionals. It is evident from this research that while these technologies hold great promise for innovation and financial inclusion, they also introduce complexities in valuation, regulation, and reporting.

Furthermore, this study contributes to addressing the research gap by offering insights into the challenges that arise due to the dynamic and rapidly evolving nature of the digital asset landscape. By comparing our research findings with the identified research gap in the Introduction, we conclude that this study has successfully provided a thorough analysis of the issues faced by both the accounting and financial reporting sectors.

The implications of our research findings are far-reaching. For the accounting sector, our study underscores the necessity of adapting financial reporting standards to suit the unique attributes of NFTs and digital currencies. This includes recognizing the valuation challenges these assets pose and the need for clear guidelines for their treatment in financial statements.

In the investment sector, our research highlights the importance of informed decision-making when considering investments in NFTs, digital currencies, and DLT. It emphasizes the significance of due diligence, risk assessment, and understanding the underlying technology to maximize the benefits while mitigating potential risks.

This study bridges the gap between emerging technologies and their impact on the accounting and financial reporting sectors. The added value of this research lies in its comprehensive analysis of the challenges and opportunities, the alignment of findings with the research gap, and the provision of practical insights for professionals in both domains. By addressing the implications of our findings, we aim to contribute to informed decision-making and strategic planning in the ever-evolving landscape of digital assets.

Conclusion

This study bridges the gap between the accounting treatment of non-fungible tokens (NFTs), digital currencies, and distributed ledger technology (DLT) and the investment considerations for these assets. The complex landscape of these emerging assets presents multifaceted challenges and opportunities, prompting this research to provide valuable insights into their implications for professionals in the accounting and investment sectors.

The research problem at hand centred on the need to address the dearth of comprehensive studies examining the intersections of accounting and investment within the context of NFTs, digital currencies, and DLT. Through rigorous analysis, this study has provided clarity on the unique attributes, applications, and challenges of these digital assets within both sectors. By doing so, it has taken significant strides towards fulfilling the research objectives.

Key findings from this study underscore the need to adapt accounting practices to the distinctive characteristics of NFTs and digital currencies. A comprehensive analysis of existing literature, empirical studies, case examples, and comparative assessments of accounting standards, including IAS 40, IAS 38, and IAS 2, has yielded insights into the effective reporting and management of these digital assets within existing regulatory frameworks. The study has also elucidated the pivotal role of blockchain technology in enhancing transparency, security, and efficiency in the issuance and management of digital assets.

The implications of this research are far-reaching. It provides professionals in both the accounting and investment sectors with a foundation for informed decision-making in the dynamic field of NFTs, digital currencies, and DLT. By offering practical strategies for addressing challenges and harnessing opportunities, this study equips stakeholders with the tools necessary to navigate this transformative landscape effectively.

The analysis showed that these digital assets have many challenges, like price volatility and regulatory uncertainty. However, cryptocurrencies still offer fast and low-cost transactions. Their potential to revolutionize traditional financial systems is evident, with ongoing discussions about their role in the future of finance.

The study states that NFTs, digital currencies, and DLT pose a number of challenges for the accounting sector, including the lack of international accounting standards for these technologies and the highly complex and evolving nature of these technologies. The research showed that financial transparency is important, especially in a digital economy. Besides, it states that NFTs, digital currencies, and DLT also pose a number of opportunities for the accounting sector, including the ability to improve transparency and efficiency in accounting and investment and the ability to facilitate compliance with international accounting standards. Also, the paper states that collaboration between stakeholders and regulators is key to successfully addressing the challenges and leveraging the opportunities that NFTs, digital currencies, and DLT present for the accounting sector.

The paper has provided answers to all of the research questions. The study provides a detailed overview of how NFTs, digital currencies, and DLT are currently being accounted for, as well as the challenges and opportunities that these technologies present for the accounting sector. The paper also investigates how the accounting sector, regulators, and investors are currently responding to these technologies. Finally, the paper identifies best practices for accounting for NFTs, digital currencies, and DLT, as well as how the accounting sector can collaborate with stakeholders and regulators to address the challenges and opportunities that these technologies present.

However, it is important to acknowledge the limitations of this study. The rapidly evolving nature of digital assets and blockchain technology introduces uncertainties that may impact the applicability of these findings in the future. Moreover, this study primarily focused on accounting and investment aspects, leaving room for further exploration of environmental, regulatory, and ethical dimensions. These limitations underscore the need for ongoing research and adaptability in this rapidly evolving field.

In light of these limitations, this research suggests several avenues for future research. Future studies could delve into the environmental impact of digital asset mining, explore the evolving global regulatory landscape, and assess the potential for broader adoption of blockchain technology across various sectors beyond finance. Additionally, investigations into the effects of regulatory alterations on financial reporting and investment strategies, including their alignment with IAS 40, IAS 38, and IAS 2, could provide valuable insights in an ever-changing landscape. These technologies are still in their early stages of development, and there is much that we do not know about them. Further research is essential to fully understand the implications of these technologies.

In essence, this study has laid the groundwork for comprehending the intricacies and potentials of NFTs, digital currencies, and DLT. By embracing the challenges and seizing the opportunities, stakeholders have the capacity to collectively forge a future where these technologies contribute positively to innovation, accountability, and growth across diverse sectors.

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Public oversight and performance measurement in public sector entities

Јавни надзор и мерење перформанси у ентитетима јавног сектора

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Abstract: The existence of the public sector is conditioned by meeting the needs of citizens for public goods and services. Business under constant public scrutiny poses challenges to public sector entities in the form of effectiveness and efficiency in providing services on the one hand, and achieving satisfactory financial performance on the other. Measuring the performance of entities in the public sector can be problematic precisely for the reason that it is necessary to measure the performance of entities whose operations are aimed at meeting public needs and not at making a profit. Therefore, the goals of these entities are taken as a starting point when establishing an adequate performance measurement system. Bearing in mind that the public sector is at the service of the citizens of a country, the question of measuring business performance, as well as the question of public supervision in public sector entities, arises. State audit, financial management and control and internal audit, as elements of public supervision, should ensure fair and true presentation of results and performance of business in public sector entities.
Keywords: citizens, public goods, measures, supervision, audit.
JEL classification: H83

Сажетак: Постојање јавног сектора условљено је задовољавањем потреба грађана за јавним добрима и услугама. Пословање под константном лупом јавности пред ентитете јавног сектора поставља изазове у виду ефективности и ефикасности у пружању услуга, с једне стране, и постизања задовољавајућег финансијског учинка, с друге. Мерење перформанси ентитета у јавном сектору може бити проблематично управо из разлога што је потребно измерити перформансе ентитета чије је пословање усмерено на задовољење јавних потреба, а не на остваривања профита. Због тога се полази од циљева ових ентитета приликом успостављања адекватног система мерења перформанси. Имајући у виду да је јавни сектор у служби грађана једне земље, поставља се питање мерења перформанси пословања, као и питање јавног надзора у ентитетима јавног сектора. Државна ревизија, финансијско управљање и контрола и интерна ревизија, као елементи јавног надзора, требали би да обезбеде поштено и истинито приказивање резултата и перформанси пословања у ентитетима јавног сектора.
Кључне речи: грађани, јавна добра, мерила, надзор, ревизија.
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Introduction

Performance measurement in the public sector is complex, because it is associated with numerous methodological problems of expressing certain quantities, as well as the specifics of the functioning of entities from this sector. The specificities of these entities lead to the fact that it is not possible to use measures whose calculation is based on profit, such as rates of return (profitability) and a number of other financial measures that are derived from and based on the accounting concept of profit (for example, net profit per action). In addition, many public sector entities have such goals that the effectiveness of their achievement can hardly be monitored by quantitative measures. With them, the lack of a single, relatively satisfactory quantitative and comprehensive performance indicator stands out as a serious control and management problem, as in profit-oriented entities, the profitability rate is usually treated as such a measure (Krstić et al., 2011).

In order to establish an adequate performance measurement system, it is necessary to start from the objectives of the public sector entity (Balabonienė & Večerskienė, 2015). The primary objective of most public sector entities is to deliver services to the public, rather than to make profits and generate a return on equity to investors. Consequently, their performance can only partially be evaluated by examining their financial position, financial performance and cash flows (CIPFA, 2016). Depending on the field of activity, each entity in the public sector defines its own goals. For the largest number of entities, the following goals may be relevant: maximizing the volume of public services provided from available resources, targeted (purposeful) use of resources aimed at better meeting wider social needs, maximizing income and financial surpluses, fully covering costs and minimizing subsidies, maximizing the possible volume of funds for achieving the set goals, maximizing the satisfaction of citizens, i.e. users of services and goods, as well as achieving the image of a socially responsible entity in the public (Krstić et al., 2011). In addition, the realization of other (non-financial) goals, such as quality and fairness in the provision of services, or innovativeness (Arundel et al., 2019; Maqdliyan & Setiawan, 2023), is equally important for these entities. The primary task of public sector entities is to meet the needs of citizens, providing them with services of appropriate quality that are not market profitable, but, on the other hand, they are expected to achieve positive financial results, so that the government can reduce the expenses for their financing. Performance measurement in the public sector is a continuous process that involves assessing the success of implementing government programs, while performance measures represent standards for determining the degree of achievement of government goals and policies (Glavaški et al., 2022). The main goal of the measurement is to improve the entity's performance in the following period.

Business performance in the private sector can be expressed in economic and financial measures, such as income, profit, growth, productivity, etc. (Čupić & Vržina, 2024). However, the presentation of achieved performance in economic and financial measures in public sector entities is not expedient if they are not acceptable to political actors, that is, if they are not compatible with political goals (Akhtari, Moreira & Trucco, 2022). In other words, if economic success is not in line with other social interests, it has no significance for evaluating the success of entities in the public sector. To this should be added the fact that the objectives set before the operations of these entities are often in conflict. For example,

the focus on success expressed through economic and financial indicators can negatively affect other performances (Živanović, 2020). The question of the size of the positive financial result is also specific in public sector entities. In profit-oriented private sector entities, a higher positive net financial result generally means higher business success. On the other hand, in the public sector the net result should usually be relatively small, i.e. slightly above zero, because a large net result can signal to those who provide financial resources that such an organization has not provided certain necessary services or goods that were required of it, and that she primarily took care of earning interests. However, if a public sector entity shows a high loss, then it has not justified the trust of the state, which can lead to a reduction in goals and programs. Therefore, although financial performance is not the dominant goal of public sector entities, their monitoring and measurement is still necessary.

1. Performance-based budgeting

It is known that public sector entities are financed by the state, that is, from the state budget. In most public sector entities, there is little opportunity to determine the optimal level of spending (investment). In such a situation, the management of the public sector entity tries to spend as much as the approved budget allows, although the budgeted amounts may be higher compared to the objectively required spending amounts. For this reason, many entities have the characteristics of operationally inefficient organizations, so the need to change this way of looking at these entities is justified. To this end, great importance is attached to budget control, that is, control of the economy of spending in relation to the financial plan (approved budget) of the public sector entity. This is especially pronounced in situations where certain entities financed by the state have the problem of receiving an increase in the sum for financing year after year.

Information on the achievement of budgeted goals is particularly important for deciding on the size of investments in the public sector and certain parts of that sector. Governments may be particularly interested in evaluating the effects achieved by investing in certain segments of the public sector of particular importance, in order to "reduce public organizations' exposure to shocks and support governmental resilience" (Anessi-Pessina et al., 2020). Similar information may be requested by other institutions and individuals who provide funds for other types of non-profit organizations, as it is their legitimate right to know how economically their invested money is spent (Krstić et al., 2011).

Recently, in professional circles, there has been a desire to reform the traditional approach to the budgeting process in public sector entities, that is, to move it towards results-based budgeting, i.e. achieved performances. Such budgeting systems require a more developed system of performance measures, which, in addition to input (investment) measures, also includes more difficult to measure output measures (effects, results), measures of the quality of services provided, measures of effectiveness and measures of efficiency. Their adequate application is very important as a support in the process of defining the planned – budgeted goals, i.e. control of budget execution, because this is the assumption of adequate allocation of resources in the coming period. Without adequately set performance measures, management in public sector entities can allocate resources only based on

subjective attitude or feeling, personal ambition or as a kind of response to certain political pressure.

The performance budgeting system establishes a cause-and-effect relationship between allocated and spent budget funds and achieved results. This system aims to improve the economy, efficiency and effectiveness of public expenditure, and to link the financing of public sector entities with the results they achieve by performing their activities. The basis of budget planning in this system is to define the objectives of the functioning of public sector entities (i.e. budget beneficiaries). The mentioned activity is important in order to evaluate the success/failure of budget beneficiaries in the realization of the defined goals in the following stages of the budget procedure. It is also necessary to obtain and include information on performance in the budget procedure, because this activity represents a key "link" of budgeting according to performance. At the same time, information on performance includes information on the achieved performance, but also information on the costs that were needed to achieve it (Dimitrijević, 2016).

Performance budgeting can be implemented in the state apparatus of a country only if crucial changes in the political and administrative culture have previously been completed, i.e. if other systemic preconditions such as (Dimitrijević, 2016):

- existence of a medium-term budget framework in order to ensure a greater degree of macroeconomic stability and fiscal sustainability of the country;
- applying a top-down approach, i.e. from top to bottom in budget planning;
- existence of a developed control environment for effective management of results and fiscal risks;
- introduction of special agencies that will professionally and responsibly assist the government in monitoring the realization of the results in accordance with the set goals through operational, that is, effective implementation and control of appropriations;
- adequate budget classification (program classification of public expenditures) in accordance with the performance management system;
- quality budget reporting with the application of modern information technology; and
- objective formulation and introduction of performance indicators of spent budget funds.

In addition, the success of performance-based budgeting requires the integration of communication, values and goals among those involved in the process, without illusionary constructs (Mauro et al, 2021).

The general theoretical consensus is that explicit performance contracting requires (1) that goals be specified unambiguously in advance; (2) that the organization be able to select undistorted performance measures, i.e. metrics that provide incentives that are adequately aligned with the organization's ultimate objectives; and (3) that organizational actors know and control the production function that transforms efforts into results, and be able to predict the likely outcomes of alternative courses of action. Speklé & Verbeeten (2014) used the term 'contractibility' to refer to the degree to which these three cumulative conditions can be met simultaneously. According to these authors, examples of highly contractible activities in the public sector include garbage collection or the exploitation of a public swimming pool. In

contrast, low contractibility is present when actors are unable to fully specify the attributes of satisfactory performance, or when the manager's systematic influence on the ultimate outcome is restricted or unknown.

2. Performance measures in public sector entities

According to one of the many classifications, performance measures in the public sector can be defined as: inputs, activities, outputs, and outcomes. *Inputs* are the resources needed to produce goods, and typically include employees, equipment, office supplies, raw materials, components, technology, and money. If the process of creating goods is relatively well organized, the financial-accounting system can simply express the value of inputs in the amount of costs necessary for their acquisition, such as employee salaries, supplier payments, etc. If, for example, the object of analysis is the municipal police, the input criteria can be the number of police officers, the number of cars, the annual budget, and the number of reports received per year per thousand inhabitants.

Activity measures allow the assessment of the stage or the entire process of conversion of inputs into outputs. They are usually easier to evaluate than input, output and outcome measures, although it should be borne in mind that activity does not necessarily mean effectiveness (higher output or better outcome), such as the collection of property tax may be slower despite the shorter time of preparation and delivery of the tax decision.

Outputs are goods created by a public sector entity and can be in the form of physical products and services (for example, the number of community police field trips). While measuring output in the form of products is relatively simple, measuring output in the form of services can be very complicated, especially if their immediate user cannot be identified, such as public lighting service can be measured as the number of functioning street lights or the length of a lighted highway. Input and output measures are often linked to the objective of assessing the efficiency or productivity of the entity, so the object of measurement can be the number of calls per municipal police officer (ratio of output to input) and costs per onsite intervention (ratio of input to output), but also the ratio of the numbers of decisions and officials (ratio of output and input) and the number of local self-government officials per thousand inhabitants (ratio of input and output).

The *outcomes* of the activities of public sector entities are external influences on the direct users of the entity's goods or all citizens. Measuring these outcomes can be difficult if the good is subject to collective consumption (for example, public lighting) or if it meets the needs of individuals for whom it is not intended (for example, a prison). In the case of prisons, the output measures are the number of nights spent in prison, the number of prison escapes and the number of prisoners who have gained additional qualifications, while the outcome measures for society are an increase in the sense of security and a reduction in future crime rates (reduction in recidivism). Measuring outcomes in the public sector can be very challenging because individuals place emphasis on different characteristics of output. For example, the benefits of functioning municipal police for citizens can be clean streets, less noise or free sidewalks. Also, the outcome can be realized several years after the output has been delivered, so the question arises of the right moment of its measurement. Finally, the

outcome can be the result of the action of several agents or subjects, i.e. co-productions. For example, not only municipal police, but also citizens who take care of waste disposal and/or report violations by other citizens or organizations contribute to communal order. Co-production contributes to an increase in output and outcomes, and can be understood as the use of free inputs, which contributes to a fictitious increase in the efficiency of public sector entities. Thus, it may seem that the communal police unit that covers the territory where better educated citizens live is more efficient than others simply because better educated citizens are more careful about proper waste disposal and report violations more often; however, it may be true that other communal police units achieve better outcomes when co-production (citizen action) is neglected.

In addition to the mentioned inputs, activity measures, outputs and outcomes, some more complex performance measures can be used that are the result of combining the previously ones (Stančić & Čupić, 2019):

- economy determined from the ratio of costs and inputs (for example, cost per employee or office);
- productivity determined from the ratio of the output and one input that contributed to its creation (for example, the number of closed restaurants per one field trip of market inspectors, the number of tax rulings issued per employee per month);
- efficiency as a ratio of output and costs of all inputs that contributed to its production (for example, cost per tax ruling, cost per onsite intervention);
- effectiveness as a ratio of outcome and output (for example, number of citizen appeals per hundred issued tax rulings); and
- cost effectiveness as a ratio of outcomes and costs (for example, cost per person who moves from the group of unemployed to the group of employed).

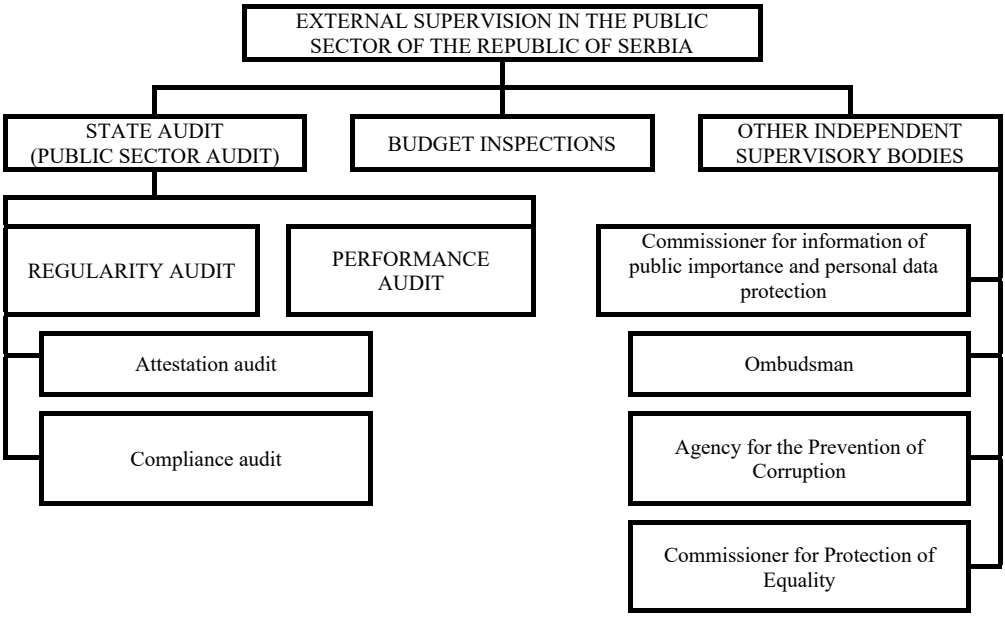
3. Public supervision and other control mechanisms in public sector

Performance measurement in the public sector is a complex, demanding and time-consuming technical task. An aggravating circumstance is the fact that budget users – public sector entities - often have no motive to reduce costs while respecting the requirements of frugality and rationality and thus contribute to the socially optimal effect of public spending. Precisely for the aforementioned reasons, it is extremely important to establish adequate control mechanisms of budget users in order to prevent false presentation of results and activities that are the subject of measurement and evaluation. The following mechanisms of control in the public sector are known in the world: external supervision (state audit) and internal supervision (internal financial control). In the Republic of Serbia, there is also the Treasury Administration. It was established by the Law on the Budget System and is an integral part of the Ministry of Finance of the Republic of Serbia, and it started working in 2005. The Treasury Administration is managed by a director appointed by the government, who is responsible for their work to the Minister of Finance. Through its operations, the Treasury Department should ensure a stable and transparent budget policy, the functioning of the public finance system, and constantly improve the efficiency in the disposal of taxpayers' funds.

3.1. External supervision (state audit)

External supervision in the public sector is often identified with state audits (or public sector audits), but it has a broader meaning and, in addition to state audits, also includes budget inspections and other independent supervisory bodies. One of the most important control mechanisms for the proper and efficient use of public funds in democratically governed countries is the state audit or public sector audit. For the legal and efficient functioning of the public sector of a country, the existence of institutional, professional and independent external control over the disposal of public funds and state property is of particular importance (Krstić & Bonić, 2017). State audit can be defined as a special type of parliamentary control of the legality of spending public financial resources and management of public assets performed by competent state bodies and institutions (Sretenović & Janković Andrijević, 2015). Within the scope of the state audit, two types of audits are carried out: regularity audit and accomplishment audit (see Figure 1).

Figure 1: Forms of external supervision in the public sector of the Republic of Serbia



Source: illustration by the authors.

A regularity audit provides reasonable assurance as to whether the financial statements have been prepared in all material respects in accordance with the framework for financial reporting in the public sector, whether they give a true and fair view of the condition and operations of the entity subject to the audit, and whether the transactions and decisions made in the entity are in accordance with the law and regulations. It is also called a traditional public sector audit and includes the following two components: an attestation audit and a compliance audit. The focus of an attestation audit is determining the accuracy of the data

contained in the financial statements. In other words, this audit assesses whether the financial statements correctly reflect the financial activities and financial condition of the public sector entity under review. The opinion that the state auditor expresses during this audit concerns whether budget funds were spent in accordance with the budget and whether they were managed in an efficient manner. In the focus of a compliance audit is the aspiration to identify cases of illegal transactions. The compliance audit means audit of the compliance of the public sector entity's operations with the budget on the one hand, and with valid professional, legal and internal accounting regulations, on the other. The opinion that the state auditor expresses during the compliance audit may be part of a separate audit report or may be contained in the confirmation audit report and is then located below the auditor's opinion on the confirmation audit. In practice, an integrated audit approach is generally applied, which implies the simultaneous implementation of an attestation audit and a compliance audit.

A performance audit is more recent and its development leads to the sublimation of traditional audit, which leads to an integral, i.e. complete, approach to public sector audit. The performance audit examines and evaluates the efficiency, effectiveness and economy of collecting and spending financial resources and managing state assets. The purpose of this audit is to improve the performance of various public sector entities with its recommendations and reports, and to contribute to greater success in protecting the public interest. Management functions and activities, programs, projects and provided services of the subject of audit are the basic areas of performance audit. Unlike other types of state audit, the performance audit is performed only after noticing a problem to which the attention of state auditors is directed.

Both in countries with a developed market economy and institutions of a democratic parliamentary system, as well as in transition countries, the Supreme Audit Institution (SAI) plays a significant role in achieving the stability of the country's financial system (Gørrissen, 2020). Through its overall activities, and especially its audit reports, the SAI should instill confidence in the parliament, citizens of the country and other interested parties. The SAI provides assurance to the parliament (to which it is responsible) and the citizens of a country that public funds are used effectively, efficiently and economically and that the financial statements and operations of public sector entities are in accordance with professional and legal regulations.

In order to respond to the demands placed before it, the SAIs in all countries, including in the Republic of Serbia, must be institutionally independent, which is regulated by the Lima Declaration, that is, by the constitution and law of each country. In accordance with the provisions of the law regulating its jurisdiction, it performs external audits of direct and indirect users of public funds of the Republic of Serbia and represents the highest state authority for auditing public funds in the Republic. Auditor titles in the public sector are state auditor and authorized state auditor. State auditor and authorized state auditor are independent professionals who hold a certificate for the title of state auditor, i.e. authorized state auditor and meet other requirements prescribed by law (Zakon, 2018).

3.2. Internal supervision

With the appearance of numerous public sector reforms in the developed countries of the world, at the end of the 20th century and the beginning of the 21st century, a trend of decentralization of internal supervision appeared. The aim of decentralization is to improve the responsibility of the management structures of the public sector and to improve the effectiveness and efficiency of the use of public resources (Felício et al., 2021). With this trend of decentralization, internal supervision gains importance, because it controls the management of budget funds and prevents their irrational and uneconomic spending (Krstić & Bonić, 2017).

The basic components of internal supervision in the public sector of the Republic of Serbia are (Zakon, 2023):

- financial management and control of users of public funds;
- internal audit of users of public funds, and
- harmonization and coordination of financial management and control and internal audit performed by the Ministry of Finance – Central Unit for Harmonization (CUH hereinafter).

Financial management and control includes a system of policies, procedures and activities that is established, maintained and regularly updated by the head of the organization, and which, by managing risks, provides assurance to a reasonable extent that the goals of the organization will be achieved in a proper, economical, efficient and effective manner (Zakon, 2023). This system includes all public funds, including funds from the European Union. The system of financial management and control is established in all entities of the public sector – users of public funds and at all levels within the organizational structure of the entity, regardless of the number of employees and the size of the entity. Users of public funds in the Republic of Serbia have a legal obligation to establish a system of financial management and control and to organize it as a system of procedures and responsibilities of all persons employed in the entity.

Internal audit in the public sector is an advisory activity that provides independent objective assurance with the purpose of contributing to the improvement of the business of users of public funds (Zakon, 2023). Internal audit checks and evaluates the functioning of the financial management and control system using risk-based audit programs. Internal audit helps the users of public funds in achieving their goals by applying a systematic and disciplined approach in evaluating the financial management and control system in relation to the following:

- risk identification, risk assessment and risk management by managers of all levels with users of public funds;
- business compliance with laws, internal acts and contracts;
- reliability and completeness of financial and other information;
- efficiency, effectiveness and economy of business;
- protection of assets and data (information); and
- completing tasks and achieving goals.

Internal audit is organizationally independent and directly responsible to the manager of the user of public funds. Internal audit provides advisory services consisting of advice, guidance, training, assistance or other services aimed at increasing value and improving the management process of a given organization (Bonić, Jakšić & Mijić, 2018). The head of the internal audit is obliged to cooperate and coordinate the work of the internal audit with the external audit. Internal audit in the public sector of the Republic of Serbia is performed by internal auditors who have passed the exam for obtaining the professional title of authorized internal auditor in the public sector, and in accordance with the professional training program (Pravilnik, 2023). The Minister of Finance issues a certificate to the candidate who has passed the exam, and the CUH maintains the Register of authorized internal auditors in the public sector.

Table 1 compares external and internal supervisory bodies in the public sector according to their main attributes.

Table 1: Comparison of external and internal supervisory bodies

Attributes	State audit	Financial management and control	Internal audit
Frequency	Periodically, systematically, according to programs	Continuously	Periodically, systematically
Supervisory authority	Supreme Audit Institution	Management and employees	Organizational unit for internal audit
Supervison type	External independent supervision	Supervision built into the organization	Internal supervision
Goals and objectives	Assurance, reassurance, providing recommendations	Ensuring the smooth running of business processes	Assurance, reassurance, providing recommendations
Orientation	Financial statements, regulatory compliance, economical and efficient spending of public funds	System management	System results
Consequences of implemented actions	Recommendations, misdemeanor and criminal reports	Corrective actions	Recommendations
Function (role)	Control and advisory	Management	Advisory

Source: adjusted according to Krstić & Bonić (2017)

Conclusion

One of the key goals of every state administration is to increase the efficiency of public sector entities. Taxpayers, i.e. citizens, are the main financiers of the public sector and their expectations are unequivocal, namely socially responsible behavior and efficient operations of all public sector entities. The efficiency of the public sector means that it is more efficient the higher the quality of public services it provides to citizens, and the lower their price. Taxpayers will feel the first the consequences of inefficient operations through an increase

in tax expenditures, which further leads to a decrease in income available for consumption. In addition to reducing the citizens' income, high public expenditures have a negative impact on the economic growth of the economy, which will, in the following period, indirectly have a negative impact on the level of income of citizens. The mentioned is called the double negative consequence of the inefficiency of the public sector.

An inefficient public sector means that budget users provide services at prices higher than those economically justified. This further implies that higher public expenditures require higher tax payments (higher tax rates), which consequently leads to lower economic growth. In this way, an inefficient public sector reduces the taxpayers' utility in two ways. On the one hand, it reduces their utility through lower income due to higher tax payments. On the other hand, it reduces their utility through lower future income due to low economic growth.

Adequately set performance measures that correspond to the objectives of public sector entities are important because without them there are no conditions for the fair allocation of resources in public sector entities. Establishing a cause-and-effect relationship between allocated and spent budget funds and achieved results is possible only in the performance budgeting system. The most common performance measures found in public sector entities are inputs, activities, outputs and outcomes. In addition to the mentioned basic measures, more complex performance measures can be used, which are the result of combining the previously mentioned measures.

Due to the specificity of financing, public sector entities do not have enough motivation to contribute to the socially optimal effect of public spending by respecting the requirements of thrift, rationality and efficiency of spending. Therefore, in addition to the performance measurement system, it is necessary to build an adequate control system, the so-called public oversight to prevent false representation of results and performances that are the subject of measurement, evaluation and reporting. State audit and internal financial control are the two most widespread control mechanisms in the public sector (in the Republic of Serbia there is also a Treasury Administration). State audit includes regularity audit and accomplishment audit, while internal financial control consists of financial management and control and internal audit (in the Republic of Serbia there is also a body of the Ministry of Finance that harmonizes and coordinates financial management and control and internal audit).

External and internal supervisory bodies in the public sector have the same general goal - increasing the efficiency of public sector entities, which is, as mentioned earlier, the key goal of every state administration. However, there are differences between the aforementioned supervisory bodies in terms of frequency, jurisdiction, function, goals, objectives, and focus on the subject of supervision. The listed differences are desirable, because they allow viewing the same object of supervision, but from several different angles, all with the aim of searching for the best values that public sector entities can provide to citizens for their invested money.

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Review article

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An overview insight into employment of disabilities at workplaces around the world – a review of the literature

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Abstract: Many people with disabilities still face difficulties and obstacles trying to secure employment. Organizations are doing more and more to improve employment opportunities for people with disabilities (PWD), because it is in their best interests, due to factors such as a dearth of skilled workers, a lack of trained workers, a rise in the prevalence of disability among their labor groups, as well as in the laws and public attitudes supporting workplace fairness and diversity. This article used a qualitative methodology and conducted a thorough evaluation of the existing literature using a variety of different databases such as Science Direct, Springer, Google Scholar, JSTOR, and Elsevier, which were used to identify various research articles related to the employment of PWD. We looked at research on the advantages of hiring people with disabilities, as well as HR management procedures with reference to recruiting persons with disabilities, and also investigated the methodology this literature used. Our findings demonstrate that the advantages of employing disabled individuals are many. To better understand how advantages may differ by disability type, industry, and work type, more research is required.
Keywords: People with disabilities (PWD), employment, diversity, HR practices, review.
JEL classification: M14, O15

Сажетак: Већина људи са инвалидитетом и даље се суочава са тешкоћама и препрекама у покушају да обезбеде запослење. Организације све више раде на побољшању могућности запошљавања особа са инвалидитетом (ОСИ), јер је то у њиховом најбољем интересу, услед фактора као што су недостатак квалификованих радника, мањак обучених радника, пораст учесталости инвалидитета међу њиховом радном снагом, као и због закона и јавних ставова који подржавају правичност и разноликост на радном месту. У овом раду се користи квалитативна методологија и спровела се темељна анализа постојеће литературе коришћењем разних база података као што су Science Direct, Springer, Google Scholar, JSTOR и Elsevier, које су коришћене за идентификовање различитих истраживачких радова повезаних са запошљавањем ОСИ. Истраживани су радови о предностима запошљавања особа са инвалидитетом, као и процедуре управљања људским ресурсима у вези са запошљавањем особа са инвалидитетом, и испитивали смо методологију коју је ова литература користила. Резултати истраживања показују да су предности запошљавања особа са инвалидитетом бројне. Потребно је додатно истраживање како би се боље разумело како се предности могу разликовати у зависности од врсте инвалидитета, индустрије и врсте посла.

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Кључне речи: особе са инвалидитетом (ОСИ), запошљавање, разноликост, праксе у области људских ресурса, преглед.
ЈЕЛ класификација: M14, O15

Introduction

Nearly 15% of people worldwide are disabled (World Health Organization, 2011, 2018). Due to the combined effects of a growing world population and increasing life expectancy, this proportion has been increasing (Albrecht, 2015; Hay et al., 2017; United Nations Fund for Population Activities, 2018). The food chain, genetics, medical and technological advancements, armed conflict, natural calamities, and societal or environmental events all have an increasing effect on the quality of life and disability survival rates (Moore, McDonald, & Bartlett, 2018; Stough, Ducy, & Kang, 2017). More than one billion people have "long-term physical, mental, intellectual, or sensory impairments that, in combination with various barriers, may hinder their full and effective participation in society on an equal basis with others." This figure must be understood in the context of an increase of 5% in the related population segment since the 1970s (Iriarte, McConkey, & Gilligan, 2015; United Nations [UN], 2006). Hence, people with disabilities (PWD) are entering the workforce in greater numbers as a result of the aging workforce and the equal opportunity employment movement (Zhu, Law, Sun & Yang, 2019). In addition, the most important factors in industrial jurisprudence, social justice and industrial peace are advanced through promoting diversity in the workplace. People with disabilities (PWD) can have a greater opportunity to participate in society on an economic and social level if their workplace is diverse.

One of the major diversity groups in the workplace is comprised of workers with disabilities (Hyland & Rutigliano, 2013). Many have claimed that, because of their high unemployment rate, people with disabilities are underutilized as a labor pool and that employers will want to hire from this pool to fill the labor shortage brought on by demographic changes as baby boomers retire and are replaced by fewer new workers (Fredeen, Martin, Birch, & Wafer, 2013; Kruse, Schur, & Ali, 2010; Schur et al., 2014). Worldwide, organizations are finding that people with disabilities (PWD) are an increasingly relevant topic. The primary causes are a shortage of skilled labor, an aging labor force and a rise in the prevalence of disabilities, as well as modifications to societal perspectives and regulatory frameworks to promote PWD participation in the workforce. (Baldridge, Beatty, Boehm, Kulkarni, & Moore, 2018; Baumgartner, Dwertmann, Boehm, & Bruch, 2015; Kulkarni, 2016). In addition, both the prevalence and understanding of disability are rising globally (World Federation for Neurological Rehabilitation, 2015; World Health Organization, 2011). Despite the stigma associated with disability (McLaughlin, Bell, & Stringer, 2004), the work performance of people with disabilities is often viewed positively (Baldridge et al., 2018; Konrad, Moore, Doherty, Ng, & Breward, 2012).

Furthermore, persons with disabilities (hence referred to as PWDs) are frequently described as the largest minority population in the world, who frequently have their rights violated and who can experience discrimination (Bickenbach, Rubinelli, & Stucki, 2017; Luo & Wang, 2017). Moreover, disability affects 20% of the world's poorest people. Approximately 80 percent of disabled individuals live in developing countries (Eide, Muderedzi, Braathen, & Stray-Pedersen, 2017). As work/life balance is influenced by a

variety of factors that are unique to each management and employee and can vary over time (Mladenović & Krstić, 2021).

There is a growing body of research on the benefits and achievements of recruiting disabled individuals. Combining this literature can draw attention to its advantages of integrating disabled individuals into the workforce and, eventually, changing perceptions about them. The primary goal of this study is to examine recent research on the employment of people with impairments, the HR management strategies for doing so and the techniques employed, and the methodologies used to examine employment across various countries around the world. More specifically, analysis is done on sixteen qualitative and quantitative articles that were published between 2011 and 2020.

1. Literature review

1.1. Disability definition

According, to the United Nations (UN, 2006, p. 4), the definition of people with disabilities is that it is the term used to describe people who have chronic physical, mental, intellectual, or sensory disabilities that, when combined with additional barriers, may prevent them from fully and equally participating effectively in society when compared to others. Moreover, disability is characterized as limitations in one's own actions, impairments in one's body structures and functions, and obstacles to social interaction (Peter, Geyh, Ehde, Müller, & Jensen, 2015), in accordance with a widely accepted biopsychosocial framework of disability in which it is understood as involving the interaction of a person's personal, environmental, and personal elements with their state of health (World Health Organization, 2011).

Additionally, in many aspects, physical impairment is different from intellectual disability. Physical disability is a dysfunction that is permanent or ongoing in a body part (Kim & Kang, 2003). It comprises chronic medical illnesses, such as cardiovascular diseases and respiratory issues, as well as sensory and musculoskeletal concerns (Carroll, 2004). Examples include multiple sclerosis, cerebral palsy, and spinal cord damage (Gammeltoft, 2018).

There are also intellectual handicaps, such as substantial impairments in cognitive functioning and adaptive behavior as shown by problems in conceptual, social, and practical adaptive skills (Schalock, Luckasson,, & Shogren, 2007, p. 118). As examples, Bartram et al. (2021) cite Down syndrome, Fragile X syndrome, and Prader-Willi syndrome. PWDs are essentially those who have long-term physical, mental, intellectual, or sensory disabilities that may make it challenging for them to engage in society completely and effectively when paired with other circumstances. (Persons with Disabilities Act, 2008). Over 15% of the world's population, or more than one billion people, are predicted to have a handicap, according to the World Health Organization (2020). PWDs are a vulnerable population because the majority of them have lives without any support as a result of poverty. The percentage of PWDs living in poverty is significantly higher than that of those without impairments, according to numerous previous studies (Agyei-Okyere et al., 2019; Opoku, Mprah, Dogbe, Moitui, & Badu, 2017; Pinilla-Roncancio & Alkire, 2021; World Health

Organization, 2011). Moreover, unemployment or low pay/income even while employed is a significant factor in why they lead such a life.

1.2. Challenges of employment for those with disabilities (unemployment of persons with disabilities)

Because previous disability management research has mostly focused on attitudes and discrimination against employees with disabilities, there is a gap in the literature covering the work and life experiences of employees with disabilities (Santuzzi & Waltz, 2016; Zhu et al., 2019), or mechanisms underlying job satisfaction or job performance among workers with disabilities (Baumgartner et al., 2015). However, people with disabilities continue to face discrimination despite the existence of several international, regional, and national laws and regulations, because their right to decent employment is frequently not upheld. Employers are starting to understand that, of all the resources at their disposal, their people are their most precious asset (Dramićanin, Perić, & Pavlović, 2021).A diverse workforce gives employers access to a range of skills from workers who bring varied viewpoints, backgrounds, abilities, and disabilities to the office. The reality is that people with disabilities have been neglected and treated with pity or protection rather than with respect (Wehab & Jaafar, 2018).

The World Health Organization (WHO) estimates that one billion people, or about 15.6% of the global population, are disabled, making them the largest minority in the world (WHO, 2011); (UN, 2006b). According to the International Labour Organization's most recent statistics on employment (Murray, 2012), 470 million people in the world's working-age population are disabled. There are currently 1.1 billion individuals living with disabilities worldwide, making PWDs one of the largest minority groups (World Health Organization, 2018). Unfortunately, despite this, PWDs continue to face disproportionately high rates of underemployment, unemployment, and work instability compared to the overall community (Beatty, Baldridge, Boehm, Kulkarni, & Colella, 2019). A rising body of research has focused on how to combat these long-standing job inequities while making better use of the high-skilled labor pool that PWDs represent (Lengnick-Hall, Gaunt, & Kulkarni, 2008; Schur et al., 2014).

1.3. Diversity and PWD employability

Businesses must support diversity and endeavor to create more inclusive workplaces because diversity has the potential to boost productivity and competitiveness (Green, Johnson, & Adams, 2002). Current empirical evidence has demonstrated that workforce diversity and inclusive work practices are essential for an organization's sustainability, development, and success in today's globalized world. (Cletus, Mahmood, Umar, & Ibrahim, 2018; Kaur & Arora, 2020; Tamunomiebi & Dienye, 2019). Hence, employees are the foundation of an organization's operation (Petković & Rapajić, 2021). Despite all the advantages, people with disabilities are a vulnerable heterogeneous group that has consistently been barred from entering the labor market.

Organizations' diversity and inclusion plans rarely include disability as a diversity dimension (Miethlich & Oldenburg, 2019). Also, it is one of the aspects of diversity

management that businesses still find difficult to understand (Waxman, 2017). PWDs should therefore be acknowledged as human resources with talent, creativity, and special talents (Buciuniene & Kazlauskaite, 2010; Hashim & Wok, 2014). The substantial improvements in science, technology, architecture, and ergonomic design mean that, together with PWDs' skill sets and abilities, there are more opportunities available to them, allowing them to contribute more effectively to the workforce (Barnes & Mercer, 2005; Pérez, Romeo, & Yepes-Baldó, 2018).

1.4. Advantages in the employment of people with disabilities

From a broader perspective, disability inclusion in human resources is becoming more widely acknowledged as a way to improve the sustainability and competitiveness of businesses (Mooney & Baum, 2019). Furthermore, according to research, people with disabilities can have highly successful jobs and can act as mentors and role models for others in the workplace (Noonan et al., 2004). Also, they are dedicated workers who do not necessarily have a high turnover rate (Hernandez et al., 2008). Although they have always been a crucial component of the working process, employees' roles and significance have evolved over time (Đorđević, Ivanović, Lepojević, & Milanović, 2021).). Workers' unique attitudes toward various corporate endeavors are fundamental to the development of organizational behavior forms and models (Nikitović, Penjišević, & Somborac, 2023).

According to empirical data, employees with impairments are more motivated, more productive, and are more likely to remain employed than people without impairments. They also experience fewer occupational accidents (Houtenville & Kalargyrou, 2012; International Labor Office, 2010; Hartnett, Stuart, Thurman, Loy, & Batiste, 2011). Hiring PWDs has more intricate and profound cultural and stakeholder consequences as a result of businesses' CSR and sustainability ambitions and the sustainability agendas of enterprises, making it more than just a pressing economic matter (Kuznetsova & Yalcin, 2017; Waxman, 2017; Williams, 2017). Also, both the employer's and the employee's perspectives can be used to assess the effects of teleworking. With this kind of job, businesses may hire more workers and members of specific groups, such as people with disabilities (Taboroši et al., 2022).

2. Research methodology (review methods)

This review of the literature was conducted by the authors using a selected methodology (Helewa & Walker, 2000). The procedure involved conducting a preliminary literature review, selecting and accessing the literature, evaluating the quality of the literature, and then analyzing and summarizing the results (Green et al., 2006). This strategy was adopted to offer a reliable, fundamental source of knowledge about the subject. It ranks lower in the hierarchy of evidence because the standards utilized were laxer than those of a systematic literature review.

2.1. Search strategy and data sources

In this literature review article, we aim to critically evaluate and summarize the peer-reviewed research on the advantages of hiring persons with disabilities, so this research is a literature review of academic papers published in the last 10 years (between 2011-2020). Because it is a descriptive study, this research adopts a qualitative methodology. In order to select relevant papers, we considered the following databases: Science Direct, Springer, Google Scholar, JSTOR, and Elsevier. As the paper tried to examine the benefits of employment disabilities and HR procedures in PWD employment, the keyword combination of these two words was used to gain access to various related articles. Other than these, keywords such as disabled employee, HR and disabilities, and diversity were also used.

This initial search turned up more than 73 prospective articles on a variety of subjects. In order to limit the search results, after reading the abstracts, a first screening was carried out, excluding articles not relevant to the search and to the goal of the review. For additional research, we exclusively chose papers that addressed the subject of "employees with disabilities," which led to a collection of 16 studies. We analyzed those papers by following the systematic review process (SLR) (Tranfield, Denyer, & Smart, 2003; Denyer, Tranfield, & Van Aken, 2008). Additionally, after examining the abstracts, important conclusions were drawn from the published articles' full texts (see Table 1 for full list). We searched for articles that were published between 2011 and 2020. To find more articles, we manually searched through the reference lists of every article that was included.

2.2. PWD employment around the world

Similar employment rates for the disabled population in developed nations are revealed by research from the WHO (2011). The employment rate of people with impairments who were working age as of 2003 in several countries is highlighted by the data below: the Netherlands, 39.9%; the United Kingdom, 38.9%; and Canada, 56.3%; Australia, 41.0%; Poland, 20.8%. These figures give the impression that just a small portion of the world's disabled population is employed and are similarly comparable to those in the United States.

According to the UN's 2017 report, only 45 nations have anti-discrimination legislation and regulations. The employment rate disparity between individuals with disabilities and people without disabilities ranges by up to 40% in the United States and many European nations (Hungary, Netherlands, Romania, and United Kingdom), and it is larger in some nations, such as Peru (UN, 2017). PWDs are more likely to get jobs in Turkey, Luxembourg, and Greece. A retreat from the anticipated aims or social goals may be shown by the adoption of terminology such as human rights, diversity, inclusion, and equal opportunities through organizational systems and processes, indicating ineffective organizational change (Williams, 2017; Vornholt et al., 2018), or rhizomatic, disputed methods of organizational life (Jackson & Carter 2007), even in the most highly educated and controlled societies (Priestley, 2007). PWDs experience major entrance hurdles in their labor markets, which contributes to the gap between policy formulation and company implementation (Vornholt et al., 2018; Kulkarni & Lengnick-Hall, 2014).

2.3. Employment of people with disabilities

People with disabilities are entering the workforce in greater numbers as a result of the aging workforce and the drive for equitable employment opportunities (Zhu et al., 2019). Disability is a significant aspect of diversity in the workplace, but identity-conscious approaches have long been the foundation of business diversity management techniques (Gould, Harris, Mullin, & Jones 2020). The identity-conscious approach to diversity management for people with disabilities identifies particular disabled employees and develops management programs that meet their requirements, such as workplace accommodations.

Table 1 summarizes the selected literature for the research analysis and provides a general overview of the methodology used in various many countries, as well as the objectives and the key findings.

Author / Year	Country	Methodology	Objectives	Key Finding
Araten-Bergman (2016)	Israel	Longitudinal survey Interview	This longitudinal study examines the relationship between managers' views and intentions, and actual PWDs hiring by putting to the test a model that incorporates demand-side characteristics, and elements of the theory of planned behavior	The intention to hire disabled individuals and positive views toward them are frequently ineffective. Instead, disability training and the existence of a stated disability employment policy were found to be important recruiting factors.
Bengisu & Balta (2011)	Turkey	Survey	To investigate the effects of hiring people with disabilities	Employing persons with disabilities benefits the hospitality sector (improves service effectiveness and quality)
Huang & Chen (2015)	Taiwan	Qualitative interviews	This study's goal was to look at the perceptions of Taiwanese employers who had long-term experience of hiring people with disabilities.	Promotions are based on competence and performance reviews relating to the job, and disability as a consideration was viewed as irrelevant. When employers have prior contact with PWDs, their opinions regarding hiring PWDs may change. Therefore, educating firms on the benefits of hiring persons with impairments is a crucial tactic for employment creation.

Henry et al., (2014)	USA	Qualitative method	To examine how businesses see the difficulties and recommendations associated with recruiting people with impairments	Employing people with disabilities has advantages. A broader client base, an expanded talent pool, enhanced brand loyalty, and an inclusive workplace culture are benefits for employers and organizations, particularly those aiming to diversify their workforces. Innovations in the support systems and modifications to employer hiring procedures may also lead to a rise in the employment of people with disabilities.
Hemphill & Kulik (2016)	Australia	Interview	To examine employment practices of employers and determine which mainstream employers most frequently employ those with disabilities	Employers who have previously hired people with disabilities are more likely to hire them.
Jones, & Latreille, (2011)	United Kingdom	Qualitative / secondary data using the Labour Force Survey (LFS) data	This article examines the decision about self-employment in the UK for workers with and without disabilities.	This article looked at the reasons why self-employment rates are greater among employed people with disabilities than among non-disabled people. This may be a reflection of the options that self-employment provides for the former to accommodate; decisions were based on job schedules, hours, and locations that accommodate their impairment
Kulkarni (2016)	India	Interviews	To identify hospitality industry leaders in diversity and related business practices and to research the advantages and difficulties of recruiting persons with impairments	Initiatives for career development should be inclusive of both employees with and without disabilities, without promoting or discouraging discrimination of any kind and assuring equal opportunity for all workers, both those with and without impairments, and providing for their needs.
Kuo & Kalargyrou (2014)	USA	Single-factor experimental design	To investigate consumers' perceptions of restaurants that employ persons with impairments	Customers exhibited a low level of positive intent to purchase from restaurants employing people with impairments. For gatherings with friends and family rather than with coworkers or business partners, patronage at restaurants that hired persons with impairments was greater.
Kuiper et al. (2016)	Netherlands	Interviews	To investigate how human relations and values affect the employment of those with impairments	Establishing and maintaining relationships with others, being able to make a positive impact, having an income, and being a part of a community are some of the reasons why people with disabilities value work.

Kwan (2020)	China	Interviews	This study reveals that by supplying office amenities, professional surroundings, a compassionate attitude, and job expectations, socially responsible HR practices can significantly improve the employability of people with disabilities, demonstrating the relationship between CSR and PWD employment.	After being hired, PWDs were given training as a beneficial measure; this also featured visits, small lectures, role-plays, and demos. PWDs were given the opportunity to master the fundamental vocational skills required for the hospitality industry as well as work ethic. Additionally, assistance was provided for co-workers on how to interact and cooperate with PWDs.
Michna et al., (2017)	Poland	Interview/ survey	This paper aims to present the results of an empirical investigation on the preferences, expectations, and requirements of disabled persons and medium-sized and micro companies in connection to employment in small and medium-sized businesses.	Positivity toward PWDs is influenced by formal compliance (32.5%), and self-personality (43.9%), and presentation (21.1%). Employers want to provide people with disabilities access to general and vocational training, and they cite the need to help people with disabilities develop their social and personal skills (such as speaking, cooperating in a group, and using the phone).
Owen et al., (2015)	Canada	Interviews and focus group	To investigate the application of social return on investment for collaborators and their families who work with people with disabilities	People with disabilities increased their independence and self-confidence. Social inclusion and wellbeing also improved
Pérez-Conesa et al., (2020)	Spain	Survey	This study provided an answer to the question of what aspects, linked to HR management, facilitate the labour inclusion of individuals with disabilities	Promoting the employment of people with disabilities in a setting with a normalized inclusive culture is the responsibility of human resources managers. Implementation of a deliberate strategy aimed at mainstreaming disabilities in the workplace to provide an inclusive environment. When used inclusively, HR management systems do not need to be modified to account for the unique characteristics and diversity of employees.

Scott et al., (2017)	Australia	Survey	To investigate the advantages and cost of hiring persons with autism	Employing adults with autism has advantages for companies (such as raising awareness of autism, encouraging an inclusive culture, developing creative and unique abilities, and boosting workplace morale). When it came to accuracy, work ethic, and quality of work, employees with autism fared above average. There are no appreciable disparities between workers with and without disabilities
Strindlund, L et al., (2019)	Sweden	Qualitative empirical study / semi-structured interviews	This study attempts to broaden how employers view the employability of people with impairments. Although companies play a crucial role in helping people with disabilities access the job market, little is known about how employers perceive this group's employability.	The study offers a framework for comprehending employers' various perspectives on a person with a disability. Their employability is seen as a complex internal interaction between workplace, authority, and individual-related variables. It might be simpler for rehabilitation specialists to tailor their assistance to establishing trustworthy commercial alliances, if they are aware of the different conceptions of employability for persons with disabilities. This could improve the inclusion of individuals with disabilities on the labor market.
Ta, T. L., et al, (2011)	Malaysia	Survey / Questionnaire	This study explores employers' attitudes to hiring individuals with impairments in the northern states of Peninsular Malaysia	The findings showed that the majority of employers support hiring people with impairments, but very few have these enabling laws, a system to deal with concerns involving people with disabilities, or a constructed environment that is completely accessible to people with disabilities.

Source: the authors' editing

3. Description and findings of the studies

The selected studies included 16 qualitative, quantitative and mixed method studies. Publications appeared in different journals, and studies were conducted in different countries around the world. After carrying out content analysis of the chosen publications included in the research, the following inferences have been drawn:

- All research studies found at least one advantage of hiring persons with impairments, despite the fact that the outcome measures across the studies we evaluated differed significantly.
- HR professionals should not only review and modify HR procedures but also recognize the advantages that adaptations for people with disabilities bring to all employees.

The findings indicate that employing people with disabilities can improve a company's competitive advantage (such as a diverse clientele, client loyalty and satisfaction, innovation,

productivity, work ethic, and improved safety), foster an inclusive workplace culture, and increase employees' awareness of their own abilities. Additionally, it can improve staff loyalty, turnover and retention rates, dependability and punctuality, profitability (including profits and cost-effectiveness), and organization image. An enhanced standard of living and income, boosted self-esteem, a larger social network, and a sense of belonging to the community were also secondary benefits for persons with disabilities. Furthermore, even if there is still much to learn about the appropriate adoption and utilization of HR practices for PWDs, aiming for PWDs' social and workplace inclusion will eventually allow everyone in society to benefit from and operate in a more inclusive employment system.

4. Limitations and future implications

Although the benefits of employing people with disabilities and the human resources practices related to it is clearly demonstrated by this research, it has certain shortcomings that can be addressed in other studies. First, a qualitative analysis of the evaluated literature forms the foundation of the study, as the current study highlights many factors related to employment of disabilities in different countries by summarizing 16 papers. Only five databases (Science Direct, Springer, Google Scholar, JSTOR, and Elsevier) were utilized, hence the current research is constrained. Quantitative studies that validate the findings of this research and demonstrate the impact employment of PWDs may be included in future research. Future studies can also be carried out to demonstrate strategies for increasing the employment of PWDs in a way that benefits companies and societies.

Nonetheless, the results of this study may have significant ramifications for career developers and placement specialists who work with individuals with physical and sensory challenges to put them in professional roles. Additionally, expanding job development initiatives is necessary to persuade senior management decision-makers to include disability in their diversity plans; put in place efficient corporate policies with incentives at the departmental and unit levels to motivate managers to hire and retain individuals with disabilities; and assist in creating creative recruitment and retention tactics like work trails, internship programs, contract employment, and temporary employment options. Even further study is required; it is evident that businesses gain by fully integrating individuals with disabilities into organizational life in a number of ways.

Examining the advantages of hiring individuals with disabilities is crucial because these individuals encounter numerous obstacles when trying to obtain and keep a job. By drawing attention to these advantages, employers may be persuaded to hire individuals with disabilities and make the necessary accommodations for them.

This position paper gave a summary of the state of disability research as of right now. Our goal is to demonstrate that this field of research is extremely important during periods of societal change, and it should be highlighted that it has already accomplished a lot. It is our responsibility to continue being engaged, inquisitive, and eager to address the numerous unanswered future research issues. By encouraging academics to study further into this subject and disseminate their findings to a large community of scholars and practitioners, we want to advance this field of study over the coming years.

Conclusion

The relationship between disability and employment has been thoroughly researched over a long period, and the dynamics between both topics have also been extensively studied. Because having a disability often means being socially isolated that is why employment is particularly important for people with disabilities (Hall, 2010) and work is one opportunity to reduce this isolation (Hall, 2010; World Health Organization, 2011)

Also exploring the benefits of hiring people with disabilities is important due to the numerous obstacles that disabled individuals have while trying to find and keep a job hence bringing attention to the benefits of hiring people with disabilities may help build the case for employing them.

There has been extensive research on the relationship between employment and disability, and much is already known about this relationship. We not only need a new understanding of disability, but also to take new perspectives to make a contribution to the field. On the other hand, the results of this study are consistent with previous research on the experiences of disabled workers in the workplace, additionally according to the results and findings of this paper, we have provided an overview of the concerns expressed by organizations around the world about hiring workers with disabilities, as well as used the current literature suitable to study the benefits of employing PWD

Finally, we conclude that hiring people with disabilities has several advantages in many aspects in all societies around the world. Furthermore, we aim to encourage scholars to dig deeper into this subject and share their findings with a large community of academics and industry professionals in order to advance this field of study over the coming years.

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Списак рецензената часописа „Анали Економског факултета у Суботици“ у 2024. години (број 52) / Reviewers of the journal “Anali Ekonomskog fakulteta u Subotici” in 2024 (No 52)

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Техничко упутство за форматирање радова / Technical instructions for paper formatting

The paper should consist of:

Title of the paper (no more than 10 words) in English.

Subtitle (optional) in English.

Personal data of authors/coauthors: name, surname, title and Institution in English.

Abstract of 200 words or less, giving the factual essence of the article, should be written in English.

Key words (no more than 10) in English.

Text of the paper, in English, cannot exceed 12 pages.

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Type your work in a common Word Processor (e.g. MS Word).

Page format: B5.

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Titles, subtitles, names of the tables, illustrations, figures, etc should be written in Arabic numerals.

Figures, illustrations and schemes should be enclosed in the .jpg format (resolution 300*300 dpi) or in the vector form (.wmf or cdr) with enclosed fonts or fonts transformed in curves. Figures, illustrations and schemes should be black-and-white (grayscale). For the texts included in figures, illustrations and schemes font Arial, size 9 pt is preferred.

1. Referencing Guide

The references should specify the source (such as book, journal article or a web page) in sufficient detail to enable the readers to identify and consult it. The references are placed at the end of the work, with sources listed alphabetically (a) by authors' surnames or (b) by the titles of the sources (if the author is unknown). Multiple entries by the same author(s) must be sequenced chronologically, starting from the earliest, e.g.:

Ljubojević, T.K. (1998).
Ljubojević, T.K. (2000a).
Ljubojević, T.K. (2000b).
Ljubojević, T.K., & Dimitrijević, N.N. (1994).

Here is a list of the most common reference types:

A. Periodicals

Authors must be listed by their last names, followed by initials. Publication year must be written in parentheses, followed by a full stop. Title of the article must be in sentences case: only the first word and proper nouns in the title are capitalized. The periodical title must be in title case, followed by the volume number, which is also italicized:

Author, A. A., Author, B. B., & Author, C. C. (Year). Title of article. *Title of Periodical, volume number*(issue number), pages.

➲ Journal article, one author, paginated by issue

Journals paginated by issue begin with page 1 in every issue, so that the issue number is indicated in parentheses after the volume. The parentheses and issue numbers are not italicized, e.g.

Tanasijević, V. (2007). A PHP project test-driven end to end. *Management Information Systems, 5*(1), 26-35.

➲ Journal article, one author, paginated by volume

Journals paginated by volume begin with page 1 in issue 1, and continue page numbering in issue 2 where issue 1 ended, e.g.

Perić, O. (2006). Bridging the gap: Complex adaptive knowledge management. *Strategic Management, 14*, 654-668.

➲ Journal article, two authors, paginated by issue

Strakić, F., & Mirković, D. (2006). The role of the user in the software development life cycle. *Management Information Systems, 4*(2), 60-72.

➲ Journal article, two authors, paginated by volume

Ljubojević, K., & Dimitrijević, M. (2007). Choosing your CRM strategy. *Strategic Management, 15*, 333-349.

➲ **Journal article, three to six authors, paginated by issue**

Jovanov, N., Boškov, T., & Strakić, F. (2007). Data warehouse architecture. *Management Information Systems, 5*(2), 41-49.

➲ **Journal article, three to six authors, paginated by volume**

Boškov, T., Ljubojević, K., & Tanasijević, V. (2005). A new approach to CRM. *Strategic Management, 13*, 300-310.

➲ **Journal article, more than six authors, paginated by issue**

Ljubojević, K., Dimitrijević, M., Mirković, D., Tanasijević, V., Perić, O., Jovanov, N., et al. (2005). Putting the user at the center of software testing activity. *Management Information Systems, 3*(1), 99-106.

➲ **Journal article, more than six authors, paginated by volume**

Strakić, F., Mirković, D., Boškov, T., Ljubojević, K., Tanasijević, V., Dimitrijević, M., et al. (2003). Metadata in data warehouse. *Strategic Management, 11*, 122-132.

➲ **Magazine article**

Strakić, F. (2005, October 15). Remembering users with cookies. *IT Review*, *130*, 20-21.

➲ **Newsletter article with author**

Dimitrijević, M. (2009, September). MySql server, writing library files. *Computing News, 57,* 10-12.

➲ **Newsletter article without author**

VBScript with active server pages. (2009, September). *Computing News, 57,* 21-22.

B. Books, Brochures, Book Chapters, Encyclopedia Entries, And Book Reviews

Basic format for books

Author, A. A. (Year of publication). *Title of work: Capital letter also for subtitle*. Location: Publisher.

Note: "Location" always refers to the town/city, but you should also include the state/country if the town/city could be mistaken for one in another country.

➲ **Book, one author**

Ljubojević, K. (2005). *Prototyping the interface design*. Subotica: Faculty of Economics.

➲ **Book, one author, new edition**

Dimitrijević, M. (2007). *Customer relationship management* (6th ed.). Subotica: Faculty of Economics.

➲ **Book, two authors**

Ljubojević, K., Dimitrijević, M. (2007). *The enterprise knowledge portal and its architecture*. Subotica: Faculty of Economics.

➲ **Book, three to six authors**

Ljubojević, K., Dimitrijević, M., Mirković, D., Tanasijević, V., & Perić, O. (2006). *Importance of software testing*. Subotica: Faculty of Economics.

➲ **Book, more than six authors**

Mirković, D., Tanasijević, V., Perić, O., Jovanov, N., Boškov, T., Strakić, F., et al. (2007). *Supply chain management*. Subotica: Faculty of Economics.

➲ **Book, no author or editor**

Web user interface (10th ed.). (2003). Subotica: Faculty of Economics.

➲ **Group, corporate, or government author**

Statistical office of the Republic of Serbia. (1978). *Statistical abstract of the Republic of Serbia.* Belgrade: Ministry of community and social services.

➲ **Edited book**

Dimitrijević, M., & Tanasijević, V. (Eds.). (2004). *Data warehouse architecture*. Subotica: Faculty of Economics.

➲ **Chapter in an edited book**

Boškov, T., & Strakić. F. (2008). Bridging the gap: Complex adaptive knowledge management. In T. Boškov & V. Tanasijević (Eds.), *The enterprise knowledge portal and its architecture* (pp. 55-89). Subotica: Faculty of Economics.

➲ **Encyclopedia entry**

Mirković, D. (2006). History and the world of mathematicians. In *The new mathematics encyclopedia* (Vol. 56, pp. 23-45). Subotica: Faculty of Economics.

C. Unpublished Works

➲ **Paper presented at a meeting or a conference**

Ljubojević, K., Tanasijević, V., Dimitrijević, M. (2003). *Designing a web form without tables*. Paper presented at the annual meeting of the Serbian computer alliance, Beograd.

➲ **Paper or manuscript**

Boškov, T., Strakić, F., Ljubojević, K., Dimitrijević, M., & Perić, O. (2007. May). *First steps in visual basic for applications*. Unpublished paper, Faculty of Economics Subotica, Subotica.

➲ **Doctoral dissertation**

Strakić, F. (2000). *Managing network services: Managing DNS servers*. Unpublished doctoral dissertation, Faculty of Economics Subotica, Subotica.

➲ **Master's thesis**

Dimitrijević, M. (2003). *Structural modeling: Class and object diagrams.* Unpublished master's thesis, Faculty of Economics Subotica, Subotica.

D. Electronic Media

The same guidelines apply for online articles as for printed articles. All the information that the online host makes available must be listed, including an issue number in parentheses:

Author, A. A., & Author, B. B. (Publication date). Title of article. *Title of Online Periodical, volume number*(issue number if available). Retrieved from http://www.anyaddress.com/full/url/

➲ **Article in an internet-only journal**

Tanasijević, V. (2003, March). Putting the user at the center of software testing activity. *Strategic Management*, *8*(4). Retrieved October 7, 2004, from www.ef.uns.ac.rs/sm2003

➲ **Document from an organization**

Faculty of Economics. (2008, March 5). *A new approach to CRM*. Retrieved July 25, 2008, from http://www.ef.uns.ac.rs/papers/acrm.html

➲ **Article from an online periodical with DOI assigned**

Jovanov, N., & Boškov, T. A PHP project test-driven end to end. *Management Information Systems*, *2*(2), 45-54. doi: 10.1108/06070565717821898.

➲ **Article from an online periodical without DOI assigned**

Online journal articles without a DOI require a URL.

Author, A. A., & Author, B. B. (Publication date). Title of article. *Title of Journal, volume number*. Retrieved from http://www.anyaddress.com/full/url/

Jovanov, N., & Boškov, T. A PHP project test-driven end to end. *Management Information Systems*, *2*(2), 45-54. Retrieved from http://www.ef.uns.ac.rs/mis/TestDriven.html.

2. Reference Quotations in the Text

➲ **Quotations**

If a work is directly quoted from, then the author, year of publication and the page reference (preceded by "p.") must be included. The quotation is introduced with an introductory phrase including the author's last name followed by publication date in parentheses.

> According to Mirković (2001), "The use of data warehouses may be limited, especially if they contain confidential data" (p. 201).
>
> Mirković (2001), found that "the use of data warehouses may be limited" (p. 201). What unexpected impact does this have on the range of availability?

If the author is not named in the introductory phrase, the author's last name, publication year, and the page number in parentheses must be placed at the end of the quotation, e.g.

> He stated, "The use of data warehouses may be limited," but he did not fully explain the possible impact (Mirković, 2001, p. 201).

➲ **Summary or paraphrase**

> According to Mirković (1991), limitations on the use of databases can be external and software-based, or temporary and even discretion-based (p.201).
>
> Limitations on the use of databases can be external and software-based, or temporary and even discretion-based (Mirković, 1991, p. 201).

➲ **One author**

> Boškov (2005) compared the access range…
>
> In an early study of access range (Boškov, 2005), it was found...

➲ When there are **two authors**, both names are always cited:

> Another study (Mirković & Boškov, 2006) concluded that…

➲ If there are **three to five authors**, all authors must be cited the first time. For subsequent references, the first author's name will cited, followed by "et al.".

> (Jovanov, Boškov, Perić, Boškov, & Strakić, 2004).

In subsequent citations, only the first author's name is used, followed by "et al." in the introductory phrase or in parentheses:

> According to Jovanov et al. (2004), further occurences of the phenomenon tend to receive a much wider media coverage.
>
> Further occurences of the phenomenon tend to receive a much wider media coverage (Jovanov et al., 2004).

In "et al.", "et" is not followed by a full stop.

➲ Six or more authors

The first author's last name followed by "et al." is used in the introductory phrase or in parentheses:

> Yossarian et al. (2004) argued that…
>
> … not relevant (Yossarian et al., 2001).

➲ Unknown author

If the work does not have an author, the source is cited by its title in the introductory phrase, or the first 1-2 words are placed in the parentheses. Book and report titles must be italicized or underlined, while titles of articles and chapters are placed in quotation marks:

> A similar survey was conducted on a number of organizations employing database managers ("Limiting database access", 2005).

If work (such as a newspaper editorial) has no author, the first few words of the title are cited, followed by the year:

> ("The Objectives of Access Delegation," 2007)

Note: In the rare cases when the word "Anonymous" is used for the author, it is treated as the author's name (Anonymous, 2008). The name Anonymous must then be used as the author in the reference list.

➲ Organization as an Author

If the author is an organization or a government agency, the organization must be mentioned in the introductory phrase or in the parenthetical citation the first time the source is cited:

> According to the Statistical Office of the Republic of Serbia (1978), …

Also, the full name of corporate authors must be listed in the first reference, with an abbreviation in brackets. The abbreviated name will then be used for subsequent references:

> The overview is limited to towns with 10,000 inhabitants and up (Statistical Office of the Republic of Serbia [SORS], 1978).
>
> The list does not include schools that were listed as closed down in the previous statistical overview (SORS, 1978).

➲ When citing **more than one reference from the same author**:

> (Bezjak, 1999, 2002)

➲ When several **used works by the same author were published in the same year**, they must be cited adding a, b, c, and so on, to the publication date:

> (Griffith, 2002a, 2002b, 2004)

➲ **Two or more works in the same parentheses**

When two or more works are cited parenthetically, they must be cited in the same order as they appear in the reference list, separated by a semicolon.

> (Bezjak, 1999; Griffith, 2004)

➲ **Two or more works by the same author in the same year**

If two or more sources used in the submission were published by the same author in the same year, the entries in the reference list must be ordered using lower-case letters (a, b, c…) with the year. Lower-case letters will also be used with the year in the in-text citation as well:

> Survey results published in Theissen (2004a) show that…

➲ To **credit an author for discovering a work**, when you have not read the original:

> Bergson's research (as cited in Mirković & Boškov, 2006)…

Here, Mirković & Boškov (2006) will appear in the reference list, while Bergson will not.

➲ When **citing more than one author**, the authors must be listed alphabetically:

> (Britten, 2001; Sturlasson, 2002; Wasserwandt, 1997)

➲ When there is **no publication date**:

> (Hessenberg, n.d.)

➲ **Page numbers must always be given for quotations**:

> (Mirković & Boškov, 2006, p.12)
>
> Mirković & Boškov (2006, p. 12) propose the approach by which "the initial viewpoint…

➲ **Referring to a specific part of a work**:

> (Theissen, 2004a, chap. 3)
>
> (Keaton, 1997, pp. 85-94)

➲ **Personal communications, including interviews, letters, memos, e-mails, and telephone conversations**, are cited as below. (These are *not* included in the reference list.)

> (K. Ljubojević, personal communication, May 5, 2008).

3. Footnotes and Endnotes

A few footnotes may be necessary when elaborating on an issue raised in the text, adding something that is in indirect connection, or providing supplementary technical information. Footnotes and endnotes are numbered with superscript Arabic numerals at the end of the sentence, like this.[1] Endnotes begin on a separate page, after the end of the text. However, journal **does not recommend the use of footnotes or endnotes.**

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