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Turinys / Contents

EDITORIAL

"Journal of Management" is periodically published applied sciences journal by Lithuanian Business College. The journal is constantly publishing articles since 2002 and has gained significant experience and international recognition. This year the journal is celebrating its 22 years anniversary. It has been well renowned by foreign scientists and number of international scholars publishing continues to increase. Currently, 40th number of the journal is released to readers. Only those articles that meet thorough requirements set by the Editorial Board are being published. Authors of these articles represent various Lithuanian and foreign countries science. From Lithuania the following institutes are represented Lithuania Business College, Vilnius University, Vilnius Gediminas technical university and other. The following institutes from foreign countries: University of Debrecen, Sapientia University Transylvania, Alexander Dubček University in Trenčín, University of Tetova and other.

Editorial board of "Journal of management" seeks for published academic researches to cover different economic directions and to be relevant to different industries and countries around the world. At the same time, the focus remains on ongoing changes in various industries, human resources, and governance. Based on these criterion, articles are chosen for publication in the journal. Focusing on relevant areas of change is expected to encourage further scientific discourse and development of social science ideas.

As usual, Journal is emphasizing scientific work of various countries scientific institutions. In this publication Slovakian scientists Grenčíková, A., Španková, J., Kozová, K. are analysing generational differences in work preferences in the context of the labor market in Slovakia. The study explores generational differences in work preferences, focusing on generations X, Y, and Z through a questionnaire and statistical analysis. Findings reveal significant variations, with Generation Z showing dominant inclinations towards digital media use for job searching, flexibility in employment, career advancement, valuing workplace diversity, yet displaying lower loyalty compared to older generations, suggesting the necessity for personalized employer approaches to enhance satisfaction and loyalty.

In another article György, O. is making a cluster grouping of EU member states according to some economic performance and circular economic indicators. She finds that The EU is striving for a greener and more sustainable economy by reducing natural resource use, protecting biodiversity, and minimizing waste through initiatives like the Circular Economy Action Plan. Member States are increasingly focusing on measuring progress towards Sustainable Development Goal 12, although varying approaches and indicators reflect different national priorities and levels of

development, leading to a growing divergence in the transition to a circular economy among EU countries.

Furthermore, Airapetian, A. and Gružauskas, V. are looking at depressive responses to socio-political shock in their cross-sectional analysis one year post Ukraine-Russia conflict. Authors describe how persistent armed conflicts have caused immense suffering and loss throughout history, prompting inquiry into factors that facilitate sustained cooperation versus prolonged violence. The ongoing conflict in Ukraine, epitomizing this global dilemma, not only inflicts physical destruction but also triggers psychological trauma, particularly impacting neighbouring countries like Lithuania, prompting a study to gauge the evolving levels of depression in the Lithuanian populace amid the conflict's unfolding.

However, Editorial cannot review all of the researches, therefore we encourage familiarizing with them in the Journal, which currently is under the indexing process with Scopus and WoS.

We invite scientists to actively publish in the Journal, share their research results and methodological insights. We expect for close cooperation.

Prof. Dr. (HP) Valentinas Navickas, Editor-in-Chief

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DEPRESSIVE RESPONSES TO SOCIO-POLITICAL SHOCK: A CROSS-SECTIONAL ANALYSIS ONE YEAR POST UKRAINE-RUSSIA CONFLICT

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Vilnius University

Abstract
The persistent recurrence of armed conflicts throughout human history has inflicted immeasurable suffering and loss. While some societies have successfully fostered peace and cooperation, others remain ensnared by protracted conflict. This disparity raises a fundamental question: What factors contribute to the ability of certain groups and nations to sustain cooperation, while others grapple with recurring violence and strife? The ongoing conflict in Ukraine serves as a poignant exemplar of this global quandary, casting its shadow not only over the Ukrainian population but also over neighbouring countries. Russia's invasion of Ukraine, which commenced in February 2022, is widely regarded as the largest military offensive in Europe since the Second World War. Beyond the tangible destruction wrought by war, it has inflicted profound psycho-emotional trauma upon the affected populace. However, the Ukraine conflict engenders broader questions about the psychological repercussions of war, encompassing not only those directly embroiled in the conflict but also the wider regional population. Lithuania, by virtue of its geopolitical proximity, stands directly exposed to the repercussions of this conflict. Yet, it is not solely the unpredictable actions on the ground that evoke fear and anxiety but also the ominous rhetoric, exemplified by former Russian Prime Minister Mikhail Kasyanov's assertion that "if Ukraine falls, the Baltic countries will be next." Such pronouncements reverberate in society, eliciting a spectrum of reactions characterized by anxiety, uncertainty regarding the future, stress, depression, and feelings of hopelessness. In many instances, these psychological afflictions extend their reach to manifest as physical health issues, such as insomnia, high blood pressure, or even heart attacks. While economic policies strive to mitigate the impact of rising inflation, it remains imperative to address the psychological well-being of the Lithuanian populace. This study thus aims to elucidate the changing levels of depression within the Lithuanian population before the outbreak of the Ukraine conflict, during its course, and one year following its initiation. Through this comprehensive investigation, we seek to discern the pressing necessity for psychological support, as indicated by the PHQ-9 scale's threshold values.
KEY WORDS: War, Mental health, Aggression, Depression, PHQ-9
JEL: I18, I31, P25, R58

Introduction

Depression, a pervasive mental health disorder, has significant implications for patient well-being and healthcare systems. The ultimate goal in depression care is achieving patient remission. However, studies have indicated a concerning depression remission rate of less than 6% for patients treated in primary care settings (Jha et al., 2019). This underscores the need for innovative interventions to improve remission rates. One such intervention, as highlighted by a quality improvement study, demonstrated that the integration of screening, diagnosing, and treating patients using principles of measurement-based care combined with evidence-based Clinical Decision Support (CDS) tools interoperable with Electronic Health Records (EHRs) can significantly enhance remission rates (Jha et al., 2019). The use of EHRs equipped with CDS systems has been posited as a potential mechanism to augment depression screening and remission rates in primary care settings (Trivedi et al., 2019). Furthermore, the implementation of a two-step screening process, utilizing both the PHQ-2 and PHQ-9, has been shown to be effective in improving depression screening rates in clinics (Fuchs et al., 2015).

The PHQ-2 and PHQ-9 are particularly favored in primary care due to their validity, reliability, and brevity (Ferenchick et al., 2019). External factors, such as participation in federal programs like the Delivery System Reform Incentive Payment (DSRIP) program, have also been associated with enhanced depression screening rates, suggesting that financial incentives may play a role in promoting screening (Texas Health and Human Services, 2019). A paradigm shift in depression care has been proposed, wherein depression is approached as a triage issue rather than solely a mental health access issue (Trivedi et al., 2019). And it is at this time that we need to think in particular about the assessment of depression and the management of the symptoms of depression, because our world is beset by two major problems: the COVID-19 pandemic, followed by the Russia-Ukraine conflict. Wars have been a constant occurrence in human history, causing much suffering and loss. However, some societies have managed to maintain peace and cooperation, while others have been plagued by conflict. This raises the question of why some groups and countries manage to foster cooperation while others suffer from wars and violence (The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2005. [revised 2005], https://www.nobelprize.org/prizes/economic-sciences/2005/ceremony-speech/).

The ongoing conflict in Ukraine is a stark reminder of this reality, not only for Ukrainians, but also for the populations of surrounding countries. Russia's invasion of Ukraine began in February 2022 and is considered to be the largest attack in Europe since the Second World War (Osokina et al., 2023). The war has not only caused physical destruction, but has also had a profound effect on the psycho-emotional state of the people affected. However, the conflict raises important questions about the psychological damage of war, not only for those directly involved, but also for the wider population of the region. Lithuania is one of those countries. This is due to our country's geopolitical position, which has a border with the

aggressor. However, it is not only the unpredictable actions that cause great fear and anxiety, but also the words of the former Russian Prime Minister Mikhail Kasyanov, who said that "if Ukraine falls, the Baltic countries will be next" (Teh, 2022, Business Insider). Such sound bites generate a lot of controversy in society. These can include a range of reactions based on anxiety, uncertainty about the future, stress, depression and feelings of hopelessness. In many cases, psychological problems also disturb physical health, which is manifested by insomnia, high blood pressure or even heart attacks (Jonušienė, 2022). Although most economists in the country are making decisions to provide as many compensatory cushions as possible in the face of the inflationary increases that have led to higher costs (Deveikis, 2023), it is important to remember to take care to take care of the psychological state of the Lithuanian population. And to make these services even more accessible if there is a need for them.

The objective was to investigate how the level of depression among the Lithuanian population changed one year after the economic and social upheavals caused by the military conflict. This research work will reveal the level of depression of the Lithuanian population. It will also help to identify the number of people who need psychological help when their scores on the PHQ-9 scale are above the cut-off values. The study will allow to observe the real situation, which will allow to assess which gender, age and educational background people are most in need of psychological help (Spitzer et al., 2014). The Cronbach α of the scale was 0.89; Items rated on a scale from 0 to 10: (a) work efficiency, (b) sense of community. Data analysis was carried out in IBM SPSS Statistics 21 and Rstudio.

Literature review

Depression ranks among the top mental health issues in the U.S. Among adults aged 18 and above, 17.3 million have experienced a significant depressive episode, accounting for 7.1% of the entire U.S. adult population (National Institute of Mental Health, 2020). Depression is both debilitating and expensive, with the combined costs of medical treatment and lost work productivity estimated at around $210 billion each year (Greenberg et al., 2015; National Network of Depression Centers, 2018). When depression goes untreated, it can lead to emotional distress, decreased work efficiency, lost earnings, strained relationships, and a heightened risk of other health issues (Smithson et al., 2017) (Siu et al., 2016). Given the undeniable connection between mental and physical well-being research indicates that depression often coexists with severe chronic diseases. The importance of early identification and intervention for depression is underscored by a robust body of evidence (Smithson & Pignone, 2017; Mojtabai et al., 2018).

Organizations such as the US Preventive Services Task Force (USPSTF) and the American Academy of Family Physicians advocate for depression screening in adults, emphasizing the integration of screening with support systems and evidence-based protocols (Siu et al., 2016; American Academy of Family Physicians, 2016). The Centers for Medicare & Medicaid Services (CMS) has also emphasized the significance of depression screening in their new value-based payment models (Centers for Medicare and Medicaid Services, 2018). The Sequenced Treatment Alternatives to Relieve Depression (STAR*D) trial, one of the most extensive prospective randomized clinical trials on depression, highlighted the efficacy of screening and treating depression in primary care settings (Gaynes et al., 2008; Rush et al., 2006). Despite the emphasis on depression screening and treatment, a significant number of patients in primary care remain unidentified and undertreated (Olfson et al., 2016; Kato et al., 2018). Efforts to enhance the identification and treatment of depression in primary care have seen an increased utilization of screening tools, notably the Patient Health Questionnaire (PHQ)–2 and PHQ-9. These tools have demonstrated clinical utility and diagnostic accuracy (Kroenke et al., 2003; Kroenke et al., 2001). Meta-analyses have further validated the effectiveness of both PHQ-2 and PHQ-9 in detecting depression in primary care settings (Smithson & Pignone, 2017). While the aforementioned studies provide valuable insights into the prevalence and management of depression in the U.S., it is crucial to recognize that mental health challenges are not confined to any single geographical region. It is of paramount importance to assess the mental state of populations worldwide, including in countries like Lithuania. Given the recent challenges faced by Lithuania, including the COVID-19 pandemic followed by the war between its neighboring countries, Russia and Ukraine, timely psychological intervention has become not just essential but mandatory (Mura et al., 2022) The compounded stressors from the pandemic and the geopolitical tensions have undoubtedly heightened the mental health concerns within the Lithuanian population.

Addressing these concerns can significantly improve the quality of life and overall well-being of individuals. This underscores the need for studies that assess the level of depression and determine which social groups require the most assistance. In light of this, we conducted a study to evaluate the depression levels within the Lithuanian population and identify the social groups most in need of support.

Methodology

A cross sectional study was conducted to determine the level of depression among the Lithuanian population one year after the invasion of Ukraine by Russian troops. The sample size was 485 respondents, using a quota sampling method. Upon choosing to partake in the research, participants were promptly presented with an informed consent form. Subsequently, they were directed to the survey. During the consent process, individuals were briefed about the research's purpose and goals. They were also assured of the confidentiality of their responses. The survey targeted the broader community and was crafted via the "Google" forms tool, then disseminated across social media platforms such as "LinkedIn", "Twitter", and "Facebook". The questionnaire consisted of 3 parts: demografic data (age, sex, educational background, employment status, job responsibilities, place of residence); Patient Health Questionnaire – 9 (PHQ – 9, scores from 0 to 27, with higher score indicating more expressed symptoms of depression). Scores of 0–4 means minimal or no depressive symptoms, 5–9 are classified as

mild depression; 10–14 as moderate depression; 15–19 as moderately severe depression; ≥ 20 as severe depression. A frequency table was constructed to categorize respondents into distinct groups. We evaluated the PHQ-9 scores, identifying the mean, median, maximum, and minimum values. Similar assessments were conducted for indicators of job performance and sense of community. We calculated the Spearman correlation coefficient to determine the relationship between PHQ-9 scores, sense of community, work efficiency, and age. Additionally, a linear regression model was developed to predict variations in depression levels based on factors such as age, gender, educational attainment, employment status, sense of community, and job effectiveness.

Results

In this cross-sectional study, a total of 485 participants were surveyed, with their primary demographic attributes delineated in Table 1. The research employed a quantitative methodology to scrutinize both the demographic profiles and psychosocial markers of the participants. Of the 485 participants, 162 (33.4%) identified as male, while 323 (66.6%) identified as female. The participants' average age was 28.69 years (SD = 13.11), spanning from 18 to 75 years, with a median age of 22 years. Educational attainment was categorized into six distinct levels: university, higher college, secondary, basic, primary, and no formal education. A notable proportion of participants (n=254; 52.37%) reported secondary education, followed by 169 respondents (34.85%) with university-level education. Employment status was segmented into five classifications: employed individuals, students, pension or capital income beneficiaries, unemployed individuals, and others not actively participating in the workforce. A significant majority of the participants were either students (n = 250; 51.55%) or employed (n = 199; 41.03%). The PHQ-9 score, gauging depression severity one year post the war's onset, yielded an average score of 7.53 (SD = 5.93), ranging between 0 to 27. National affiliation was assessed on a scale of 1 to 10, with 1 indicating minimal affiliation and 10 indicating maximal. The mean score stood at 7.00 (SD = 2.57). Work proficiency was evaluated on a scale from 1 to 10, where 1 indicated a decline in work quality, and 10 indicated enhancement. The mean score was 4.76 (SD = 1.61). Collectively, these findings offer an in-depth insight into the demographic and psychosocial attributes of the study's participants, facilitating a comprehensive comprehension of the war's socio-psychological ramifications.

Table 1. General characteristics of the participants in the study.

Characteristics	**n**	**%**		
Gender (M/W)	162/323	33.4/66.6		
Education (Higher university degree)	169	34.85		
Education (Higher College)	44	9.07		
Education (Secondary)	254	52.37		
Education (Elementary)	16	3.30		
Education (Primary)	1	0.21		
Education (Without any education or training)	1	0.21		
Employment (Employed)	199	41.03		
Employment (Student)	250	51.55		
Employment (Pension or capital income beneficiary)	17	3.51		
Employment (Not in employment)	10	2.06		
Employment (Other, does not depend on labour)	9	1.86		
	Mean	**Standard deviation**	**Median**	**Interval**
Age (year)	28.6866	13.11302	22	18-75
PHQ-9(one year after the start of the war)	7.527835	5.928443	6	0-27
Sense of community (1 - low; 10 - high)	6.997938	2.570895	8	1-10
Work efficiency rating (1 - deterioration in work quality; 10 - improvement in work quality)	4.762887	1.605602	5	1-10

In **Table 2**, the distribution of depressive symptom severity among respondents is delineated. Specifically, 37.1% of participants reported experiencing minimal depressive symptoms, followed by 34.1% with mild symptoms. Moderate depressive symptoms were observed in 15.9% of the respondents. A smaller proportion of the sample indicated more pronounced depressive manifestations, with 6.8% reporting severe symptoms and 5.8% indicating very severe symptoms. This distribution provides insight into the varying degrees of depressive symptomatology within the study population.

Table 2. Distribution of depressive symptom severity

PHQ-9 score	Frequency	Percentages
Minimal depressive symptoms (0-4 points)	180	37.1 %
Low levels of depressive symptoms (5-9 points)	167	34.4 %
Moderate depressive symptoms (10-14 points)	77	15.9 %
Severe symptoms of depression (15-19 points)	33	6.8 %
Very severe depressive symptoms (20-27 points)	28	5.8 %

A Spearman rank-order correlation analysis (**Table 3.**) was employed to discern the associations between depressive symptoms, as quantified by the PHQ-9 one year post the war's commencement, and variables such as the sense of national cohesion, alterations in occupational performance, and the age of the participants. The PHQ-9 scale, which has a potential score range of 0 to 27, served as a metric for the intensity of depressive symptoms, with elevated scores denoting heightened depression severity. Evaluations pertaining to shifts in national cohesion and occupational efficiency were conducted utilizing a 10-point scale, where diminished scores signified adverse impacts, and augmented scores represented favorable outcomes. The analytical outcomes revealed a modest inverse correlation between the PHQ-9 scores and alterations in occupational performance ($r = -0.149$, $p < 0.001$), insinuating that pronounced depressive manifestations correlate with suboptimal work efficacy. A similarly modest inverse association was discerned between the PHQ-9 scores and age ($r = -0.296$, $p < 0.001$), suggesting that the younger demographic exhibited more pronounced depressive symptoms. The sense of national cohesion and variations in occupational performance also demonstrated an inverse relationship ($r = -0.122$, $p < 0.01$), indicating that an intensified sense of national cohesion is concomitant with diminished occupational efficacy. Furthermore, the sense of national cohesion and age exhibited a modest inverse correlation ($r = -0.161$, $p < 0.001$), with the data suggesting that the younger cohort manifested a more robust sense of national cohesion.

Table 3. Spearman's correlations between PHQ-9, sence of community, work efficiency rating and age. *** - p <0.001; ** - p<0.01; * - p<0.05

	PHQ-9 (one year after the start of the war)	Sense of community	Work efficiency rating	Age
PHQ-9 (one year after the start of the war)	1.000			
Sense of community	0.063	1.000		
Work efficiency rating	-0.149***	-0.122**	1.000	
Age	-0.296***	-0.161***	-0.033	1.000

A linear regression analysis was undertaken, designating the PHQ-9 as the dependent variable, while gender, age, educational attainment, employment status, sense of community, and work efficiency rating were treated as independent predictors (**Table 4.**) The derived model, characterized by a coefficient of determination ($R^2 = 0.1119$), elucidated several salient determinants. Notably, male respondents exhibited a mean PHQ-9 score that was 2.11 points lower than their female counterparts, implying a diminished intensity of depressive symptoms among men. Furthermore, the PHQ-9 score exhibited a decrement of 0.10 points for each advancing year of age, suggesting a potential attenuation in the severity of depressive symptoms among the older demographic. From an educational perspective, participants with secondary education registered an average PHQ-9 score that was 2.50 points higher than those with primary education, underscoring the potential influence of educational background on the magnitude of depressive symptoms. Intriguingly, for every unit increment in the score evaluating the repercussions of the Ukrainian conflict on occupational performance, there was a corresponding reduction of 0.58 in the PHQ-9 score. This intimates a potential association between the ramifications of the Ukrainian war on job efficacy and the intensity of depressive manifestations. While the model elucidates approximately 11.19% of the variance in the PHQ-9 scores, it furnishes pivotal foundational insights into the precursors influencing shifts in depressive symptomatology, thereby paving the way for subsequent in-depth investigations in this domain.

Table 4. A linear regression model with the depressive symptom scale as the dependent variable and age, place of residence, education, the impact of war on work performance and ratings of sense of community as independent variables. *** - p<0.001; ** - p<0.01; * - p<0.05.

Independent variable	Regression coefficient β	Standard error	t value	p value
Constanta	13.03658	1.84743	7.057	<0.001***
Gender[T.Male]	-2.11063	0.555297	-3.801	<0.001***
Age	-0.10166	0.033809	-3.007	0.002782**
Education[T.Higher education]	0.513968	0.959895	0.535	0.592597
Education[T.No education]	6.500171	5.934472	1.095	0.273934
Education[T.Elementary education]	1.854016	1.604718	1.155	0.248532
Education[T.Primary education]	-3.16454	5.684617	-0.557	0.578007
Education[T.Secondary education]	2.502536	0.895417	2.795	0.005405**
Employment[T.Other]	0.690698	1.92605	0.359	0.720049
Employment[T.Not employed]	3.08381	1.861617	1.657	0.098282
Employment[T.Recipient of pension or capital income]	2.745183	1.689858	1.625	0.104937
Employment[T.Student]	-1.30985	0.91935	-1.425	0.15489
Sense of community	-0.00589	0.105725	-0.056	0.955629
Work efficiency rating	-0.5811	0.161346	-3.602	<0.001***

Conclusion

The findings of this study underscore the significant impact of depressive symptoms on various demographic groups, particularly among the younger population. A notable negative correlation was observed between age and depressive symptoms, indicating that younger individuals are more susceptible to experiencing heightened levels of depression. This revelation emphasizes the need for future research to prioritize and address the mental health concerns of the younger generation. Furthermore, the aftermath of war has shown to exacerbate depressive symptoms, which in turn adversely affects job performance. As the severity of depressive symptoms escalates, there is a concomitant decline in work efficiency and productivity. Gender disparities were also evident, with women manifesting more pronounced depressive symptoms compared to men. A breakdown of the respondents' experiences revealed that a majority, almost 70%, reported mild to minimal depressive symptoms. Meanwhile, 16% indicated moderate symptoms, 7% severe, and a concerning 6% experienced very severe depressive symptoms. Alarmingly, the majority of those in the severe and very severe categories were young individuals. These findings highlight the pressing need for targeted interventions and support mechanisms, especially for younger individuals, to address and mitigate the debilitating effects of depression on personal well-being and societal productivity.

Recommendations

One of the primary strategies is the organization of Mental Health Awareness Campaigns. Such campaigns play a pivotal role in disseminating information about the signs and symptoms of depression, enabling individuals to recognize their feelings and seek timely assistance. Social media platforms, in particular, have emerged as powerful tools in this regard. For instance, Saha et al. (2019) highlighted the potential of social media campaigns, such as #MyTipsForMentalHealth on Twitter, in advancing public discourse on mental health (Saha et al., 2019). Another critical aspect is Increasing Accessibility to Mental Health Services. This can be achieved by establishing more mental health clinics or centers, providing online counseling services for those unable to attend sessions in person, and offering services in multiple languages to cater to diverse populations (Alonzo & Popescu, 2021).

Furthermore, promoting Physical Activity is another effective strategy. Exercise has been scientifically proven to alleviate symptoms of depression. Organizing community activities or sports events can serve as a catalyst for encouraging physical activity among the masses. Furthermore, it's essential to Engage the Media. Collaborating with media outlets to broadcast stories that foster positivity, resilience, and hope can serve as a counter-narrative to the often negative news that might be impacting the youth.

The authors recommend further research and studies on the assessment of depression levels in the face of major disasters such as war and pandemics. The authors also suggest the creation of a depression map that will help to assess the target municipalities in need of assistance, thus saving public funds and ensuring that the population in need receives assistance.

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CLUSTER GROUPING OF EU MEMBER STATES ACCORDING TO SOME ECONOMIC PERFORMANCE AND CIRCULAR ECONOMIC INDICATORS

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Abstract
In the next few years, the EU economy must go through a big change that will lead to a greener and more sustainable Europe. The goal is to use natural resources less, which will help protect biodiversity and cut down on waste, both of which are important parts of being sustainable. The EU Commission has been publishing reports, decisions and plans for the transition to a circular economy since 2015, with the primary aim of helping European countries to make the transition and accelerate progress. In 2020 the European Commission adopted a new Circular Economy Action Plan, and measuring the transition to a circular economy is part of the Sustainable Development Goals (SDGs) under SDG 12, Sustainable Production and Consumption. All EU Member States now aim to monitor their progress towards the SDG targets. After 2017, the problem of measuring the circular economy has also seen a surge in the literature, with an increasing number of experts exploring the issue. The circular economy concept covers many sectors, so it is clear that it cannot be captured by a single indicator. However, each country measures this using different national indicators, depending on the country's weaknesses and what it considers important to measure. Today, the issue of the transition to a circular economy (CE) in the EU has gained momentum. In recent years, the shift towards a circular economy has become increasingly visible in EU Member States. In their statistical records, they try to provide indicators to show the extent of this change. In other words, EU countries are increasingly focusing on measuring their progress at a macro level. At the same time, Member States are using different approaches to measuring sustainable consumption and production, and thus different indicators to measure the circular economy, and the shift towards the circular economy has become more pronounced in both less developed and developed EU Member States. The difference between Member States in this respect lies in their different levels of development and the fact that they have their own strategies and indicators. All the indicators under SDG 12 on achieving sustainable consumption and production measure the achievement of this objective. The difference between countries is that the indicators against which the SDGs are measured are not uniform. The indicators and their corresponding values can be found in the statistical systems of the Member States. The following study brings together the relevant information and aims to provide a general picture of the similarities and differences in this area, and to divide the EU countries into two distinct clusters using the indicators of the circular economy.
KEY WORDS: Circular economy, Indicators, Sustainable production and consumption, SDG, Cluster analysis.
JEL: O52, O57, Q01, Q59

Introduction

Several authors in the literature address the issue of measuring the transition to a circular economy. Moraga and co-authors (2019) and Pascale and co-authors (2021) also deal with the enumeration of circular economy indicators without counting the statistical office records of each country. In this paper, we enumerate sustainable consumption and production indicators from the statistical records of the EU-27 member states, in order to answer which indicators are most common in these countries and what the differences are between countries. Garcia-Bernabeu et al (2020) attempted to rank EU countries' performance using circular economic indicators, whereas in this paper we attempt to group EU countries into two distinct clusters using economic performance and circular indicators.

In the next few years, the EU economy must go through a big change that will lead to a greener and more sustainable Europe. The goal is to use natural resources less, which will help protect biodiversity and cut down on waste, both of which are important parts of being sustainable. In March 2020, the European Commission adopted a new Circular Economy Action Plan (COM, 2020), which forms the basis of the European Green Deal, Europe's sustainable agenda. In addition, the new action plan puts a strong emphasis on initiatives along the whole life cycle of products, from design to consumption and recycling. Promoting sustainable consumption and preventing waste are also very important. Measuring the transition to a circular economy is part of the Sustainable Development Goals (SDGs) under SDG 12, Sustainable Production and Consumption. All EU Member States now aim to monitor their progress towards the SDG targets. However, each country measures this using different national indicators, depending on the country's weaknesses and what it considers important to measure. In terms of measurement, the websites of the statistical offices of each country provide the indicators that the country considers important to examine and publish.

My research serves **a dual purpose**. On the one hand, I want to map, review, and aggregate the indicators for Objective 12 on the websites of the statistical offices of the EU Member States in order to get a comprehensive picture of the national indicators of the Member States that are relevant for the transition to a circular economy. The research question is how the SDG targets are mapped into the statistical systems of each country and how these can be used for EU-wide analysis. In recent years, EU countries have paid increasing attention to indicators at the macro level. Second, after the indicators have been

enumerated, I have conducted a cluster analysis using the most commonly reported circular indicators (with 2020 and 2021 data).

The first hypothesis of my research was that the indicators of the circular economy appear in the statistical registers of the EU Member States in a nearly identical way. As a second hypothesis, I tested whether countries with more advanced economic performance also performed better in terms of indicators measuring the circular economy.

Theoretical Background

Several ways have been thought of so far to measure the change to a circular economy. At the moment, there are three main ways to measure the amount of change and progress: focusing on resources and material consumption, keeping track of energy consumption, and switching to a circular process in order to make less waste and find ways to deal with waste (Hoffer, 2021). Measuring progress towards the circular economy at the national level is also an objective set by EU Member States individually. The current, generally accepted understanding is that the extent of the transition to a circular economy can be measured primarily through resource and material use and waste management. Against this background, countries have developed different strategies, sometimes called action plans or roadmaps, to achieve the transition to a circular economy. These were published from 2016 onwards, with different timing from country to country, and most EU countries (with one or two exceptions) have now described concrete steps to take and targets to achieve in the coming period (Hoffer, 2021).

In 2007, the UNEP formulated the Life Cycle Management (LCM) model, which refers to the ability and attitude of economic actors to consider products or services from the design stage, through production, consumption, and use, to disposal, including their link to sustainability (UNEP, 2007). Life cycle management is a way of thinking about business that can provide a basis for companies, public authorities, and government decision-makers to take action for sustainable development and the sustainability of products. This can help, for example, to reduce CO_2 emissions from the production of products or the material and water footprint.

Moraga and co-authors (2019) also consider the classification of indicators in the circular economy, but also find that most indicators focus on measuring the conservation of materials. They classify the indicators they formulate into 4 categories: indicators focusing on functions (1), products and components (2), materials and energy (3), and composite indicators (4) (Moraga et al., 2019). ascale et al. (2021) have compiled a list of indicators used in the literature to measure the circular economy. They classified and analysed 61 CE indicators, categorising and analysing them at three geographical (micro, meso, and macro) levels based on the three dimensions of sustainability (economic, social, and environmental), taking into account the circular framework (3Rs; see below). Elia et al. (2017) have pointed out that, although several attempts to develop CE indicators have been made over the last two decades, the process is still in its infancy. Most studies focus mainly on macro-level analyses, with micro-level analyses being a very small slice of the subject (Elia et al., 2017), which is also a consequence of the complexity of the subject and the lack of methodology. Currently, the macro level is the most analysed area of CE intervention. In some extreme cases, authors equate the circular economy with recycling, but most authors interpret the concept as a combination of reduction, reuse, and recycling, which is best represented by the 3Rs framework (Kirchherr et al., 2017).

The R-frame system is a way to close material circles by loops, or levels. This is done in a hierarchical way. When there are fewer R-levels (lower R-frames), the process is shorter, less outside help is needed to finish it, and the strategy is more circular. Conversely, the more R levels, the less circular the strategy. In the past few years, many authors or pairs of authors have tried to come up with a single sign of a circular economy. Through their research, Saidani and co-authors (2019) and Potting and co-authors (2017) found that it is not easy to make a composite indicator that measures the transition. Interestingly, it is worth highlighting Potting's R-framework, which uses the most, i.e., 10 strategies to increase the circularity: reject, reconsider, reduce, reuse, repair, refurbish, remanufacture, recycle, reuse again, and reclaim (Potting et al., 2017).

Garcia-Bernabeu and co-authors (2020) tried to make a composite indicator of the circular economy, among other things. Their aim was to use the composite indicator to establish a ranking by comparing the performance of EU countries (Garcia-Bernabeu et al., 2020). They emphasise the importance of measuring the transition to a circular economy at the national level, as CE is a key driver of sustainable development, and in this respect, governments can play a crucial role in setting and implementing targets and measures in the future. Here again, we can see the idea, which is also partially reflected later in this article, that the indicators can be divided into 4 broad areas: production and consumption, waste management, secondary raw materials, competitiveness, and innovation.

Kozma et al. (2021) state that mapping the wide range of indicators does not yet give us a clear ranking of the EU Member States, and that it is not easy to rank them by the values obtained. Nonetheless, the aim is to use the indicators to identify the performance of individual Member States in the circular economy.

Methodology

Mapping the indicators of the EU Member States

Figure 1 shows that the indicators for measuring sustainable consumption and production vary a lot across EU Member States, from 2 to 25. The largest number of indicators, 25, is found in the Italian statistics, the smallest in the Croatian statistical statement (2).

Fig. 1. Distribution of sustainable consumption and production indicators by country, editing based on the database created using Tableau Public.

Based on statistical records and their online availability, I aggregated 107 indicators (Table 1). All EU countries except Cyprus and Latvia have statistical registers. Sustainability indicators are available, including indicators for sustainable consumption and production. According to Table 2, the indicators have been classified into six categories based on the literature reviewed. Indicators related to waste collection and treatment top the ranking with 35 indicators. The data also shows which categories each country considers important to measure and which group of indicators is the most relevant for them.

Table 1. Distribution of indicators by type

Indicators by type	Number of indicators	Number of countries, where it appears
Emissions of pollutants	10	9
Material use	19	27
Waste generation and treatment	35	25
Energy use	5	9
Businesses and tourism	30	17
Projects and education	8	8
Total indicators	107	

Source: own data collected and edited from the websites of the statistical offices of the EU Member States.

Figure 2 shows the indicators that are most frequently found in EU country statistics. These indicators come from two categories: waste management and material consumption. The leading indicators are recycling rates and total material consumption.

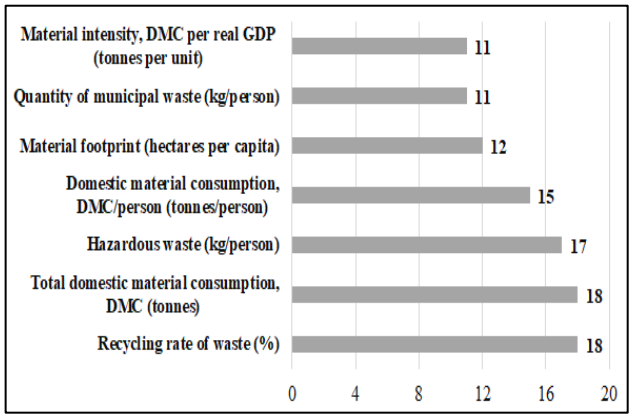

Fig. 2. Frequency of indicators (how many countries have the indicator in their statistics?) Data collected and edited from the websites of the statistical offices of the EU Member States.

Figure 3 clearly shows that in most countries, the majority of indicators focus on measuring material use and waste management. Indicators related to waste management are the least emphasized in Austria, while indicators related to material use are less emphasized in Hungary and Estonia. In Hungary, the indicators measuring emissions of pollutants stand out compared to the other countries, while indicators measuring the activity of companies are emphasized in Austria, Germany, and Italy. The indicators on energy use are dominated by Latvia, while the projects and grants category is most prominent in Croatia.

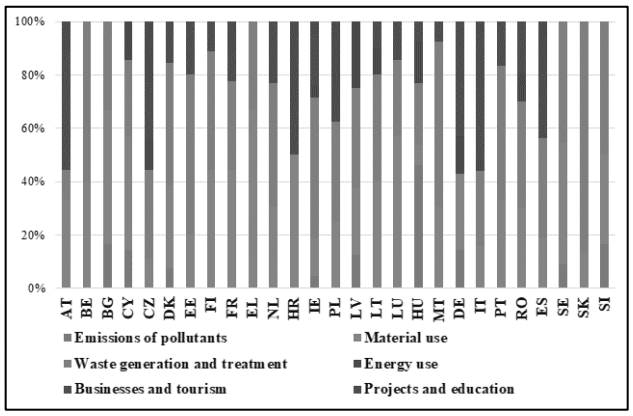

Fig. 3. Distribution of indicator categories in EU Member States. Data collected and edited from the websites of the statistical offices of the EU Member States.

The six groups of indicators are briefly described below.

One of the most important ways to measure the change to a circular economy is through the group of material use indicators. In Environment at a Glance 2020, the OECD summarizes key environmental trends in areas such as climate change, biodiversity, water resources, air quality, and the circular economy. In the circular economy section, indicators measuring resource use, such as resource productivity or domestic material use per capita, also play an important role in this study. The data show a slow downward trend in material use between 1990 and 2017,

and the resource productivity of the world economy improved during the period under review, while material intensity decreased significantly (OECD, 2020). Nevertheless, the OECD's Global Material Resources Outlook to 2060 shows that after 2017, global material consumption, as a measure of material use, will increase in the coming years (OECD, 2019). Improving resource efficiency is a very important factor in mitigating global environmental problems (e.g., climate change, biodiversity loss), so systemic thinking and appropriate action by governments are important (Pomázi-Szabó, 2021). Indicators measuring material use and consumption are included in the statistics of all EU countries. In total, there are 19 such indicators, the most common being total domestic material consumption (18 countries), domestic material consumption per capita (15 countries), and ecological footprint (12 countries). Romania has the highest number of indicators in this category (6).

As for the indicators measuring emissions of pollutants, they appear in the statistics of nine countries: Bulgaria, Cyprus, Denmark, Ireland, Latvia, Germany, Hungary, Slovenia, Sweden, and the United Kingdom. Of the 10 indicators, six are reported for Hungary. The most frequently occurring indicator, which appears in 4 countries, is the average CO_2 emissions per kilometre of new passenger cars. Hungary has the most indicators in this category (6). The number of indicators measuring waste generation and treatment is 35, and they are to some extent present in the statistical records of all Member States except Croatia and Germany. The three most frequently occurring indicators are hazardous waste (21 countries), recycling rate (18 countries), and municipal waste (11 countries). The highest number of indicators in this category is found in Slovakia (13) and Ireland (11). Energy use indicators appear in the statistics of nine EU countries: Cyprus, the Czech Republic, and Ireland. Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Italy, Latvia, Lithuania, Hungary, Germany, Italy, Romania, Romania. In total, there are 5 indicators in this category, with the most frequent (6 countries) being the electricity capacity from renewable energy sources. Latvia, Hungary, and Romania have the most indicators in this category (2-2).

The number of indicators for business and tourism is 30, and they appear in the statistics of 17 EU countries. Three indicators stand out, which are also monitored in four other countries: employment in the environmental goods and services sector, the number of organisations operating EMAS (Eco-Management and Audit Scheme) and the use of standard accounting tools to monitor the economic and environmental aspects of tourism. Austria, Ireland, Romania, and Spain have the highest number of indicators in this category (4-4). In the category of projects and education, there are 8 indicators in the statistics of 8 EU countries (Austria, the Czech Republic, France, Croatia, Ireland, Poland, Spain, and Italy). The two most frequently occurring indicators, which appear in four countries, are the National Action Plan and the level of education for sustainable development. Poland has the most indicators in this category (3).

Discussion

Cluster analysis based on the most common circular indicators

The second aim of my research was to find out whether it is possible to organise EU countries into clusters using the most commonly used circular indicators. My analysis is based on two main sets of indicators: those assessing economic performance or development and those measuring the transition to a circular economy. The second hypothesis of my research was that countries with more advanced economic performance also perform better in terms of indicators measuring the transition to a circular economy. To make the clusters, I made a database of 22 indicators. Eleven of them measure the performance and growth of the economy, and the other eleven are the most common indicators of the circular economy. The database was compiled from statistics published by the European Union (2020 and 2021 data were used). The indicators reflecting economic performance were GDP per capita (euro), average net income (euro), income distribution (inequality rate, %), external trade balance (million dollars), extreme poverty rate (%), employment rate (%), long-term unemployment rate (%), R&D as a share of GDP (%), general government budget (million euros and as a percentage of GDP), and share of tertiary education (%).

Frequency played the largest role in the choice of circular indicators used. I compared the indicators for the countries that appeared in most countries at the time of enumeration. Following this logic, I selected 11 indicators: resource productivity, material use per capita, material use per GDP, circular material use rate, material footprint, greenhouse gas emissions per capita, share of renewable energy in gross final energy consumption, energy dependency, hazardous waste rate, municipal waste and recycling rate.

Below is a brief explanation of each indicator:

1. DMC: domestic material consumption: domestic extraction + import-export (tonnes).
2. Resource productivity: GDP/DMC.
3. DMC/capita: domestic material consumption per capita.
4. Circular material use rate (CMR, %) measures the proportion of materials recovered and recycled back into the economy as a share of total material use.
5. Material footprint, hectares per capita, or raw material consumption (RMC) within a geographical area: refers to the demand for the extraction of materials (minerals, metal ores, biomass, fossil fuels) generated by the consumption of goods and services.
6. Per capita greenhouse gas emissions measure the total national emissions of the so-called "Kyoto basket" of greenhouse gases, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and the so-called F-gases (hydrofluorocarbons, perfluorocarbons, nitrogen trifluoride /NF_3/ and sulphur hexafluoride /SF_6/).
7. Share of renewable energy sources in gross final energy consumption, %: measures the share of renewable energy consumption in gross final

energy consumption according to the Renewable Energy Directive.

8. Energy dependence shows the extent to which an economy relies on imports to meet its energy needs. The indicator is calculated by dividing net imports by gross available energy.
9. Municipal waste in tonnes measures the total amount of waste generated per inhabitant per year in a country, excluding major mineral wastes.
10. Hazardous waste as a percentage of total waste generated.
11. Recycling rate measures the proportion of municipal waste recycled as a percentage of total municipal waste generation.

The compiled database was analyzed using the statistical data processing software Jamovi. I tried to support the formulated hypothesis by means of hierarchical cluster analysis. I opted for this method for two reasons; firstly, the database I have created has a small number of elements, and secondly, it is less sensitive to outliers. The cluster analysis was preceded by a correlation analysis for the indicators I selected, since cluster analysis treats all variables equally. If two variables are closely correlated (r absolute value is greater than 0.7), it is appropriate to exclude one of the variables. As a consequence, five economic indicators (GDP per capita, average net income, income distribution, long-term unemployment rate, and general government budget) and two circular indicators (hazardous waste rate and material use per capita) were excluded from further analysis, resulting in a total of 15 indicators (9 circular, 6 economic).

Results

To construct the clusters, I used standardised values for each variable to avoid the effect of differences in magnitude. Ward's hierarchical method is one of the most commonly used methods, combining the elements so that the increase in the internal standard deviation square after the merging is as small as possible. As with the K-means method, Ward's method minimizes the sum of the squared distances of the points from their cluster centres. Hierarchical clustering can be represented using a species diagram, or dendogram (Figure 4), which plots both the cluster-cluster relationships and the order of clustering (clustering viewpoint) or subdivision (subdivision viewpoint). The tree also gives us the order of mergers. The dendogram (Figure 4) shows which Member States are closest to each other in terms of the indicators analysed. Two clusters can be identified: the first cluster, consisting of 15 countries (brown), and the second cluster, consisting of 12 countries (blue) (Table 2).

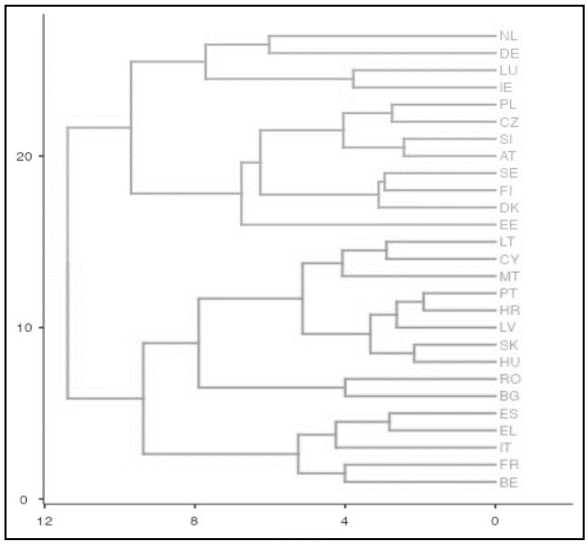

Fig. 4. Cluster dendrogram

After analysing the data, it was found that cluster 2 countries perform better overall, with an average score of 64% for 14 out of the 22 indicators examined. For the indicators measuring economic performance, 73% show better average scores compared to Cluster 1, and for the transition to a circular economy, the share is also above 50% (Table 2). In the following, I will describe in more detail the differences in economic performance and circular performance between the two cluster countries using average values.

Table 2. Countries in the two clusters

Cluster	Number of countries	Countries	Indicators in which they perform better
Cluster no.1	15 countries	BE, BG, SK, HU, PT, HR, LT, LV, IT, ES, FR, EL, CY, IT, RO	8 indicators: income distribution, general government budget in million euros, general government budget as a percentage of GDP, DMC/capita, CO_2 emissions, ecological footprint, hazardous waste, municipal waste
Cluster no.2	12 countries	NL, DE, SE, DK, FI, AT, IE, LU, PL, CZ, SI, EE	14 indicators: GDP/capita, external trade balance, average net income, R&D as a share of GDP, long-term unemployment rate, extreme poverty rate, employment rate, DMC, resource productivity, recycling rate, energy dependency, renewable energy rate, recycling rate

Source: own editing based on data from the cluster analysis.

If we look at the averages of the economic data for the countries in the two clusters, we can say that 8 of the 11 economic indicators in cluster 2 show better averages. For six of these indicators, there is a significant difference in the averages, and for two indicators, the averages are close between the two clusters (share of tertiary education and share of employed). As the average values for three indicators are lower for cluster 2 countries than for cluster 1, it can be said that the averages of the economic indicators for the two clusters do not give a clear answer as to which group the more or less developed countries belong to. Let us take the indicators in turn. Six economic indicators of the countries in cluster 2 have a much higher average value than those of the countries in cluster 1.
These indicators are:

1. The average trade balance value: the average of the countries in Cluster 2 is 75 times that of the countries in Cluster 1.
2. GDP per capita: the average for cluster 2 countries is two times higher than the average for cluster 1 countries.
3. Average net income is 80% higher in cluster 2 countries than in cluster 1 countries.
4. The share of GDP devoted to R&D is on average 70% higher in Cluster 2 countries than in Cluster 1 countries.
5. The deep poverty rate: on average, 1/3 as many people live in deep poverty in cluster 2 countries as in cluster 1 countries.
6. The long-term unemployment rate is on average 60% lower in cluster 2 countries than in cluster 1 countries.

Thus, cluster 2 countries perform better than cluster 1 countries on most, but not all, economic indicators (except for income distribution, the general government budget in millions of euros, and the percentage of GDP). Looking at the averages of the data for the circular economy indicators for the two cluster countries, six out of the 11 indicators analysed show better averages in cluster 2. Cluster 2 includes those countries with an average resource productivity 41% higher than that of Cluster 1. In terms of the recycling rate, the countries in cluster 2 recycle on average 40% more material back into the economy than those in cluster 1. The same surplus of over 40% is also reflected in the recycling rate for these countries.

However, Cluster 2 countries perform 20% better in terms of material use, renewable energy, and energy dependency. These are the six indicators in which Cluster 2 countries perform better in terms of recycling, while showing higher values for CO_2 emissions, waste, hazardous waste, material use per capita, and footprint compared to Cluster 1 countries. This is probably because we have seen from the economic data that these countries have a higher production rate, which results in a larger footprint, more waste, more CO_2 emissions, and more material use per capita for the time being. It can be said that Cluster 2 countries, although having better economic indicators, perform less well in terms of circular economy indicators and need further improvement in this respect.

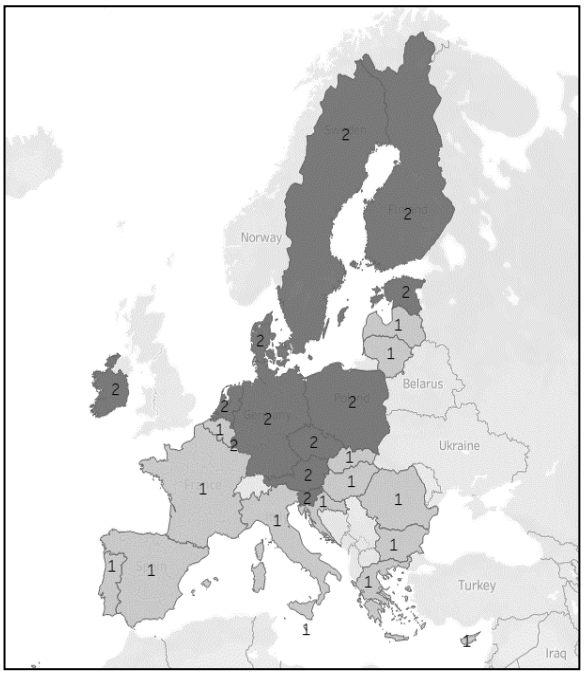

Fig. 5. Map of countries in the two clusters created by using Tableau Public.

Next, I performed the most important test of the relationship, the t-test, to find out whether the difference between the means of the two groups in my sample is due to existing differences (significant) or whether the difference is just a result of chance. [1] My null hypothesis was that the two means in the two samples are statistically identical, i.e., the difference between the means of the two groups is not significant for the factors under investigation. I was interested in the significance level of the t-tests. If the significance level is less than 0.05 ($p < 0.05$), then we can say with 95% confidence that the differences between the group averages calculated on my observed data are not due to chance. I complemented the analysis with a normality test and a homogeneity test. For those factors where one of these was violated, I used Welch's estimation, in the other cases, I used Student's estimation.

[1] The use of the t-test could be criticized for not being a simple random sampling. However, it is not my intention to draw conclusions for all the countries of the world, but only to characterise the countries included in the analysis as accurately as possible. For this reason, taking a random sample is not necessary. The other two conditions, normality and homogeneity, have been checked for each indicator. Whichever one is violated, in that case the Student's (S) t-test is not used, but the Welch' t (W) test is considered valid. I have indicated which test I used.

Table 3. Two independent samples T-test

Indicator	T	P	Mean of clusters		Cohen' s d	Dif. ***
DMC/ capita	S	0.033*	1	14,55	-0.875	72,64
			2	20,03		
Recycling rate	S	0.004**	1	32,88	-1.217	68,33
			2	48,12		
CO_2 emissions	W	0,01**	1	6,69	-1.169	70,72
			2	9,46		
GDP/ capita	W	0,009**	1	18069,33	-1.234	48,61
			2	37169,17		
Average net income	W	0,004**	1	12255,67	-1.301	54,57
			2	22457,33		
Income distribution	S	0,016*	1	5,18	1	124,82
			2	4,15		
Extreme poverty rate	W	0,002**	1	9,27	1.374	329,89
			2	2,81		
Gover- nment budget as a share of GDP	S	0,004**	1	-7,53	-1.220	154,62
			2	-4,87		
Research and develop- ment as a share of GDP	S	0,004**	1	1,35	-1.226	58,70
			2	2,3		
Long-term unemploym ent rate	S	0,009**	1	70,97	-1.097	92,81
			2	76,47		
Unemploy- ment rate	W	0,01**	1	3,09	1.074	245,24
			2	1,26		
External trade balance	W	0,03*	1	661,67	-0.980	1,33
			2	49862,25		

*p < 0,05
**p ≤ 0,01
*** Difference in the mean of cluster no. 1 expressed as %

The null hypothesis says that there is no significant difference between the two groups of countries in the average value of the indicator. This is true for 10 indicators, which means that the differences between the two groups of countries are not significant, regardless of whether the countries are in two groups. For example, for DMC, the mean values for the two groups of countries are the same. Overall, there are no significant differences for 8 of the 11 indicators of the circular economy (material use, resource productivity, share of circular material use, material footprint, share of renewable energy in gross final energy consumption, energy dependency, and share of hazardous waste and municipal waste). According to the alternative hypothesis, there are some indicators for which there is a significant difference between the averages of the two groups of countries. For the variables under consideration, there are 12 indicators (Table 3) for which there is a significant difference between the average values of the two groups. As the p-value is less than 0.05, the null hypothesis is rejected in these cases. For the following 12 indicators, the strength of significance can be broken down into 2 categories depending on the p-value ($p < 0.05$ and $p \leq 0.01$): material use per capita, recycling rate, CO_2 emissions, GDP per capita, average net income, income distribution, R&D as a share of GDP, employment and extreme poverty rates, and the share of the public budget in GDP, unemployment rate, and external trade balance. The largest significant difference between the mean scores of the economic indicators of the countries in the two groups is found in the deep poverty rate, as $p=0.002$, thus providing strong evidence against the null hypothesis and allowing us to accept the alternative hypothesis that there is a significant difference between the two groups of countries in this respect.

This is followed by three more indicators with $p \leq 0.01$, all three with $p=0.004$ (average net income, research and development as a share of GDP, and public budget as a share of GDP), thus providing strong evidence against the null hypothesis and allowing us to accept the alternative hypothesis that there is a significant difference between the two groups of countries on these indicators as well. Cohen's effect size is large, as $d > 1$ for all four indicators mentioned above, suggesting a strong effect. The p-value of the recycling rate and CO_2 emissions indicators indicates a significant difference in the degree of transition to a circular economy, as the p-value is $p \leq 0.01$ in both cases, thus rejecting the null hypothesis and accepting the alternative hypothesis that there is a significant difference between the two groups of countries for these two indicators as well. The Cohen effect size is $d > 0.8$ in both cases, indicating a strong effect. However, because the p-value for the per capita material use indicator is p 0.05, we reject the null hypothesis and accept the alternative hypothesis that there is a significant difference in this indicator between the two groups of countries. The Cohen effect size is $d > 0.8$ in both cases, indicating a strong effect. The difference in the means of the differences between the two clusters in percentage terms is shown in the last column of Table 3. The difference between the means is calculated in % shows the percentage difference between the averages of the two groups of countries. It is clear that the averages for cluster 1 are below those for cluster 2.

Conclusions

Based on the analysis that was done, the move towards a circular economy has also become more noticeable in EU Member States. As a result, they are trying to use indicators in their statistical records to show how big this change is. In other words, EU countries are increasingly focusing on measuring their progress at the macro level. After taking stock of the indicators, it can be concluded that Member States are trying to demonstrate progress by measuring different indicators, but that there is no uniform measurement at Member State level. A review of their statistical data shows that Member States have different approaches to measuring sustainable consumption and production, and thus different indicators for measuring the circular economy. However, the analysis has revealed that, overall, there are some prominent and commonly used indicators that can be found in the statistics of several countries and that have been used as a basis for my cluster analysis. The cluster analysis allows the EU countries to be divided into two large groups, but it turns out that there

is not yet a significant difference between the two for all circular economy indicators, with the exception of three indicators at present: the reuse rate, CO_2 emissions, and material use per capita. The analysis also showed that, currently, it is mainly the economic performance indicators that show a significant difference. It is an open question whether a significant difference will emerge between the two groups of countries by 2030, based on indicators measuring the circular economy in the coming years. However, based on the analysis carried out, the shift towards a circular economy has become more pronounced in both less developed and developed EU Member States.

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GENERATIONAL DIFFERENCES IN WORK PREFERENCES IN THE CONTEXT OF THE LABOR MARKET: SLOVAKIAN CASE

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Abstract
The study examines the differences in the work preferences of generations X, Y and Z. Its main goal is to identify the preferences of individual generations in the context of integration into the labor market, based on a questionnaire. To achieve the stated goal, we conducted a questionnaire, the results were verified through a chi-squared test, and last but not least, a comparison between all generations mentioned was also performed. The results indicate that significant differences can be observed among the examined generations in aspects such as the use of digital media in the form of social media for job searching, flexible forms of employment, career development, diversity in the workplace, and also loyalty to the employer. Simultaneously, it was found that generation Z has taken a dominant position in all the areas examined. They are the ones who use social media to the greatest extent for the above-mentioned purposes, among all generations they have the highest preference for flexible forms of employment, the area of career development is also the most important for them, they value diversity in the workplace compared to older generations much more, but they are also the least loyal employees among the generations in question. We see improvements in making working conditions more attractive depending on the generations. A universal policy of motivation or benefits is not sufficient, and a proactive approach by employers in the form of a more personalized approach is needed. Such an approach can have an impact on higher satisfaction and also employee loyalty.
KEY WORDS: generation, exchange of labor force, work preferences, labor market.
JEL: J11, J21, M5

Introduction

The labour force in the Slovak labour market currently consists of baby boomers, generation X, generation Y and the youngest generation Z. The specifics of the value orientations of the individual generations have an impact on the practices used in the field of human resources management and personnel management. Specifically, we are talking here about the transformation within the work preferences of individual generational cohorts. This transformation also has significant impacts on fundamental aspects such as employee turnover. This indicates that a universal motivation or reward policy is no longer effective. What is needed, on the contrary, is a proactive approach on the part of employers aimed at attracting, retaining and continuously developing talent from all the generations in question. The study is divided into several parts, where we talk about the literature review, research methodology, and last but not least, it also includes the findings and conclusions.

Literature review

The world faces a variety of challenges, among which we include, for example, globalization, communication and technological changes, or environmental sustainability - right here, human resources can represent one of the key factors in creating an organization's competitiveness (Graczyk-Kucharska & Erickson, 2020). However, a problem that the field of human resource management may face is precisely the lack of resources as such (Szafrański et al., 2017). All managers, no matter what level of management they are at, should be skilled enough to be able to manage and lead employees of any generation. They should also contribute to the achievement of the organization's goals and at the same time to achieving higher performance (Nyvlt & Pruskova, 2017; Kubaľa & Vetráková, 2018). Managers should also have sufficient knowledge of aspects such as the specifics, values, attitudes, needs or behaviours of the different generations in the workplace, but they should also have knowledge of the motivational needs of the generations in question (Kirchmayer & Fratričová, 2018). When comparing older and younger generations, we can talk about the fact that they differ significantly in their values, but also in their approach to work and education (Kolarova et al., 2016; Němec et al., 2017; Bajkai-Tóth et al., 2022). The area of relationships is also influenced by individual generations - each generation has a specific impact on them. We can see this when comparing older and younger generations, where on the one hand the older ones need closeness or cohesion, but on the other hand the younger generations tend to be more independent or autonomous (Caganová et al., 2017). Looking at young people, their choice of work is determined by factors that include the attractiveness of the workplace, the alignment of the values of the individual and the organisation, but they also place emphasis on their personal characteristics or preferences (Spychala et al., 2017; Statnickė, Čeledinaitė et al., 2018). It is extremely important for organizations to understand the way young people approach their workplace choices. It is important to emphasize areas such as career development, organizational climate or adaptation to work

(Csiszárik-Kocsír & Garia-Fodor, 2018). If we focus on identifying generational cohorts preceding generation Z, we can mention baby boomers, generation X, and generation Y (Susanti & Natalia, 2018; Southgate, 2017). Rudolph et al. (2021) point out that substantial differences can be observed in each generational cohort. However, currently, the labor market is being entered by generation Z, which significantly differs from the older generations in aspects such as their way of working and work motivation (Graczyk-Kucharska & Erickson, 2020). This is a generation that is in constant contact with their friends, while also having a much higher number of friends compared to older generations. Multitasking is typical for this generation, in which they perform several activities at the same time. Representatives of generation Z are also very materialistic, they lack patience, but at the same time they are also realistic, creative and ambitious. They primarily undergo the education process in a virtual (online) space, where they tend to implement their creativity - through digital media they share their ideas without citing traditional sources of pre-existing knowledge (Lazanyi & Bilan, 2017). In the workplace context, they prefer modern recruitment tools while prioritizing flexible working conditions (Dalessandro, 2018; Derous & De Fruyt, 2016; Lazányi & Bilan, 2017). Generations X and Y also have their specifics. It is typical for members of generation X to place emphasis on career, but also on work-life balance. Furthermore, freedom holds value for them, making them a generation for which management is not so straightforward – precisely for this reason, they prefer a workplace that allows flexibility (Parthasarathy & Ramalingam, 2015). Generation Y or in other words millennials are also known as the so-called children of technology (Grenčíková & Špánková, 2016). When comparing it with other generations, it can be said that they prefer receiving information from online sources and also working from home over lectures or trainings that take place in a specific place and at a specific time, which requires their physical presence. In terms of the specifics of this generation, aspects such as flexibility, sociability, mobility and, last but not least, learning new ideas are considered its advantages (Hitka et al., 2019). Hitka et al. (2019) conducted research that aimed to compare the motivational preferences of Czech and Slovak employees with selected regions outside the European Union. Preferences were analyzed both in terms of country and age of employees. It turned out that there are significant differences in the expectations and motivations of individual generations, especially in the area of finances. The authors claim that regardless of which generation an employee belongs to, he has the right to both - a decent wage and adequate motivation. Managers should have knowledge about all generations, they should not be unfamiliar with their specific needs, characteristics or skills. On this basis, it is then possible to increase the efficiency of the workplace and the success of the organization. It is important for supervisors to be able to communicate with each generation in question, while understanding the importance of diversity. Furthermore, it was pointed out that motivational factors such as the atmosphere at the workplace or a good work team do not show significant differences in the context of their perception by individual generations in the Slovak Republic. This means that these factors are perceived as important from the perspective of all generations. The authors point out that it is on this basis that it is essential that managers are able to provide a good and also motivating working environment for all generations. Last but not least, they claim that every single generation can contribute to the development of the organization. On the one hand, there are the older generations, who have years of experience, and on the other hand, there are the younger generations, whose contribution can be in the form of knowledge and technological advancements (Hitka et al., 2019).

Methodology

The labour market is influenced by many factors, one of the most prominent of which in recent times has been generational change. Each generation comes with its own specific value orientations, which are reflected in their choice of jobs. The main goal of the presented study is to identify the preferences of individual generations in the context of integration into the labour market, based on a questionnaire. Data collection regarding the value orientations of individual generations was carried out in electronic form. The questionnaire was constructed using a Likert scale (1 = strongly disagree, 5 = strongly agree) and consisted of 14 questions. This was distributed to the general public via social media and email communication. The survey took place from November 24, 2022, to December 12, 2022. A total of 1257 respondents participated, meeting the age criteria and thus representing representatives of generation X (1965-1981), Y (1982-1994), or Z (1995-2010). The sample was even across all generations in question, meaning that there were 419 respondents for each generation. The title of the questionnaire was "Comparison of the preferences of generations X, Y and Z when joining the labour market". The data obtained from this questionnaire were processed using the statistical method and the chi-squared test was used for verification, through which we examined the dependence between the variables in question. The mentioned methods were used in accordance with already published studies, the authors of which deal with the issue of generational change. The questionnaire was used by the following authors: Edgarová et al. (2021), Jung and Yoon (2021), Smaliukieneová and Bekesieneová (2020) or Savanevicieneová et al. (2019). The following authors implemented the chi-squared test in their research: Ozkan and Solmaz (2015), Kupczyk et al. (2021) and Popaitoon (2022).

Results

From the analysis of the collected data through the questionnaire, it can be concluded that the differences between the mentioned generations are significant. The study focuses on the use of social media as a preferred source through which job seekers explore new job opportunities. The results are presented in Figure 1.

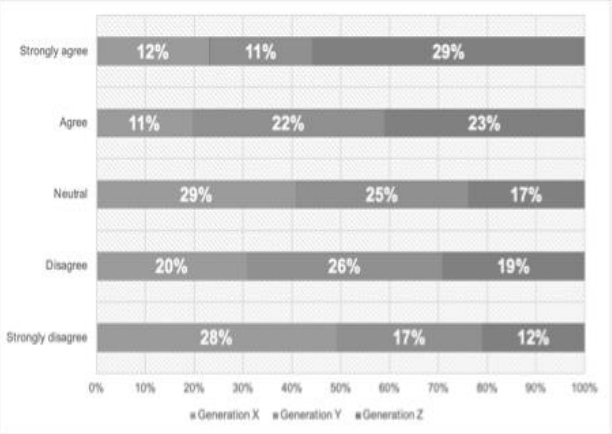

Fig. 1. Social media as a source of recruitment
Source: Own elaboration

The results point out that job opportunities are primarily sought through social networks, especially by the youngest generation Z, in comparison to older generations. This positive attitude was expressed by a total of 52% of respondents from generation Z, while only 23% of representatives of generation X. Generation Y took a positive attitude in a total of 33% of cases. This can be justified by the fact that generation Z represents the most digitally literate generation yet to be found in the labour market. They prefer working with the latest technical and technological advancements, and their relatively high preference for utilizing various digital tools is noticeable not only for personal purposes but also for job searching through social media. For the implementation of the chi-squared test, the following hypotheses were established:

H0: We assume that being part of the specific generation has no association with the use of social media as a source for job search.

H1: We assume that being part of the specific generation is associated with the use of social networks as a source for job search.

The test statistic (78.6034) exceeded the critical value (9.488), based on which the null hypothesis can be rejected while accepting the alternative hypothesis. The chi-squared test was performed with a significance level (α) of 0.05.

The study also looks at the use of flexible forms of employment in relation to different generations, whose preferences in this respect also differ to a significant extent. The findings can be seen in Figure 2.

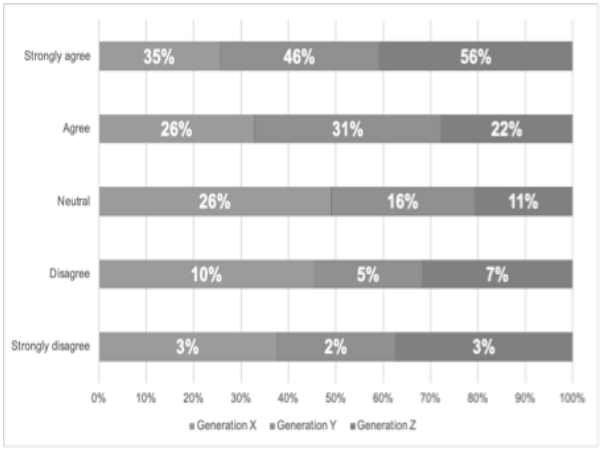

Fig. 2. Flexible forms of employment
Source: Own elaboration

Based on the results, we can see that flexible forms of employment are preferred across all three generations, but the degree of preference varies. While a total of 78% of representatives of generation Z and 77% of representatives of generation Y expressed a positive attitude, in the case of generation X it is only 61% of representatives of this generation. This means that within the older generation X there is still a higher level of resistance to flexible forms of employment compared to younger generations. This can be justified by the fact that representatives of the younger generation have a greater need to be mobile - to work when they want and where they want. On the other hand, older generations still prefer real interpersonal interaction outside of virtual space. For the implementation of the chi-squared test, the following hypotheses were established:

H0: We assume that being part of the specific generation is not related to the preference for flexible forms of employment.

H1: We assume that being part of the specific generation is related to a preference for flexible forms of employment.

The value of the test statistic (44.4185) was found to exceed the critical value (9.488) with significance level (α) of 0.05. As a result, the null hypothesis was rejected and the alternative hypothesis was accepted.

Another aspect observed is the preference in career development. This is the key to eliminating work monotony or stagnation in terms of both personal and professional development. The results can be seen in Figure 3.

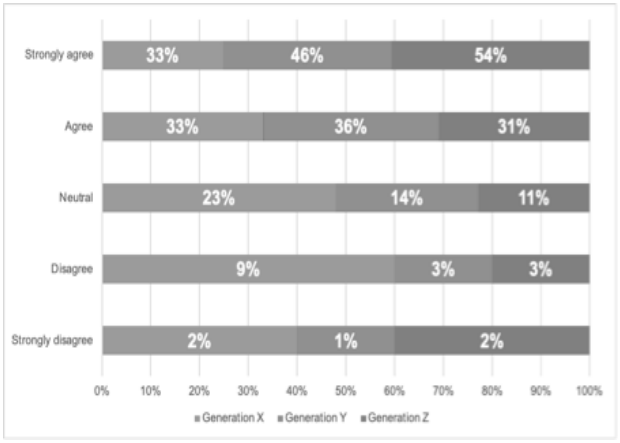

Fig. 3. Career development
Source: Own elaboration

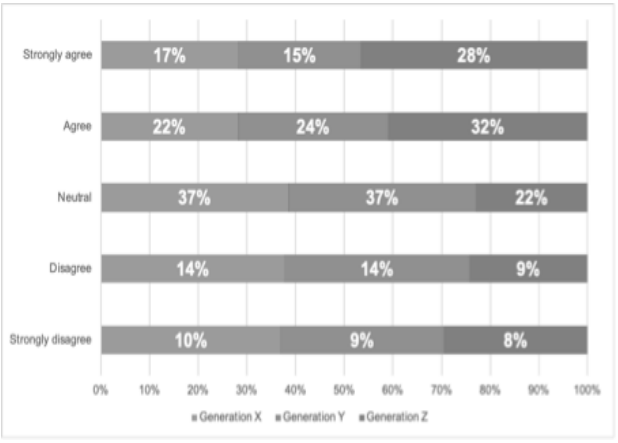

Fig. 4. Diversity in the workplace
Source: Own elaboration

The findings pointed to the fact that the younger the generation, the higher the preference for career development. When comparing the youngest and oldest generations, we see that while 85% of the respondents of generation Z have a need for career development, in the case of generation X it is 66% of respondents. Within the generation Y, we then talk about 82% of respondents expressing a positive attitude. Furthermore, we also observe a greater neutral attitude of generation X towards career development in comparison to younger generations, indicating their indifference towards this preference in favor of other aspects of work. This may be due to the observed need of the younger generation for rapid career growth. Representatives of this generation want to do work that they find interesting, which gives them the opportunity to develop. As a result, they will also have a greater need to constantly move up in their career. For the implementation of the chi-squared test, the following hypotheses were established:

H0: We assume that being part of the specific generation is not related to career development preference.

H1: We hypothesize that being part of the specific generation is related to career development preference.

The established test statistic (51.4248) exceeded the critical value (9.488) with a significance level (α) of 0.05. As a result of these findings, the null hypothesis was rejected and, conversely, the alternative hypothesis was accepted.

Workplace diversity is an increasingly discussed concept. We can speak of various differences, whether they are cultural, racial, age-related, gender-related, and many others. Currently, the uniqueness of each employee is being emphasized, regardless of the above-mentioned aspects. The presented study also deals with the preference of a workplace that values differences. The results can be seen in Figure 4.

Among the generations compared, it turned out that generation Z prefers diversity in the workplace the most. Specifically, they expressed a positive attitude in 60% of the cases, while in the case of both generation X and generation Y only 39% of respondents took this positive attitude. A high preference for diversity can also be observed in the neutral attitude, where while 22% of generation Z representatives hold this stance, for generation X and Y, it amounts to an identical 37%. Diversity is thus most valued from the perspective of the youngest generation Z. It can be argued that it is generation Z that reacts to aspects such as equality and inclusion perhaps the most among all the generations studied. This means that based on this, they will also be interested in working in a workplace that values diversity and utilizes its uniqueness to its advantage. For the implementation of the chi-squared test, the following hypotheses were established:

H0: We assume that being part of the specific generation is not associated with the preference for workplace diversity.

H1: We assume that being part of the specific generation is associated with the preference for workplace diversity.

The test statistic (50.0514) was higher than the critical value of 9.488. The chi-squared test was performed with a significance level (α) of 0.05. Based on the results, the null hypothesis was rejected and the alternative hypothesis was accepted.

Lastly, we can also highlight the aspect of employee loyalty to the employer. Trends like "quiet quitting" or even the so-called "great resignation" are resonating more and more. This raises the question of whether these issues leading to high employee turnover are solely a problem of generation Z or if they represent a broader societal phenomenon. The acquired findings are presented in Figure 5.

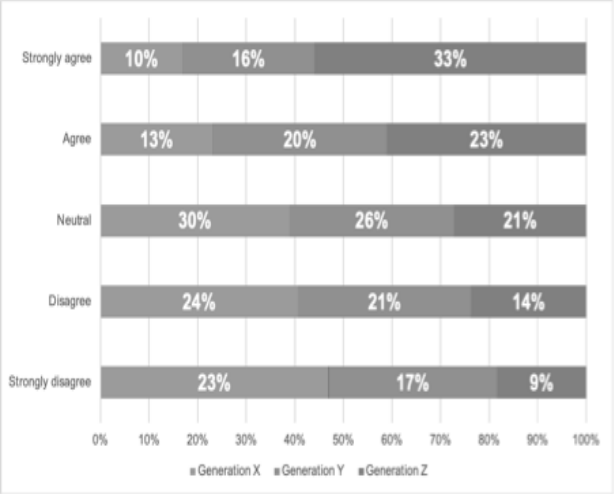

Fig. 5. Loyalty to the employer
Source: Own elaboration

The way in which the value orientation of the younger generations has been transformed is also observable in this case. The findings show that as many as 56% of generation Z respondents would have no problem leaving their employer, while only 23% of generation X respondents would have no problem doing so, which is half the number of generation Z respondents. For Generation Y, 36% of respondents would have no problem leaving their employer. The reason is that the younger generation has no issue, and in fact, they actively seek to try new things. It turns out that they are much more responsive to areas such as CSR, mental health or organizational culture, as a result of which they will also demand more attractive working conditions compared to previous generations. For the implementation of the chi-squared test, the following hypotheses were established:

H0: We assume that being part of the specific generation is not related to employee loyalty.

H1: We assume that being part of the specific generation is related to employee loyalty.

The value of the test statistic (100.5571) is higher than the critical value (9.488) with a significance level (α) of 0.05. Therefore, it can be concluded that the null hypothesis is rejected and the alternative hypothesis is accepted.

Conclusion

The aim of the study was to identify the preferences of individual generations in the context of integration into the labour market, based on a questionnaire. Many previously published studies have shown significant differences in the issue of work preferences of different generations, and the same was confirmed in the present research. The study emphasized several aspects, among which we are talking about the use of social media as a source of searching for job offers, flexible forms of employment, career development, diversity in the workplace and, last but not least, loyalty to the employer. Generation Z was found to be the dominant generation in each of these areas. This generation is by far the most digitally literate, which is why they use channels like social media when entering the labour market. They also have a strong desire for flexibility. Fixed working hours, during which they have to spend their time in the workplace, are not attractive to them. Instead, they want to be mobile and work at a time and place they deem most suitable based on their subjective preference. When looking at the area of career development, once again, it is generation Z that shows the highest preference in this aspect. For representatives of this generation, it is important to do work that they find interesting, thanks to which they can learn, develop and thus move forward and grow in their career. Additionally, workplace diversity is significant for them, with findings indicating that among all examined generations, generation Z is the one most inclined towards valuing differences. Finally, we can also mention the area of loyalty of generation Z to the employer, where it has been shown that, compared to older generations, generation Z is the one that has no problem trying new things and thus has a tendency to so-called fickleness in the sense of changing employers frequently. This has very negative impacts on aspects such as high employee turnover. Based on the findings, we suggest making working conditions more attractive depending on the individual generations. A universal policy of motivation or benefits is not the path to increasing employee satisfaction and overall loyalty to employers. If the employer's goal is to attract, retain and develop the talents of all the generations in question, it must take a proactive approach in the context of the transformation of the above-mentioned areas.

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WORK PERFORMANCE AND WORK FROM HOME: THEORETICAL DEVELOPMENT

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Abstract
Employee job performance has been associated with management since its inception as a scientific discipline. The goal of proper management of human activity is to achieve higher job performance. In its current form, job performance is not only associated with quantity, but quality as well. From the point of view of an organization's leadership, managers or supervisors within the work environment, in the past, leading their employees to better job performance was relatively easy. With the progress of science and technology, a gradual change connected with the introduction of information and communication technology can be seen and certain types of work started to shift significantly to the home environment. This trend was greatly accelerated by the Covid-19 pandemic when, as part of interventions to prevent the spread of the virus, organisations had to react by introducing work from home wherever possible. Working from home is gradually becoming a working standard that is being used by more and more employers and employees. Many employers, also thanks to the pandemic period, have found that several kinds of costs can be saved by introducing work-from-home. On the other hand, working from home has become equally convenient for employees, bringing many advantages, but on the other hand also disadvantages, such as loss of social contact or more complicated teamwork. Of course, working from home brings other aspects, such as changing factors and the environment where work is realised, which is also connected to work performance. The aim of this paper is to identify, based on a literature review, key research themes related to work performance and working from home. To identify relevant literature, Web of Science database was selected while this research focuses on peer-reviewed publications published in English language up to April 2023. The total scope of the selected publications analysed based on the Prisma methodology is 14 research articles between 2008 and 2023. The published studies includes the following research directions: 1. Change in work performance in the context of the implementation of Covid-19 interventions, 2. Gender roles and their impact on work from home and work performance, 3. Mental and emotional aspects at home and the allocation of time for work, 4. The use of modern telecommunication technologies their impact on teamwork in the context of work from home. These 14 studies are found in several journals (n-11). The first study in the final set is from 2008. Based on a dataset taken from Web of Science (the keyword string "work performance and work from home"), a map of the keywords and the most cited authors extracted from that string was created. These maps are created using the analytical tool VOSviewer. Based on the publications analysed, the most frequently cited author was identified (Bakker A.B.) The findings of this study contribute to the literature related to work performance and working from home.
KEY WORDS: work performance, work from home, literature review, Prisma, WOS
JEL: M11, M12, M54

Introduction

Performance and working from home exists in the society for a long time, but recently this topic has recently raised many challenges. The implementation of work from home has been accelerated by the pandemic of more available technologies in all work spheres where the type of work has allowed it. Work performance represents the extent to which employees meet their job responsibilities, objectives and achieve expected results. It means that work performance focuses on how well an employee performs his or her job in terms of quality, quantity, as well as time invested in work performance (Mihaleche, 2022; Cooper 2019; Robinson and Judge 2017; Blok et al., 2011; Janssen 2004). These definitions show that, in contrast to traditional management, work performance management does not only focus on the quantity of work, but also on the quality of the results achieved. Most authors agree on the above definition with only slight modification in individual studies. Work performance represents the extent to which an employee successfully fulfils his/her job duties and goals and achieves the necessary and expected results and can be seen as a way of measuring the quality of the tasks performed by employees, as well as their adaptability, commitment, and job satisfaction (Hajiali et al. 2022; Alnıaçık et al. 2012). Work performance can be measured using objective and subjective indicators, such as a combination of productivity, job quality, job presence and job satisfaction indicators (Darvishmotevali and Ali 2020; Singh et al, 2016). When examining stress and its effects on job performance, it is important to consider not only workplace stress, but to focus on the personal lives of employees as well (Rasool, SF et al. 2020). Such stress was caused by Covid-19 and the economic downturn, which deeply affected work-life balance and had clear implications for employees' work performance (Sarwar et al., 2023; Sun et al. 2022). This study focuses on literature analysis using Prisma statistical method. In the introduction part and literature review section, both new and older studies are listed for better clarification and identification of issues across different researches. The aim is to identify research directions of authors whose studies are available in Web of Science based on the defined criteria described in the methodology section.

Literature review

The first definitions of job performance based on studies available in Web of Science can be attributed to Goodman et al. (1970), Merrens et al. (1975), Sheridan et al. (1975), Terborg (1977). Goodman et al. (1970) dealt with models of motivational orientation, motivational stimulation, work commitment, and the expectancy model. He subsequently applied these models based on self-reports, unpublished technical reports and informal interviews which in turn led to the results that the best predictor of job performance among the mentioned models is the expectancy model. Merrens et al. (1970) in their study looked at the Protestant Ethical Scale as a predictor of repeated work performance. The results of his study conducted with the Protestant Ethics Scale involving 373 people indicated that the group of people with high Protestant Ethics Scale spent significantly more time working on the task and also produced more outputs. Thus, he concluded that the type of work behavior studied is part of the Protestant ethical personality variable. Sheridan et al. (1975) examined the correlational relationships between job performance and four types of job satisfaction measures. A relatively highly cited and the most prominent author in terms of number of studies is Kuvaas B. He conducted research on job performance in relation to perceptions of employee investment and intrinsic motivation. The conclusions of that study show that investment in employees has a positive effect on job performance only when there is a high level of intrinsic motivation (Kuvaas B., et al. 2018, Kuvaas B and Dysvik A., 2009). All definitions of work perfomance emphasize the importance of the results achieved and the quality of work in particular. The studies mentioned above have looked at work perfomance in a specific context and for example on the impact of stress, burnout, social support, fairness in the company or commitment. The mentioned factors largely influence job performance and thus both the quality and quantity of employees' work. Work from home is a relatively newer term compared to work performance and has come to be used by companies mainly in the context of the development of technology and computers while its implementation in practice has not been at a high level (Volokh, 1995; Stanek, 1998). In the context of management, the first study to focus on work from home was by Raghuram and Wiesenfeld (2004), who in their research looked at work and non-work conflict and stress on the 'virtual' employee. In the context of the current global situation, working from home is being implemented in companies at a significantly faster pace than before (Waizenegger, 2020; Feng and Savani, 2020). The pandemic has thus improved and accelerated the adoption of telecommunication and virtual technologies in both the workplace and the home (Jackowska and Lauring, 2021).

The increased interest in implementing work-from-home is also evidenced by the number of studies, 81 in total according to Web of Science, of which 71 have been published from 2020 to 2023. The massive expansion of work-at-home activities and the disparities in employee performance in this form of work is very relevant for the management. This paper focuses on the literature analysis using Prisma statistical method on the basis of which the selection of researches is processed. The aim of this study is to identify and analyze the research directions of authors whose research contains keywords related to work performance and working from home, and whose studies are available in the Web of Science based on the defined criteria described in the following methodological section.

Methodology

The Web of Science database was selected in the search for relevant literature. The following search string "work performance and work* from home" was used in the initial selection of relevant studies (total number of studies - 10,336). Document type - article (8,432), Web of Science index SSCI (1,199), Web of Science Categories - Management (154 results). In addition, only articles published in journals that are currently (April, 2023) classified at Q1 and Q2 level in the management category were considered. Subsequent selection of studies was done on the basis of their availability, so that they could be used in the context of this study.

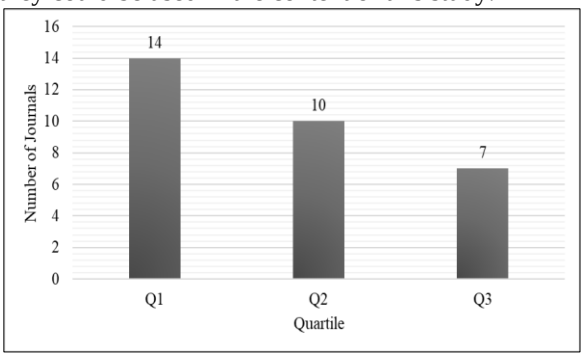

Fig. 1. Distribution of journals by quartiles
Source: Own elaboration

Based on Journal citation reports (JCR) tool, 31 journals that met previous criteria in the search of relevant articles were analyzed. Of the 44 suitable studies, the selection was reduced to articles published in journals classified by the JCR SSCI methodology in Q1 and Q2 (24 journals).

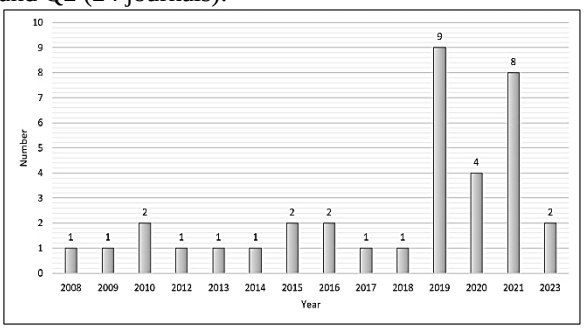

Fig. 2. Number of studies published during 2008-2023
Source: Own elaboration

The final set of research articles of this study with the specified criteria is 14 (open access full-text articles, quantitative analysis of the abstracts confirmed that the

research problems corresponded to the specified aim). The selection of studies based on journals (n11) is as follows: Academy of management journal (1), Career development international (1), European journal of information systems (1), Human relations (2), International journal of human resource management (1), International journal of physical distribution and logistics management (1), Journal of internationalmanagement (1), Journal of occupational and organizational psychology (2), Small business economics (1), Technovation (1), Work aging and retirement (2). The first study from the final set of articles was published in 2008 (1) and the following in 2009 (1), 2010 (1), 2015 (1), 2018 (1), 2019 (2), 2020 (3), 2021 (5), 2023 (1).

The following illustration (Illustration 1) shows a map of the keywords used in the final set of articles. The most used keywords in the researches were: performance, work, management, satisfaction, work from home, motivation, career, gender.

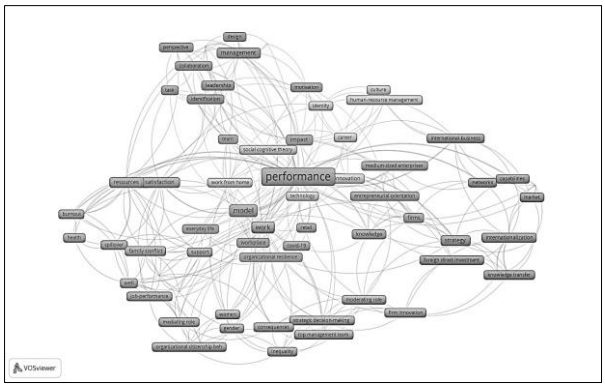

Illustration 1: Map of keywords used
Source: Own elaboration

The most cited authors are shown in Illustration 2. All mentioned authors were the most frequently cited in the literature analyzed. The most cited authors in the studies was Bakker, ab. This author is dealing with the topic of work performance and engagement for a long time, and overall his most cited studies are 1. Daily fluctuations in work engagement: an overview and current directions (Bakker ab., 2014), where he reviewed the literature related to fluctuations in work engagement (n citations = 157). 2. Work Engagement (Bake ab., el al. 2010), where he looked at work engagement and its impact on a single employee as well as the entire organization (n citations = 1731). 3. Job demands, job resources, and their relationship with burnout and engagement: a multi-sample study (Schaufeli and Baker, 2004), in this study he looked at the relationship between burnout, engagement, and employee turnover. In the results of the paper, it states that different strategies need to be chosen whether engagement should be reduced or increased due to the health problems that burnout can cause and which would lead to employee turnover (n citations = 13439). This author is not in the final set. He was the most cited in the available research, but his research was not directly in the review taken from WOS using the given search string.

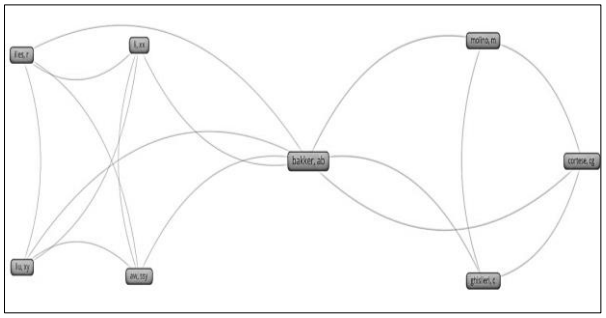

Illustration 2: map of most cited authors
Source: Own elaboration

The procedure to find the final set of relevant publications is shown by the PRISMA model (Illustration 3). This model was designed to help systematic reviewers transparently report why the review was conducted, what the authors did and what they found. It was created based on the methodology already outlined in other publications (Page et al., 2021; Mother 2009).

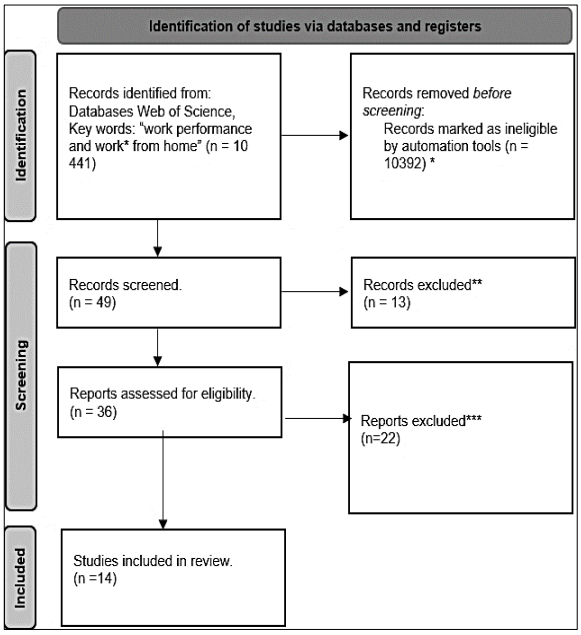

Illustration 3: PRISMA: Flow diagram
Source: Own elaboration

The first selection of research articles was based on the condition for selecting relevant sources, which is described in the introduction part of the methodology. The study has to be from the management category, document type article, Web of Science index (SSCI), language English and open access. The second selection and condition that the research article must meet is the quartile rating of the journal. This rating tells about the quality and level of the journal. Therefore, for the analysis, articles with a journal rating of Q1 and Q2 are used. This selection was done by analysis using the JCR tool. The last selection of articles was based on abstract analysis. The selected research articles were excluded after qualitative analysis of the abstracts due to research topic in the articles, which did not meet the requirements set out in the methodology. Although the research articles contained the required keywords such as work

performance and working from home, but in this context most of the articles were understood in terms of the companies' status, its work performance and working abroad and in the home country.

Results and discussion

The studies are quite different, but certain elements of each study suggest similarities in their research areas. From the final studies (14) listed by Prisma (Figure 3), the following research directions were identified: 1. Change in work performance in the context of the implementation of Covid-19 interventions, 2. Gender roles and their impact on work from home and work performance, 3. Mental and emotional aspects in the home and the division of time for work, 4. The use of modern telecommunication technologies their impacts on teamwork in the context of work from home.

Recently, this research area has become more relevant, especially as a consequence of the covid-19 pandemic, which greatly accelerated the implementation of work from home in all work spheres where the type of work allowed it. The introduction of homeworking continues to be used even after the pandemic has ended. During the Covid-19 crisis, changes in leadership behaviour associated with working from home were associated with changes in the perceived quality and productivity of managers at different organizational levels (Stoker et al. 2022). When conducting work from home, analysing employee performance can be viewed from multiple perspectives such as mental, emotional, technical or innovation, or gender equality in the workplace and at home (Oladipo at al., 2023; Jackowska et al., 2021; Demerouti et al, 2020, Rothman et al. 2014). According to Kováčová and Drahotský (2022), pointing to the results of earlier studies, they report that gender does not play a significant role in work engagement. However, the work environment in work from home is different and there may be changes that affect different genders. From a mental and emotional perspective, it is necessary to consider the impact within co-worker relationships in the virtual space and also the impacts connected with the relationships and cohabitation at home (Oladipo et al., 2023; Hall et al., 2010). When working from home and its impact on the workplace, it is important that there is a change in behaviour between supervisors and subordinates so that it leads to positive intergroup connections in the workplace. Family-supportive behaviour by supervisors and how it is perceived by subordinates reinforces work engagement. Thus, a positive pro-family change in supervisor behaviour leads to a change in subordinate behaviour, which in most cases has effects on engagement and performance in both work and home environments (Rofcani et al., 2019).

Thus, the above studies clearly represent the impact of the functioning of interpersonal relationships. Telework has also been understood in certain studies as communication through telecommunication technologies with the client. This type of work has been greatly expanded by the spread of the Covid-19 pandemic. As a result of the pandemic, there have been a number of constraints that have had impacts on employment (Mura et al., 2022). The pandemic has led to a sudden shift to teleworking. It becomes important when working with clients remotely to increase and reinforce a sense of belonging. Here it is possible to distinguish team communication functions such as coping, learning, planning and positioning , which together create belonging. Based on research findings, increasing belongingness is related to well-being and also productivity and helps to better performance of work tasks (Hafermalz et al., 2021).

The Covid-19 pandemic brought with it a number of difficulties, one of them was the need for increased care of the home and children. This leads to the issue of gender equality. For a long time, overall care was predominantly done by women and this was further affected by the pandemic. The labour market thus prevents women from competing with male workers, who are not as affected by domestic work. In order to be more competitive, they choose the self-employed route and run their business from home. In this way, they are considerably more flexible with their time. By doing so, women gradually become business owners and, by working from home, achieve significant synergies that allow them to narrow the performance gap with men. From the perspective of the overall economy, such productive behaviour by women leads to higher economic performance, but it is important to use policies to do more to support such enterprises (Oladipo et al., 2023).

Working from home brings with it an interaction between employee behaviour within the organization and its side effects on two family outcomes which are family performance and marital behaviour, and there may be a so-called emotional exhaustion which will lead to changes in productivity (Aw et al., 2021, Molino et al., 2015). The introduction of working from home requires a change in management style by the organization's leadership or managers. However, the accelerated introduction of this kind of work in recent years can be seen as a kind of crisis situation. Such crisis situations affect both employees and managers as there is uncertainty which causes stress and internal unrest (Fritsche et al, 2011). However, instead of the required behavioural change, managers react stagnantly to stressful situations, which means that they do not adapt their behaviour to the needs of calming and relieving tension, but instead choose a directive leadership style in all areas (Stoker et al., 2019).

Conclusion

The key concepts mentioned, their clarification and the research directions "work performance" and "working from home" in terms of scale are quite well analyzed. From a management perspective, these concepts have been used for a longer period. However, in terms of the range of literature sources, the combination of the above concepts of 'work performance and work from home' can be considered to be under-researched, as can be seen from the relatively low

number of selected research sources with the above management focus.

The findings of this study contribute to the literature of this field and suggest the need for further exploration of the topic considering that the implementation of working from home is becoming a growing global trend, accelerated by interventions to prevent the spread of the Covid-19 pandemic, as well as the significantly better availability of technological capabilities to businesses, organizations, and individuals as well.

Recommendations for further research, are based on analyses of selected articles (final set), presented in Table 1. Recommendations for further research addressed by the authors of the analysed studies are as follows: Analyze the impact of entrepreneurship and technological advances causing changes in the labor market based on longitudinal observation from a gender role perspective; Analyze how older workers can respond more effectively in the event of another pandemic or crisis; Analyze the motivational value mechanism and measurement focusing on emerging relationships from employee performance to organizational performance; Analyze the impact of different family structures in the home and their impact on work performance when working from home.

An analysis of the final set of research sources is included in the table below.

Table 1. Overview of the analysed literature

N	Authors	Article Title	Year	Keywords	Cited	Objcet
1	Oladipo, O; Platt, K; Shim, HS	Female entrepreneurs managing from home	2023	Female entrepreneurship; Self-employment; Performance; Work from home; Gender gap	0	The study deals with gender roles and entrepreneurship of women from the household of 'female entrepreneurs'
2	Hafermalz, E; Riemer, K	Productive and connected while working from home: what client-facing remote workers can learn from telenurses about 'belonging through technology'	2021	Remote work; COVID-19; belonging; Goffman; client-facing work; backstage	14	The study deals with the belongingness of remote communication as a result of four types of teamwork
3	Movarrei, R; Vessal, SR; Vessal, SR; Aspara, J	The effect of type of company doing home delivery during a pandemic on consumers' quality perceptions and behavior	2021	Last-mile delivery; Retail; COVID-19; Quality perception; Hygienic quality	1	The authors conducted research on home delivery during a pandemic and the impact on retailers
4	Jackowska, M; Lauring, J	What are the effects of working away from the workplace compared to using technology while being at the workplace? Assessing work context and personal context in a global virtual setting	2021	Work from home; Virtual work; Group perceptions; Group efficacy; Knowledge sharing; Global teams	10	The impact of virtuality on group behaviour
5	Aw, SSY; Ilies, R; Li, XX; Bakker, AB; Liu, XY	Work-related helping and family functioning: A work-home resources perspective	2021	organizational citizenship behaviour; helping; work-family interface; work-home resources model	9	Examine the relationships between the provision and receipt of interpersonal behaviours by employees in organisations
6	Demerouti, E; Hewett, R; Haun, VC; De Gieter, S; Rodriguez-Sanchez, A; Skakon, J	From job crafting to home crafting: A daily diary study among six European countries	2020	compensation; diary study; home crafting; job crafting; spillover	33	Home autonomy and home workload strengthened the positive relationship between seeking resources at work and at home.
7	Kooij, DTAM	The Impact of the Covid-19 Pandemic on Older Workers: The Role of Self-Regulation and Organizations	2020	heterogeneity; adaptability; intervention; perspective; performance; management; resources; dynamics; outcomes; design	24	The impact of Covid-19 pandemic interventions and the response of older people
8	Rofcanin, Y; Heras, ML; Bosch, MJ; Wood, G; Mughal, F	A closer look at the positive crossover between supervisors and subordinates: The role of home and work engagement	2019	crossover; FSSB; home engagement; POS; work engagement	6	The main aim of this study is to analyse the mechanisms and boundary conditions for understanding how positive experiences are transferred from supervisors to their subordinates.

9	Audenaert, M; Decramer, A; George, B; Verschuere, B; Van Waeyenberg, T	When employee performance management affects individual innovation in public organizations: the role of consistency and LMX	2019	Employee performance management; LMX; perceived individual innovation; public sector; public residential care	58	Authors contribute by focusing on consistent employee performance management and Leader-Member Exchange (LMX).
10	Bhave, DP; Lefter, AM	the other side: occupational interactional requirements and work-home enrichment	2018	emotional labor demands; off-job activities; family conflict; time allocation; managing emotions; within-person; fade-out; recovery; model; performance	18	Analyse how the demands of work interaction affect work-home enrichment
11	Molino, M; Cortese, CG; Bakker, AB; Ghislieri, C	Do recovery experiences moderate the relationship between workload and work-family conflict?	2015	Work-family conflict; Psychological well-being; Recovery experiences; Workload	34	The purpose of this study is to analyse the role of four recovery experiences (psychological detachment, relaxation, mastery, and control) in preventing work-family conflict (WFC)
12	Hall, GB; Dollard, MF; Tuckey, MR; Winefield, AH; Thompson, BM	Job demands, work-family conflict, and emotional exhaustion in police officers: A longitudinal test of competing theories	2010	reciprocal relations; stress; resources; burnout; satisfaction; performance; experiences; validation; IO/OB; model	139	Authors proposed and tested a complex theory that aims to explain the seemingly contradictory relationships between work demands, emotional exhaustion, and work-family conflict (WFC)
13	Lucas, WA; Cooper, SY; Ward, T; Cave, F	Industry placement, authentic experience and the development of venturing and technology self-efficacy	2009	Self-efficacy; Technology; Venturing; Industry placement; Authentic experience; Higher education	47	Analyse how students learn and how they perform when they learn in school, at home and in external environment
14	Sonnentag, S; Niessen, C	Staying vigorous until work is over: The role of trait vigour, day-specific work experiences and recovery	2008	demands-control model; daily stress; job satisfaction; family conflict; self-regulation; everyday life; well-being; performance; energy; personality	80	This study examined trait vigour (i.e. a person's general level of vigour), day specific workload (time pressure, work hours), and recovery resulting from unwinding during leisure time as predictors of day specific vigour as experienced at the end of the working day.

Source: own elaboration

The table above provides an overview of the final set of studies. The table shows each study in ascending order of year of publication, and for each of the studies, keywords and the exact focus of the research based on abstract analysis are listed.

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SUSTAINABLE FOOD PACKAGING IMPACT TO THE REDUCTION OF TRANSPORT COSTS

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Abstract
People dealt with many new issues related to sustainable development goals. Different decisions oriented to sustainable food packing would be very useful, if they could bring significant effect through the reduction of CO2 emission. The paper focuses on sustainable food packing and its effect on reduction of freight transportation costs. This topic has many research gaps and requires theoretical and practical investigations. Integration of sustainability into long term process has clear implications for the environment. Meherishi et al. (2019) highlight that the process of creating sustainable packaging guarantees the optimal use of materials and energy and is efficiently regenerated without wasting of natural resources. The impact of food packaging on transportation is clear and depends on a number of factors, which are shaped by the characteristics of the food packaging. In addition, among benefits of sustainable food packaging are such main functions as product safety and its identification. Modern complex solutions covering sustainable packing and transport costs reduction are important for increasing environmental sustainability. The study aims to analyze the impact of packaging on the reduction of transport costs. The aim was reached by performing sustainable food packaging and its impact on the reduction of transport costs theoretical justification and by conducting biometric analysis. The overview of the literature of sustainable food packaging and its impact on the supply chain was conducted, and it was found that the food packaging described different types of packaging and new packaging technologies which have an impact on the supply chain and are determined by some factors related to the characteristics of food packaging and the nature of the supply chain. Equally the overview of literature on the transport of food dynamics and the role of transport costs reduction on sustainability was also conducted. It was found that there is a need to develop new technologies and methods for food management and CO2 emissions for longer transport routes reduction. Either the research was conducted by biometric analysis for 2022-2023 to identify current trends, and it was found that the number of analyzed articles, included four clusters, which show that topics are oriented to delivery, flow, algorithms, structure, and role. The bibliometry analysis results show that product packing has links with transport and delivery and algorithms. The authors provided investigations under the topic as it requires knowledge to fill the existing gaps.
KEY WORDS: sustainability, food, packaging, transport, cost, supply chain
JEL: Q01

Introduction

As global carbon emissions have reached their highest levels in years, manufacturers and retailers are increasingly aware of the need to provide more sustainable food. According to a 2019 report by the Intergovernmental Panel on Climate Change (IPCC), the transport-related carbon footprint can range from a few percent to more than half of the total carbon footprint associated with the production, distribution and storage of food. Together, transport containers, pallets, trailers, refrigerators, warehouses and other essential components of freight transport cause these greenhouse gas emissions. Larger companies are now moving towards a carbon footprint and trying to take a greener approach to supply chain management.

For most businesses, a sustainable food supply in the supply chain basically means reducing fuel consumption by optimizing existing transport networks. This is achieved by reducing the air in the packed product that is ready to be transported - by reducing the packing of the food products we could transport more products at the same time.

In the paper authors analyze the theoretical links starting from sustainable packing and food packing impact and finalizing by the role of transport costs reduction and transport congestions. The paper consists of several parts. First, the authors highlight the importance of sustainability in the freight transportation process. Second, the authors present sustainable food packing aspects. Third, the authors describe food packaging impact on supply chain. Fourth, there is the presentation of transport of food dynamics. Fifth, the role of transport costs reduction on sustainability as a guiding principle is demonstrated. Sixth, as the main effect is the reduction of road congestion, which is presented in the pre-last section. Finally, the authors provide concluding remarks.

The aim is to perform a analysis of the impact of packaging on the reduction of transport costs.

The main objectives are:

1. To perform a theoretical justification of sustainable food packaging and its impact on reducing transport costs.
2. Conduct a biometric analysis that examines articles focused on analyzing the relationship between food transportation and costs.

Theoretical background

Sustainability importance in processes

Environmental problems such as excessive consumption of land resources, air, water, and soil pollution, and loss of biodiversity are progressively threatening the Earth's systems of life-support. This situation calls for urgent decisions on the transition to sustainable systems in different areas (Geissdoerfer et al., 2017). To address these and other sustainability challenges, the circular economy concept, which entirely is not new, has recently been gaining prominence on the agendas of policymakers (Nikolaou et. al., 2021). Over the last ten years, the circular economy (CE) has not only become a meaningful area of research, but business has also started to realise its value potential and promise (Benachio et al., 2020).

The CE is thus seen as a sustainable economic system in which economic increment is disconnected from the use of resource by reducing and returning natural resources (Schöggl et al., 2020). D'Amato et al. (2017) affermed that the CE concept, based on the ideas of industrial ecology (Belaud et al., 2019; Corvellec et al., 2022; Bruel et al., 2019) and industrial metabolism, does not have any environmental impact, unlike the linear economy. They stressed the achievement of the objective through the redesign of the 'product' life cycle (Peña et al., 2021; Dahiya et al., 2020) and supply chains, minimising costs and reducing waste in the system. The main idea is to turn the by-product of an industry into a resource for another industry, with a focus on cooperation and dynamics between sectors. A sustainable circular economy seeks to achieve economic prosperity by conserving nature and resources and reducing environmental impacts (Nikolaou et al., 2021). It can also stimulate innovation and the creation of new business opportunities, contributing to sustainable and long-term economic development (Schöggl et al., 2020).

Sustainability - when people responsibly meet their current needs without harming and leaving the possibilities for future generations to explore ways to meet their needs too (dos Santos et al., 2022). This means that we need to take care of the planet's ecosystems, resource use and social well-being in a way that is consistent with the planet's capacities and capabilities, rather than simply a short-term depletion of a resource or degradation of the environment (Ramirez-Corredores et al., 2023; Hoosain et al., 2023). It is a long-term approach that seeks to balance economic, social and environmental considerations to ensure that current activities do not harm future generations and the planet (Hristov et al., 2019).

Sustainability is based on three key areas, as shown in Table 1.

Table 1. Key areas in sustainability

Principles	Description	References
Environmental protection	This includes protecting natural ecosystems, reducing pollution, preserving biodiversity, and conserving the planet's natural resources.	Ramirez-Corredores et al, 2023; Hoosain et al, 2023; Hristov et al, 2019; Velenturf & Purnell, 2021
Social justice	This aims to ensure that all people have access to decent living conditions such as clean water, clean air, adequate food, education, and healthcare. This includes promoting equality, reducing poverty, and reducing inequalities in society.	Hristov et al, 2019; Bennett et al, 2019; Jaeger-Erben et al, 2021
Economy	A sustainable economy aims to use resources efficiently, so that they will be available in the future. In a sustainable economy, companies must also consider the social and environmental impacts of their activities.	Stumpf at al, 2021; dos Santos et al, 2022; Hoosain et al, 2023; Hristov et al, 2019; Jaeger-Erben et al, 2021; Upadhyay et al., 2018

Source: compiled by the authors

Integrating sustainability into long term processes has clear implications for areas such as the environment, the economy and social justice. In today's world, stakeholder relations are increasingly defined as a circularity based on sustainability (Ruggerio, 2021). Due to the global increase in pollution and resource consumption (Brusseau, 2019), environmental protection requires the attention of both government and business, which has increased the need to adopt sustainable environmental practices. One of the essential principles of sustainability is sustainability in environment, which is based on the aim of meeting humanity's needs in a way that respects the environment and its quality, and on maintaining the ecosystem for the benefit of future generations (Daly, 2017). To increase the value of an organization, it is useful to integrate the principle of environmental sustainability into its activities, which would also increase the value of digitisation (Brusseau, 2019; Patlins, 2017).

Thus, sustainable environmental practices are linked to the principle of social justice, which seeks to ensure that all people have decent living conditions, and to the principle of a sustainable economy, where the aim is to use resources efficiently so that they remain for future generations, as well as the adoption of digital technologies and the creation of digital jobs (Harrington, 2016).

A sustainable circular economy is an economic system model that seeks to exploit and optimize natural resources to reduce waste, minimise environmental pollution, and increase long-term economic efficiency (Velenturf & Purnell, 2021). This model differs from the traditional linear economy, where the production process is resource-intensive and waste-intensive.

Sustainable food packaging

Packaging ensures the movement of a product from the point of primary to the point of destination or consumption, with a direct or indirect impact on all industries (Meherishi et al., 2019). An international consortium, the Sustainable Packaging Coalition, identifies the attributes that characterise sustainable packaging. Throughout its life cycle, sustainable packaging is: safe, healthy, and useful, manufactured, recycled from renewable or recycled materials, using clean production technologies, transported using renewable energy. The process of creating sustainable packaging is

based on the optimal use of materials and energy and is efficiently regenerated in both biological and industrial cycles (Meherishi et al., 2019).

Food packaging is directly linked to consumption. Food packaging materials such as plastics, paper, glass, wood, aluminium, steel, and composites pollute the land, air, and water and have negative environmental consequences (Velenturf & Purnell, 2021). This is because food packaging is not always properly sorted after consumption and is discarded as rubbish, and there is a lack of appropriate waste disposal methods (Tassinari et al., 2023). It is therefore important to assess the sustainability of packaging not only in terms of biodegradability, but also to include all the resources that go into the creation of the packaging, such as whether the packaging material is suitable for re-packaging, the energy used in the production of the packaging, the distance over which the packaging will be transported, the way the packaging is stored and the weight of the packaging. Research has shown that food packaging accounts for more than 66% of all packaging in circulation in more economically developed countries (Gallucci et al., 2021). Meanwhile, land, water, and air pollution have been identified as the most significant negative environmental impacts caused by packaging.

The greatest damage to the environment is caused by plastic, which in the European Union alone consumes 50 million tonnes of plastic every year, of which only about 50 percent is collected, and only 30 percent of the collected quantity is properly processed (Fadare et al., 2020). The remaining 70 percent of the waste goes to landfills at best. In the worst case, the waste is thrown directly into the streets, into the water, but where, which leads to pollution. In order to reduce pollution, the European Union, in line with the new Circular Economy Action Plan of the Green Deal, has planned to increase the recycling of litter in the Member States to 10 million tonnes by 2025.

The role of food packaging is being developed in light of changing market conditions. The authors have examined and described different types of packaging and new packaging technologies that would ensure the desire of consumers to receive high-quality, healthy, and safe food products, as far as possible with extended service life.

Table 2. Types of food packaging

Type of food packaging	Description	References
Active packaging	The technologies for packaging deliberately include components which release or absorb substances into or from packaged food or into or from the environment which surrounds food. In this way, the shelf life of packaged food is extended, and its condition is maintained or improved.	Yildirim et al., 2018; Wyrwa & Barska, 2017; Fang et al., 2017; Sharma et al., 2021; Majid, et al., 2018; Qin et al., 2020
Intelligent/ smart packaging	It is a new technology designed to facilitate better food quality and safety, using the communication function of the packaging for this purpose	Fang et al., 2017; Qin et al., 2020; Chen et al., 2020; Müller & Schmid, 2019; Kalpana et al., 2019; Poyatos-Racionero et al., 2018; Drago et al., 2020; Cheng et al., 2022
Bioactive packaging	With a conceptual approach to the development of functional foods, bioactive packaging technology is being developed, where the food packaging or coating plays a unique role in enhancing the health impact of the food on the consumer.	Jafarzadeh et al., 2020; Torres-Giner et al., 2017; Roy & Rhim, 2020; Primožič et al., 2021
Packaging with nanotechnologies	Nanotechnology in packaging provides environmentally friendly coatings that increase the likelihood of improving food quality, safety, stability, and efficiency in hermetic systems.	Sharma et al., 2017; Nile et al., 2020; Mustafa & Andreescu, 2020; Primožič et al., 2021
Nanocomposites packages	Nanocomposites are fillers with at least one dimension the size of a nanoparticle, with a surface area proportionally larger than that of microparticles, which improves filler-matrix interaction and material properties.	Sharma et al., 2017; Nile et al., 2020; Mustafa & Andreescu, 2020; Primožič et al., 2021
High chemical barrier packaging	High barrier packaging is used to maintain the quality of food products by preventing the passage of oxygen, water vapour, pressurised vapour or liquid molecules, reducing adsorption, desorption and diffusion of gases and liquids.	Brody et al, 2008; Han, 2014; Majid, et al., 2018; Sangronizet al., 2019

Source: compiled by the authors

Table 2 dissects the types of food packaging and briefly describes their application and effects. As a whole, the types of food packaging presented in Table 2 are designed to meet the needs of a changing market and consumers, which are mainly focused on the consumer's desire to receive high-quality, healthy and useful foods and the reduction of the negative impact of food packaging on the environment.

The transition to sustainable food packaging solutions involves all actors in the food chain - regulators, producers, traders, suppliers and consumers. Jurconi et al., (2022) investigated consumers' attitudes towards sustainable food packaging and found that 81% of the study respondents were in favour of the benefits of using sustainable packaging as it is important for them to live in a less polluted environment, and also highlighted the importance of timely information on sustainable product packaging on the market.

Food packaging impact on the supply chain

Changes in global product supply chains and the lengthening of these chains, are also affecting the packaging layers, with corresponding changes in the amounts of directly associated waste throughout the supply chain (Awad et al., 2021). It is clear that packaging presents challenges and opportunities for both the environment and society, touching on economic, environmental, and social issues and influencing supply chain costs (Meherishi et al., 2019; Ramirez-Corredores et al., 2023; Nikolaou et al., 2021). Packaging is a broader concept than cardboard or box, and it is a whole system that allows you to store, handle, transport, and sell goods safely, efficiently, economically throughout the supply chain (Jaeger-Erben et al., 2021).

The impact of food packaging on the supply chain is clear and depends on a number of factors, which are shaped by the characteristics of the food and its packaging and the specificities of the supply chain (Stumpf et al., 2021). As regards the benefits of food packaging, the main functions such as food safety, product identification, logistics and transport, environmental impact, and social implications are identified.

For example, different packaging materials, such as plastic, cardboard, glass or metal (Fadare et al, 2020; Gallucci et al., 2021), have different advantages and disadvantages in the supply chain and therefore have different environmental and economic impacts on the supply chain. Food packaging helps to maintain the safety of products and protects them from physical vulnerability, exposure to weather and microbes. Chen et al., 2020 investigated the rationale and technological application of innovative smart packaging solutions and found that they improve product traceability, reduce food waste and losses, and impact the quality and safety of the food supply. Another important factor is the good quality of food packaging, which helps to maintain product quality for longer, reduce waste and increase product longevity. Majid et al. (2018) wrote that good quality smart packaging is directly linked to product quality and longevity. Product identification ensures the successful movement of the product through the supply chain, as the packaging contains all relevant information about the product: package stamps, brand names, composition, expiry date, and bar codes, which speed up the search for the product for suppliers and consumers, enable them to select the right product, and allow for transport, storage, and tracking. Transport efficiency and safety depend on the food packaging's weight, shape, size and composition. In the supply chain, it is important to design packaging systems appropriately in order to reduce product loss, logistics costs, and environmental impact (Guo et al., 2017).

When assessing the benefits of food packaging for the supply chain, it is also important to consider the negative environmental impacts associated with issues that have become global, such as plastic packaging pollution, increasing waste, and energy use. In many countries, especially in the developed economies, there is a high level of consumerism, which leads to large volumes of food packaging, with consequent increases in waste management costs and challenges in ensuring proper recycling (Rong et al., 2011). As not all waste is properly collected and recycled, plastic or single-use packaging alone is a serious environmental challenge as it is a long-lived waste product, and therefore a shift towards sustainable and environmentally friendly packaging would be an important aspect of the supply chain, which is important to be achieved through the application of green technologies and renewable energy sources that reduce energy costs in production, storage, transport, waste disposal processes (Awad et al., 2021).

Transport of food dynamics

As increasing demand for ecologic food, it is necessary to consider the current approach to the food transport chain. According to global population growth trends it is estimated that the number of the Earth's population will reach 9.8 billion people in 2050 (United Nations, 2015). Life expectancy in Europe will reach 82 years by 2050 (Conrad et al., 2015). This trend is due to the growing demand for food. However, raising awareness of healthy lifestyles in the current food supply chain processes is not effective. A healthier lifestyle has affected the short-term demand for organic food. The supply chain for organic food is long, and the traditional retail channel is not suitable for organic production. Therefore, in order to obtain better package feeding, it is necessary to reduce the preparation time. Another sales channel, in this case, is last-mile delivery. More and more people are shopping online, and this growth has speed up. Euromonitor International's report shows that the actual growth of global retail, including online food retail, is $1.4 trillion between 2020 and 2025 (Euromonitor, 2021). New strategic approaches to the transition of the food sector from physical retail to online need to be developed (Gružauskas et al., 2022).

Changes in online food retail trends require small volumes to be delivered at multiple delivery points, negatively impacting sustainability. The distribution of goods in cities and passenger transport are the essential sources of consumption of energy, air pollution, and noise (Faccio et al., 2015). The development of online food retail in the world's 100 largest cities will grow by 36% by 2030, without affecting the number of trucks (World Economic Forum, 2020). Fossil fuels are estimated to have caused disproportionate greenhouse gas emissions between 2005 and 2018, resulting in global CO2 emissions from transport of 1.2 billion tones (Euromonitor, 2019).

Transport-related emissions are expected to increase by 32% and congestion by more than 21%, meaning that all commuters will go to work every day (World Economic Forum, 2020). Increasing urbanization poses a number of problems for urban areas. Urbanization is growing rapidly: about 70 percent of the inhabitant of the Earth lives in cities, comparing to 49 percent today (United Nations, 2014). This leads to an increasingly negative impact of congestion on the environment. These problems put pressure on companies to adopt environmentally friendly vehicles, but they require more resources to purchasing and maintain these vehicles. Nevertheless, last-mile transportation is the least efficient supply chain part and is expected to account for 28% of total shipping costs (Euromonitor, 2019). There exist a balance between aspects economics and environmental, but social aspects must also be taken into account. Traffic congestion not only increases CO2 emissions but also reduces food package (Jouzdani et al., 2021; Chen et al., 2021). Therefore, in a growing energy supply market, sustainability cannot be achieved through current supply chain management.

The European Union attaches great importance to the SDGs, but it lacks the technological or regulatory mechanisms to achieve them. In 2021, the European Union launched an urban mobility program that aims to reduce pollution from transport by digitising public transport and promoting car-sharing. Rapidly evolving sustainable solutions, that optimize vehicle flows and infrastructure use, and encourage the avoidance of empty and unnecessary journeys are linked to better multimodal transport networks, dynamic routes and distribution

patterns (European Comission, 2021). The European Union adapts United Nations Goals and Key Targets for Sustainable Development for 2030. One of the goals is, among other things, to improve road safety and urban pollution (Humphreys 2017).

The new strategy addressing these issues, called the Green Deal, aimed to reducing emissions of net greenhouse gas by at the least 55% by 2030 (European sustainable development network, 2019). Even according to a report by the European Policy Centre, by 2020 the EU had not achieved almost all the SDGs, including the targets for saving energy, biodiversity, air, water, soil and chemical pollution (E. policy Centre, 2021). It is therefore indispensable to develop new technical and electronic energy management methods in order that achieve sustainable development.

The documents show the need to develop autonomous vehicles and adaptive algorithms for the electronic food industry. As transportation companies work to reduce costs, increase operating capacity, and reduce driver shortages, demand for research is expected to continue to grow. According to DHL, the target is to reduce shipping costs per kilometer by 40%, some of which can be done for shipping customers (E. international Passport, 2021). In the field of logistics analysis, there is a growing interest in optimization of loading volume on trucks.

Several academic studies have shown the need to develop new technologies and methods for electronic food management. Authors conducted an in-depth literature review of refrigeration chains, citing 40 publications with similar evidence on food package, shelf life, or comfort (Awad et al., 2021; Paciarotti et al., 2021). The review revealed a number of flaws in the study. First, the analysis concluded that sound route designs and vehicle models that take into account product package and environmental impact will remain an open area of research. Second, the researchers disagreed with the lesions models used to apply the cold foods freshness.

Therefore, it is necessary to study important variables and qualitative models. Thirdly, the complexity of the problem requires the development of heuristic and metaheuristic methods to solve such patterns (Awad et al., 2021). The authors found that published publications and found that researchers did not pay much attention to time-related issues. The need depends on the time it takes to consider a broader understanding of how to solve the transport problems (Koç et al., 2020). These strategies should therefore include sustainable development and the SDGs.

The role of transport costs reduction on sustainability as a guiding principle

Several White Papers provide answers to frequently asked questions about vehicle loading planning (Tan et al., 2021; Awad et al., 2021; Vidal et al., 2020; Koç et al., 2020; Guo et al., 2017; Malladi et al., 2018; Gunawan et al., 2021). Driving algorithms often draws attention on distance or the shortest possible time of delivery, but the food industry needs to take into account the package of food. Sovald and Stirn (2008) understood the problem of vehicle mobility against the background of package of products, their research was applyed on time-dependent optimization and integrated the cost of transport into the target function (Osvald, 2008).

Another study, Rong et al. (2011) described how to increase efficiency in supply chain processes from manufacturing to retail and tangibly contribute to measuring food packaging failure due to product flow and volume (Rong, 2011). A current study investigated the impact of reduced food package on urban transport, focusing on warehouse management methods and delivery times (Fikar, 2018; Waitz, 2018). One of the research projects of this method was carried out Portuguese restaurants (2015). Instead of cargo, the focus is on the availability of sea bananas (Haass et al., 2021). Their method measures the initial package of food and determines the route adjustment and optimization. Fikar and Braeker (2022) developed a two-pronged approach to optimizing food transportation to identify compromise solutions between distance and food package deterioration (Fikar et al., 2022).

According to the publication, the general direction and collection shorten the distance to the store, but necessary in certain cases to extend the distance and combine several products if there are no refrigeration units in the store. They also point out that larger fleets and direct shipments can further reduce food losses. In the above articles, the simulations checked the package of food but did not take into account excessive loads.

CO2 emissions was revied in other motorway-related studies. In view of the increasing direct supply of organic food to final consumers, CO2 emissions from longer transport routes are also problematic, and new modes of transport need to be developed (Nabot et al., 2016). Authors analyzed retail channels and concluded that the overuse of cars of the last displacement significantly increases overall carbon emissions (Seebauer et al., 2016). Authors found that consumers on average, reduced the carbon footprint of their shipments by 84 % as a result of the transition from full truck delivery to last mile delivery (Carling et al., 2015). Naboth et al. (2016), who performed a comparative analysis on interactive food retail, show that on-line food retail is very important in reducing CO2 emissions in the last kilometer of stocks, and recommend investing in more efficient transport processes. Kellner (2016) analyzes the impact of congestion on CO2 emissions, but omits its impact on food package. Authors developed algorithms for planning pollution processes for last-mile deliveries to reduce environmental impact (Tan et al., 2019).

Another study of Velazquez-Martinez et al. (2016) shows that when optimizing the CO2 route, consider the height, weight, and efficiency of the truck. It is therefore important to take into account not only the package of food, but also environmental impacts, such as CO2 emissions.

The reduction of road congestion

Sustainable development goal SDG 11 promotes safety in cities and road congestion reduction. Reduction of the size of food package could help to achieve that. By now, most of researchers focus on reduction of traffic congestions methods and believe that traffic congestion is less problematic than on motorways, but even small

bottlenecks in transport and transport systems can play an important role in reducing efficiency (Calvert et al., 2018). The study focused on increasing traffic congestion, some of which focused on controlling traffic flows rather than delivering products (Jabbarpour et al., 2018; Isa et al., 2015). Authors conducted a study on computational methods for detecting blockages, and one of the most important observations was the assertion that tools need to be developed to evaluate and evaluate real cases (Jabbarpour et al., 2018). His research focuses more on the overall diagnosis of stenosis. Authors analyzed blockchain and proposed a method to generate a flow data block that allows analyzing relationships with space and time (Xu et al., 2013).

Tang et al. (2018) analyzed congestion in terms of strength and proposed a method for measuring node tolerances. The latest research not only analyzes historical or current traffic conditions, but also tries to assess future trends. Authors proposed neural networks to predict the flow of traffic (Peng, 2020). Traffic and congestion assessment or analysis can provide driving information, but this information needs to be integrated into the driving process to improve decision-making (Gružauskas et al., 2021).

Very little research focuses on traffic congestion in traffic problems. For example, Xiao et al. (2016) recommend managing green actions in case of traffic jams (Xiao et al., 2016). Authors proposed self-adaptive algorithms for traffic congestion management (Sabar et al., 2018). Authors proposed methods to support deep learning in overload-related vehicle navigation (Koh et al., 2020). Nguyen et al. (2021) proposed a green algorithm to optimize route planning based on floating intelligence. However, the calculation of congestion in online stores is less analyzed. Authors proposed a method to optimize cold chain transportation routes in front warehouse in terms of congestion (Chen et al., 2021). Jouzdani et al. (2021) analyzed the food chain in terms of sensitivity in light of traffic congestion. Their analysis shows that congestion affects all aspects of sustainability, not just social ones. Therefore, it is necessary to develop doctoral algorithms, taking into account the density of turnover, the package of food and the impact on the environment.

The practical application of disaster recovery algorithms can be carried out using tokens. Studies have been carried out on autonomous vehicles, taking into account the risk of congestion. Authors analyzed the problem of load balancing and balancing and developed a routing algorithm that shows good network load and customer service performance (Rossi et al., 2018). Boson (2020) conducted a comprehensive review of last-mile transit documents. One of the main consequences is that from a management point of view, it is important to develop last-mile logistics and optimization methods, as well as real-time data, disaster recovery algorithms, fleet management and management algorithms (Bosona, 2020). Author argues that it is important to consider storage for foreign transportation, not just methods of distribution and automation of warehouses (Zennaro et al., 2022). Authors documented the use of the Internet of Things in intelligent traffic and highlighted that this technology is essential for real-time planning and deployment (Ding et al., 2021). Shladover (2018) explores connected and automated vehicle systems that are essential for urban transportation, where real-time decision-making can be overwhelming. Authors modeled micromaterials and liquids on food routes, their research showed that this method reduced distance by 15% and weight by 22% (Aktas et al., 2021).

Table 3. Template for designing the transport of food with reduces package size

Method	Evaluation
Goal function	Size of food package, size of vehicle and its fleet, loading composition, stability, height of freight, etc.
Optimization	Considering all aspects of the packing and loading problem. Mathematical optimization method consider actual package dimensions and multiple physical, legal and business-specific rules.

Source: compiled by the authors

Table 3 presented above provides a documented overview of food transport and traffic congestion reduction patterns. Most simulations involve distribution centers and a special type of supply chain network that can represent the home. Some studies take into account not only the birth of the last mile, but also the processing steps. The deadline set for orders usually has a random demand pattern for food delivery. Almost all simulations limit truck, warehouse or production capacity. But only a small part of the models are ecologically dynamic, that is, overloaded. The garage usually focuses on delivery time, distance or cost, while the latest versions focus more on CO2 emissions or food package.

Only a few channels determine the characteristics of transport destinations seeking to reduce traffic congestions. Food transport models often focus on the model itself rather than optimization technologies, so most people use contactless search, simulated defrosting. Some studies use complex optimization methods based on colonies of ants, bees, swarm seeds or other types of evolutionary or genetic algorithms. However, in the field of electronic energy, disaster recovery methods are not tested, which focus not only on ordinary time, but also on real time, but often analyze congestion problems.

Methodology

The authors conducted a biometric analysis for 2022-2023 to identify current trends. After the introduction of the keywords „packing“, basically the results of the publications of the authors of „VOSviewer“, which were used to create bibliographic maps, were included in the figures below. After searching for literature, a bibliographic map was created to reconstruct the most common authors of articles, which are repeatedly used by the authors of articles. As a rule, circles on bibliometric maps can have different colors, distinguishing sets that indicate which keywords are closest to each other, as well as circles that are also reflected in different sizes indicating the meaning of the word, the clearer the meaning of the word. The lines indicate the relationship between the elements, and their clarity indicates the strength of the connection, and the distances between the keywords determine the strength of the interface. The closer they are to each other, the greater their connection.

The paper's authors established clusters during bibliometric analysis.

The methodology applied for the identification of clusters included three steps:

• VOSviewer software is applied for the analysis of publications appeared during period of 2022-2023;

• Bibliographic coupling analysis is used for the clusters' construction;

• Keywords important for the papers written on packing topic are groupped based on their co-occurancies in the titles of the publications.

Results

The figure below (Fig. 1) shows the prevalence of the most frequently repeated words of authors after publications in the „VOSviewer" audience database.

When analysing related keywords, it was found that the number of analysed articles included four clusters (see Fig. 1). These clusters show that topics are oriented to delivery, flow, algorithms, structure, and role.

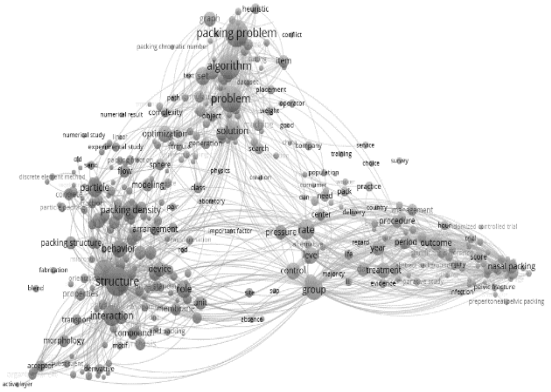

Fig. 1. Results of bibliometry analysis: four clusters. Keywords according to the results of the search packing in the „VOSviewer" database
Source: Compiled by the authors based on the results of the „VOSviewer" database

The results of this study are provided below. The first cluster consists of words: management, control, efficiency, delivery, duration, food, etc. The word „management" has 170 links, 60 occurrancies, and total link strength – 515. The other words: „delivery" has 112 links, 27 occurrancies, total link strength – 208, and „food" has 96 links, 24 occurancies, total link strength – 150. The fourth word „duration" has 107 links, 27 occurrancies, and total link strength – 280. The fifth and sixth words „efficiency" has 145 links, 35 occurancies, total link strength – 340, and „control" has 239 links, 113 occurancies, and total link strength – 747.

The second cluster consists of words: packing mode, shelf-life, preparation, engineering, metal, flexibility, transport, plane, etc. The word „packing mode" has 71 links, 22 occurrancies, and total link strength – 141. The second word „shelf-life" has 42 links, 15 occurrancies and total link strength – 58. The third word „preparation" has 104 links, 25 occurrancies, and total link strength – 169. The fourth and the fifth words: the word „engineering" has 125 links, 34 occurancies, total link strength – 227, and the word „metal" has 79 links, 24 occurrancies, and total strength links – 151. The seventh word „flexibility" has 78 links, 15 occurrancies, and total link strength – 105. The words „transport"have 108 links, 47 occurancies, and total link strength – 265; the word „plane" has 66 links, 20 occurancies, and a total link strength – 97.

The third cluster (see Fig. 2) consists of problem, solution, algorithm, optimization, optimization problem, genetic algorithms, packing problem, energy consumption, raw material, and computational experiments. The word „problem" has 283 links, 296 occurrancies, and total link strength – 2001 and is the most popular. The second word „solution" has 265 links, 165 occurrancies, and total link strength – 1212. The third word „algorithm" has 230 links, 277 occurancies, and total link strength – 1527.

The fourth and the fifth words: the word „optimization" has 206 links, 115 occurrancies, and total link strength – 665, and the word „optimization problem" has 94 links, 30 occurancies, and total strength links – 285. The seventh word „genetic algorithm" has 85 links, 35 occurancies and total link strength – 209. The words „packing problem" has 165 links, 306 occurancies, and total link strength – 1263 and word „energy consumption" has 52 links, 14 occurancies, and total link strength – 82. This shows that the search of solutions which solve packing problems gets high attention from researchers. The words „raw material" has 53 links, 11 occurancies, and a total link strength – 74 and word „computational experiments" has 76 links, 13 occurancies, and a total link strength – 145.

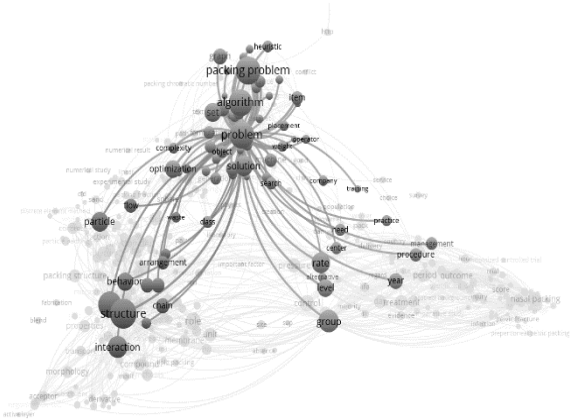

Fig. 2. The third cluster
Source: Compiled by the authors based on the results of the „VOSviewer" database

The fourth cluster consists of words (according Fig. 3): packing structure, packing model, packing density, liquid, modeling, flow, particle packing, experimental study, mathematical model, etc. The word „packing structure" has 127 links, 72 occurancies and total link strength – 310. It shows low attention on packing. The second word „packing model" has 102 links, 48 occurancies and total link strength – 212.

The third and fourth words: word „packing density" has 184 links, 152 occurancies, and total link strength – 571 and word „liquid" has 96 links, 31 occurancies, total link strength – 171. The fifth word „modeling" has 152 links, 69 occurancies and total strength links – 350. The seventh word „flow" has 150 links, 73 occurancies and total link strength – 362. The eight word „particle packing" has 76 links, 39 occurancies, and total link strength – 156.

The ninth word „experimental study“ has 78 links, 37 occurancies, and total link strength – 119. And the tenth word „mathematical model“ has 127 links, 33 occurancies, and total link strength – 246.

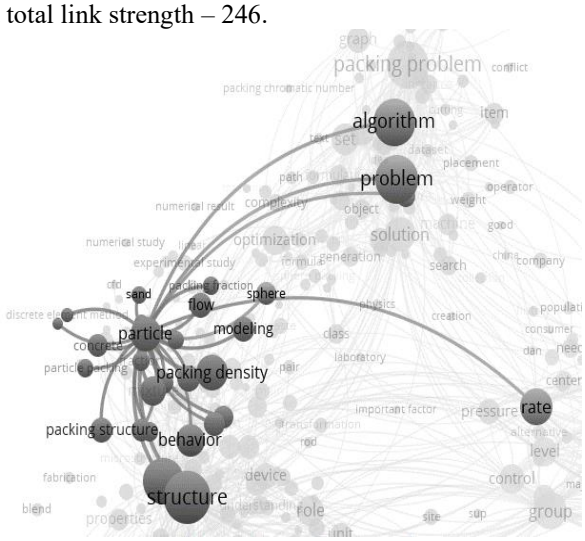

Fig. 3. The fourth cluster
Source: Compiled by the authors based on the results of the „VOSviewer” database

The results of bibliometry analysis shows that the topic of products packing has links with transport and delivery and algorithms. Such link also highlighted in the theory.

Discussions

People are involved in many new topics related to the SDGs. Many of the options focused on sustainable food packaging would be very useful if they could significantly reduce CO2 emissions. The report focuses on sustainable food packaging and its impact on reducing transport costs. This topic has many research gaps and requires theoretical and practical research. Incorporating sustainability into the long-term process has a clear impact on the environment. The authors point out that a sustainable packaging production process ensures optimal use of materials and energy and is effectively regenerated without wasting natural resources. The impact of food packaging on transportation is obvious and depends on many factors, which are determined by the nature of the food packaging. The benefits of sustainable food packaging also include key features such as product safety and traceability. Modern comprehensive solutions, including reducing sustainable packaging and transportation costs, are important for increasing environmental sustainability. The study aims to analyze the impact of packaging on reducing transport costs. The goal was achieved by introducing sustainable food packaging and its impact on reducing transport costs, theoretical foundations, and biometric analysis. A review of the literature on sustainable food packaging and its impact on the supply chain was carried out, which found that food packaging describes different types of packaging and new packaging technologies that affect the supply chain and are identified taking into account specific factors related to the characteristics of food packaging and the type of supply chain.

In addition, a literature study was conducted on the dynamics of food transport and the impact of reduced transport costs on sustainability. It concluded that new technologies and methods for food processing and CO2 emissions need to be developed to reduce transport distances. The study was conducted in the course of biometric analysis from 2022 to 2023 to identify current trends, and it was found that the number of analyzed units included four groups, which indicates that the topics were focused on presentation, flow, algorithms, structure, and role. The results of bibliometric analysis show that the product's packaging is associated with transportation and delivery, as well as algorithms. The authors studied this topic because knowledge is needed to fill the existing gaps.

Conclusions

The authors investigated how food packaging affects the reduction of transport costs. The authors identified the print functions and different optimization methods that are commonly used to analyse the impact on cost reduction, in this case, transport cost reduction. Among the optimization methods, the most popular methods used in other authors' studies are different types of evolutionary and genetic algorithms.

Theoretical analysis has shown the need to develop food reduction package approaches, taking into account traffic congestion and sustainability factors. In order to achieve that objective, new targets should be set for a number of criteria relating to food package, carbon dioxide emissions, and operating costs. The food transport should identify past congestion and create new patterns. To test the effectiveness of the food package size, you need to analyse the usage weekly, daily, and in real time. The authors looked at the environmental impact of different types of food packaging and the need for sustainable packaging.

The authors also looked at the impact of food packaging on the supply chain, which clearly depends on a number of factors determined by the characteristics of the food packaging and the characteristics of the supply chain, and, after a review of food transport and congestion reduction, found that a small proportion of the models are eco-dynamic.

The models considered focus mainly on delivery time, distance, or cost, but recent work has focused more on CO2 emissions or food packaging. Inevitably, in order to reduce carbon emissions, both wholesalers and retailers need to move towards more sustainable food products, including more sustainable food packaging, which research shows has implications for cost reduction in the supply chain.

A cluster analysis based on keyword associations identified four distinct clusters of terms, each representing a group of related concepts and keywords.

Furthermore, it's important to note that the link between packing and transport is visuable in publications between 2022 and 2023. We restricted our analysis to publications from 2022 to 2023 due to the overwhelming volume of available publications, potentially overlooking relevant earlier research on the subject. However, during the bibliometric analysis, a connection between packing and transport field topics was identified in the publications. The analysis of recent literature and keyword associations indicates the significant interrelationship between products packing and transportation problems. While the

concept is theoretically highlighted, there are very few papers on this specific subject written.

In conclusion, the results of this analysis emphasize the need for further research in the field of packing in logistics, particularly with a focus on its practical implications on efficiency and CO2 reduction. Understanding the challenges and opportunities that packing presents in transport management is crucial for businesses seeking to adapt to the changing landscape of the global economy.

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DIGITIZATION PROCESSES IN SLOVAK HEALTHCARE SECTOR – THE ISSUE OF SLOVAK DOCTORS AND NURSES

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Abstract
One of the main health policy initiatives in European Union countries is the transition from a patriarchal medical model to a co-managed and integrated approach of personalized healthcare. The 2030 Agenda elements implementation for Health and Quality of Life in terms of technological advances enables the of healthcare delivery optimization. The impact of the elements of digital health and care can be observed on the patient care delivery side and also on the healthcare professionals' performance side. It has the potential to contribute to reducing, in particular, preventable and avoidable mortality, which represent large economic losses in terms of lost productive years. This study focuses on the assessment of job satisfaction with digitalization among doctors and nurses working in hospitals. The research was conducted through a questionnaire survey. The respondents were doctors and nurses working in hospitals in Slovakia. The study evaluates the satisfaction of doctors and nurses with the digitization of work according to the basic characteristics of the respondents by means of correspondence analysis. The goal of the study is to investigate the bureaucratic burden of nurses and doctors regarding digitalization of work in health care institutions as a modern society development prerequisite based on smart technologies. The research was conducted on primary data collected between April 2022 and November 2023 through a questionnaire survey among doctors and nurses working in Slovak hospitals as part of the research task of the APVV 19-0579 project. Forty hospitals in Slovakia were contacted and the sample consisted of 212 doctors and 752 nurses. The normality of the data distribution was carried out by means of histogram and Gaussian curve when being found out to be not normally distributed. Subsequently, they were analysed through descriptive statistics and correspondence analysis. Correspondence analysis was used to investigate the relationship between digitization and administrative burden to the basic characteristics of the respondents, and the relationships were visualized through a correspondence map. The impact of digitization of work and administrative burden is to be also analysed, as smart healthcare elements should have a positive impact on reducing or simplifying administration within the work of doctors and nurses. The results have revealed that, both doctors and nurses lack application of new technologies that along with digitization of work in medical practice bring up a lot of benefits. The results of the study highlight the importance of digital transformation in healthcare, identifying the impact of technologies usage on various aspects of medical practice, such as speed and accuracy of diagnosis. Elements of digitization implemented into healthcare systems bring a modernization effect and faster data availability to the daily work of doctors and nurses. However, the impact on job satisfaction is insufficient and makes precisely the opposite perception. The conclusion is that the administrative burden has not changed significantly despite the digitization of several administrative activities in healthcare and still remains a significant issue, which can also be considered as a challenge for policy makers.
KEY WORDS: Digitization of healthcare, Internet of Things, working conditions, doctors and nurses, Agenda 2030
JEL: F66, J45, I11

Introduction

Based on the processing of the literature review, we conclude that the healthcare sector, among other professions, is also facing digitalization. However, the Slovak healthcare sector has long been haunted by excessive overload of bureaucratic tasks in both nursing and medical practice. The literature and its findings demonstrate that the level of technological progress enables the implementation of smart technologies to facilitate work and reduce bureaucracy. Another significant benefit of new technologies and digitization within the doctors' and nurses' work is the healthcare services personalization, which is to be tailored to the specific customer - the patient, especially in the field of preventive healthcare and faster sorting out of patients with regard to the health problem severity. Telemedicine and chatbot primary diagnostics could help to achieve this. Researchers dealing with this issue demonstrate just this kind of significant relationship. Taking into account the findings, we form the premise of the need to investigate the level of digitization of work in health care institutions in Slovakia. The goal of the paper is to investigate the bureaucratic burden of nurses and doctors in the context of digitization of work in healthcare institutions as a prerequisite for the development of a modern society based on smart technologies.

Literature review

A smart city is a sustainable city dealing with urban problems and improves the quality of life of citizens through the fourth industrial revolution technology elements and the management among stakeholders. As a result of rapid urbanization, smart cities are emerging to solve urban issues in various sectors such as healthcare, transportation, environment, welfare, economy, security, energy and efficient distribution of urban resources. Smart technology is the basis for providing various services through devices to which ICT capabilities are used while supporting various applications in a wide range of fields such as healthcare, education, commerce, agriculture and manufacturing (Samarakkody 2022; Myeong 2022; Alabdali 2023). In this process, city and municipal governments play an important role by integrating smart services into all application domains including healthcare, transportation, clean and green technologies, entertainment and leisure facilities, and crowd management (Hashem et al. 2023). Policy makers in countries are working to implement smart city concepts at the regional levels. Information and communication technologies in various forms need to be implemented in

such cities (Sharif and Pokharel 2022). Smart cities are complex entities that integrate multiple systems to support the human lifecycle. These systems also include smart healthcare (Badidi 2022). The first wave of smart cities was focused on the concept of using next-generation information technologies, such as IoT infrastructure, cloud computing, big data, and geospatial information integration, to support smart city planning, construction, management, and services (Liu, Wiu 2023). Progress evaluation is a challenge because not every city or country has the means to measure performance by using defined indicators (Karal, Soyer 2023). Related to the Smart City, its health-oriented goals, there is the 2030 Agenda, which has an explicitly defined goal for healthcare sector, such as (SDG 3) "Good Health and Wellbeing" that includes nine partial goals. Specifically, these are to improve health and well-being outcomes as well as to reduce health care costs. Several authors suggest a lifelong approach to health literacy, which requires a long-term effort. In addition, the health and healthcare agenda is part of the sustainable development field, which addresses its underlying determinants (Christie, Ratzan 2019; Bowen, et al. 2021).

Maintaining or restoring health is a major task of the health care system, which is carried out under monetary constraints and increasing staff shortages (Diebel-Fischer 2022). In today's world of wireless communication networks, Fog Computing and Internet of Things (IoT) are important technologies for smart healthcare applications and for the development of safety networks (Tripathy, et al. 2022). The interaction of EHRs between different process components, the value added created complemented by CPS, furthermore the interaction of humans with electronic devices monitoring biophysical functions and new business frameworks in healthcare are bringing the concept of Industry 4.0 into healthcare referred to as Health 4.0 (Tupá, Masárová, Karbach 2020). The Fourth Industrial Revolution presents challenges in healthcare, which brings with it many positive elements. Specific challenges associated with Industry 4.0 specifically for healthcare are: patient self-diagnostic systems, patient monitoring, digital data archive, use of artificial intelligence, coordination and collaboration (Krčméry, Papulová 2020; Martinkienė, et al. 2021; Mura, et al. 2022). Digital technologies have a profound impact on all areas of modern life, including the workplace. Some forms of digitisation require the simple exchange of digital files for paper, while more complex cases involve machines performing a wide range of tasks on behalf of humans (Sætra, Fosch-Villaronga 2021). Maintaining or restoring health is a major task of the health care system, which is carried out under monetary constraints and increasing staff shortages (Diebel-Fischer 2022). The Internet of Things (IoT) has emerged in recent years as a significant technology for health service systems (Onesimu 2021). The potential of Internet-of-Medical-Things (IoMT) technology to connect biomedical sensors in eHealth has improved people's standard of living (Kumar, Chand 2020). Medical devices can be connected to health information technology systems through networked technologies to provide quick access to medical data. This interconnection, known as IoMT connects medical devices and applications (Kashyap, et al. 2022). Patients are more actively involved in the decision-making process and IoMT enables faster diagnosis through the collection of large-scale medical data. However, in all of this, confidentiality, security, and quick responses are taken into consideration when exchanging sensitive medical data (Ksibi, et al. 2023). Traditional healthcare institutions have recognized the need to innovate their workflow, yet there is a great deal of uncertainty about digitization (Tripathy, et al. 2022).

Methodology

The goal of the study is to explore the bureaucratic burden of nurses and doctors in terms of digitization of work in healthcare institutions as a prerequisite for modern society development based on smart technologies.

Partial objectives:

- Literature analysis - Web of science, summary and definition of the selected areas issues,
- Collection of respondents' answers,
- Respondents' answers analysis,
- Questionnaire responses processing,
- Questionnaire results interpretation.

Elaboration tasks of analytical part:

- To find out whether there is a relationship between the educational attainment of nurses and their satisfaction with bureaucratic job factors among nurses,
- To find out whether there is a relationship between the educational level of nurses and their satisfaction with the digitization of work among nurses,
- to find out whether there is a correlation between the specialization of doctors and their satisfaction with bureaucratic factors in the work of doctors,
- to find out whether there is a correlation between the specialization of doctors and their satisfaction with the digitization of doctors' work.

Research data was collected through a questionnaire survey of doctors and nurses. This questionnaire was distributed between April 2022 and November 2023. The questionnaire was developed in terms of the project APVV 19-0579, which dealt with the setup of personnel management processes in hospitals and its impact on the migration of doctors and nurses to work abroad as well as the project VEGA 1/0691/22, which dealt with the economic aspects of emigration of university graduates in medical disciplines in terms of the sustainability of healthcare institutions staffing in Slovak Republic.

The first part of the questionnaire was focused on the basic characteristics of the respondents and on information regarding the health facilities where they worked. The second part was dealing with the respondents' satisfaction ratings with the staff management processes in hospitals. The questionnaires were distributed online through the Google Forms platform and were addressed directly, by reaching out to hospital management. The sample of respondents consisted of 212 doctors and 752 nurses.

To process the results the method of correspondence analysis was used. This statistical method is used to analyze the relationships among data categorical variables. Its use is appropriate when analyzing responses from questionnaire surveys and other types of data, where the variables have categorical or nominal distributions. To confirm the results of correspondence analysis data, there

is a correspondence map serving as a visual representation of the results. The correspondence map contains the variables that have been analyzed and are displayed as points in graphical space. The distance between the variables (points) on the map determines the tightness of the relationship of the points. The closer the variables are on the correspondence map, the tighter their relationship is. The STATISTICA program was used to analyze the data.

Results

Based on the defined main objective, which is to investigate the bureaucratic burden of nurses and physicians in terms of digitalization of work in health care institutions as a prerequisite for the development of a modern society based on smart technologies, the correspondence analysis was used to assess how selected background characteristics of respondents influence their satisfaction with work factors such as bureaucratic burden and data digitalization. The selected background characteristics of physicians include their successful completion of attestation (specialty) training. We were also focused on the basic identifying characteristics of nurses, specifically their level of educational achieved.

The analysis of bureaucratic burden and digitization of nurses' work in healthcare institutions in Slovakia

In the first part, the relationships between bureaucratic burden and nurses' educational achieved are to be analyzed. The nursing profession is closely linked to the bureaucratic procedures they have to follow, which result from the work tasks related to this job position (Tab.1).

Table 1. Relative frequencies of nurses' responses to the analysis of education and bureaucratic burden

	Percentage of total (nurses_Data) Variables in rows: education(3) Variables in columns: bureaucracy(5)					
	1	2	3	4	5	Total
1	10,94793	12,41656	5,87450	1,735648	0,400534	31,3752
2	8,94526	8,67824	4,80641	2,269693	0,133511	24,8331
3	16,42190	17,22296	7,74366	1,735648	0,667557	43,7917
Total	36,31509	38,31776	18,42457	5,740988	1,201602	100,0000

* Variables in rows (level of education achieved): 1 - secondary vocational education; 2 - higher education/university degree - Bc.; 3 – higher education/university degree - Master. Variables in columns (bureaucratic burden) 1 - completely dissatisfied; 2 - rather dissatisfied; 3 - neither satisfied nor dissatisfied; 4 - rather satisfied; 5 - completely satisfied.
Source: Author's processing by STATISTICA outputs, 2023

The resulting χ 2 test value is 7.73849 at a freedom degree number df=8 (p=0.4594). This shows that there is no significant relationship between the level of education achieved of nurses and bureaucratic burden at the selected significance level of α=5%.

However, regarding the percentage distribution, the level of bureaucratic burden is distributed according to the nurses' education achieved as follows: nurses with the highest education level (higher education level (HE) Master) - are the most dissatisfied with the bureaucratic burden. After summing the percentage data of the rating within completely dissatisfied and rather dissatisfied is 33.6%. For nurses with HE level I (Bc.) education, 17.6% are dissatisfied with bureaucracy. Nurses with secondary level of education total 23.4% are dissatisfied with bureaucracy; 74.6% of the total respondents expressed dissatisfaction of nurses with bureaucratic burden at work.

The correspondence map (Fig. 1) signifies the strongest relationship for the level of dissatisfaction with bureaucracy and HE level II Master degree, as well as secondary education and the variable rather not (rather dissatisfied) with bureaucratic burden. The scores that indicate both satisfaction but also indecision in determining satisfaction with this factor of work have the biggest distance from the scores of education levels indicating that there is the weakest relationship among these variables.

The rationale for this perception is the fact that nurses who achieved HE I (Bc.) were full-time students of bachelor's degree programs in nursing who, after completing their education, entered the labor market and were employed as nurses in health care institutions and pursued next studies in an part time form. They have been employed for a short period of time and therefore their perception of the bureaucratic burden at work is less intense than that of nurses with a secondary vocational education who have been working in the system for decades, as well as nurses with a university degree II Master. These two categories have been in the health system longer and therefore perceive the changes more intensely.

Eliminating elements of bureaucracy in healthcare and supporting nurses by digitizing their work is a priority for modernizing the sector. The use of electronic health records, e-prescribing, electronic systems for managing and scheduling work services, health apps. Selected examples show that digitization in different countries is helping nurses to facilitate their work, reduce bureaucracy and deliver quality care to patients more efficiently using new technological approaches.

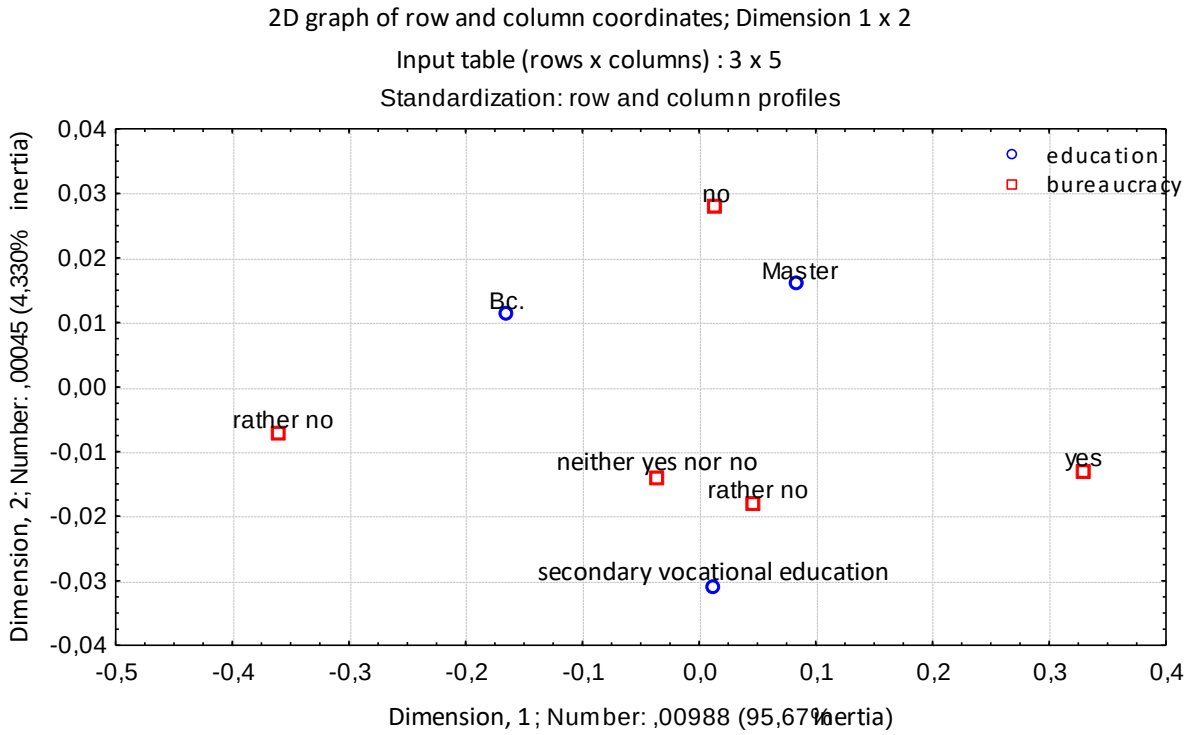

Fig. 1. Correspondence map to analyze the nurses' education and the bureaucratic burden level
Source: Author's processing by STATISTICA outputs, 2023

Table 2. Relative frequencies of nurses' responses to the analysis of education and digitalization of work

	Percentage of total (nurses_Data) Variables in rows: education(3) Variables in columns: digitalization of work (5)					
	1	2	3	4	5	Total
1	3,60481	5,60748	9,74633	8,27770	4,13885	31,3752
2	4,00534	6,00801	6,14152	5,74099	2,93725	24,8331
3	5,60748	8,41121	10,94793	14,15220	4,67290	43,7917
Total	13,21762	20,02670	26,83578	28,17089	11,74900	100,0000

* Variables in rows (level of education achieved): 1 - secondary vocational education; 2 - higher education/university degree - Bc.; 3 – higher education/university degree - Master. Variables in columns (digitization of work) 1 - completely dissatisfied; 2 - rather dissatisfied; 3 - neither satisfied nor dissatisfied; 4 - rather satisfied; 5 - completely satisfied.
Source: Author's processing by STATISTICA outputs, 2023

The resulting χ 2 test value is 11.0132 at a freedom degree number df=8 (p=0.2010). This shows that there is no significant relationship between nurses' level of education achieved and their job satisfaction with digitization at the selected significance level α=5%.

In percentage comparison, it can be observed that the highest level of satisfaction with the digitization of work is among nurses with the highest educational degree, namely 18.8%. 39.9% of the total respondents are rather satisfied and completely dissatisfied after summing the percentage data. As many as 26.8% of the total number are unable to express their level of satisfaction with digitization of work. 33.3% are dissatisfied with the digitization of work for nurses (Tab. 2).

In Fig. 2, it can be observed the following relationships of variables: respondents with a secondary vocational education have the strongest relationship with an indecision attitude towards job satisfaction with digitization. Quite strong relationship this variable has with complete satisfaction. Also, a strong relationship can be identified for university-educated level I nurses (Bc.) with dissatisfaction with digitization of work. Respondents with II. education degree (Master) has the strongest relationship with the variable: rather satisfied with the digitization of nurses' work.

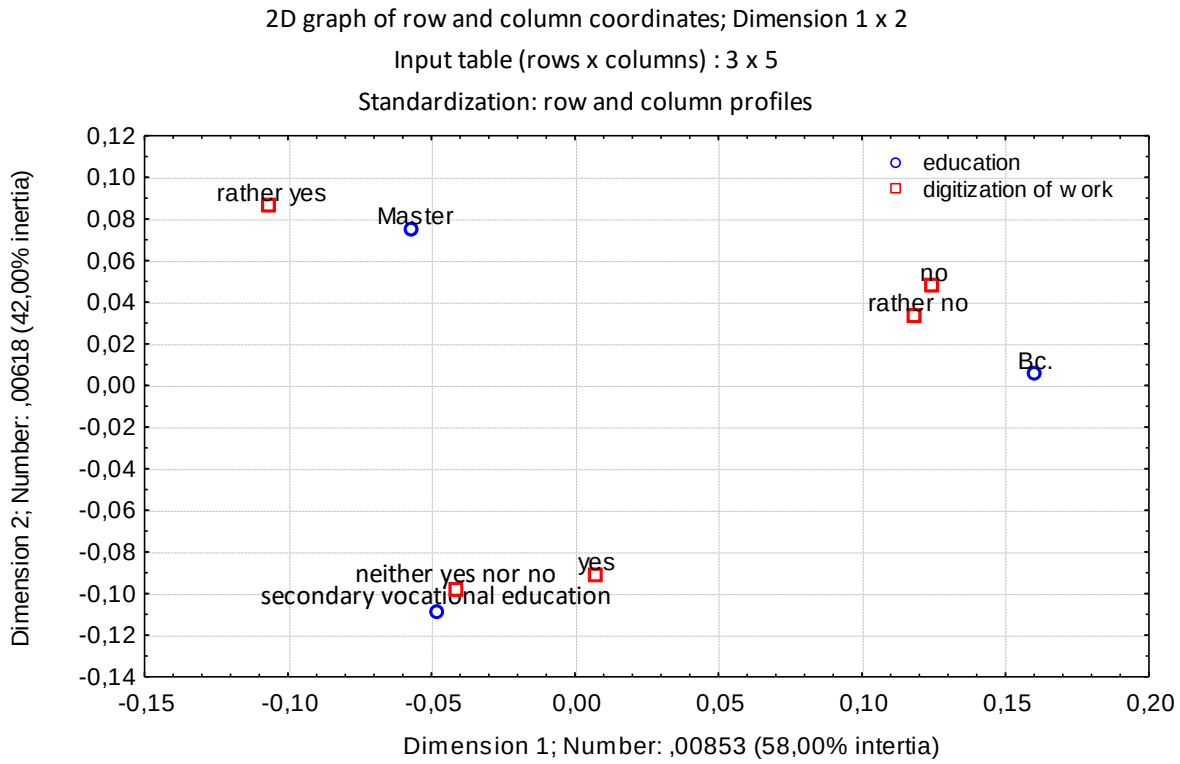

Fig. 2. Correspondence map to analyze the education and the digitization of nurses' work
Source: Author's processing by STATISTICA outputs, 2023

Table 3. Relative frequencies of nurses' responses to the analysis of bureaucratic burden and the digitization of work

	Percentage of total (nurses_Data) Variables in rows: bureaucracy (5) Variables in columns: digitalization of work (5)					
	1	2	3	4	5	Total
1	8,81175	7,20961	8,27770	9,07877	2,93725	36,3151
2	3,33778	9,21228	11,34846	11,08144	3,33778	38,3178
3	0,93458	2,40320	6,40854	6,00801	2,67023	18,4246
4	0,13351	1,06809	0,80107	2,00267	1,73565	5,7410
5	0,00000	0,13351	0,00000	0,00000	1,06809	1,2016
Total	13,21762	20,02670	26,83578	28,17089	11,74900	100,0000

* Variables in rows (bureaucratic burden): 1 - secondary vocational education; 2 - higher education/university degree - Bc.; 3 – higher education/university degree - Master. Variables in columns (digitization of work) 1 - completely dissatisfied; 2 - rather dissatisfied; 3 - neither satisfied nor dissatisfied; 4 - rather satisfied; 5 - completely satisfied.
Source: Author's processing by STATISTICA outputs, 2023

The resulting value of $\chi 2$ test is 127.924 at the freedom degree number df=16 (p=0.000). Hence, there is a significant relationship between bureaucratic burden and digitization of work at the selected significance level α = 5%.

Of the total respondents, as many as 39.9% of nurses are rather satisfied with the digitization of work. In terms of the number of respondents it can be considered a positive aspect. However, the bureaucratic burden of nurses is proving to be a real problem. This is evident from the results where the percentage is 74.64% after adding the variables (rather dissatisfied and completely dissatisfied). The results of the analysis point out to the fact that satisfaction with digitization is higher among nurses in contrast to the bureaucratic burden, which is not significantly eliminated according to the data.

The correspondence map (Fig. 3) shows the following relationships: based on the distribution of points on the map, nurses are dissatisfied with the digitization of work, but they are more dissatisfied with the bureaucratic burden that should be eliminated through digitization and computerization. Nurses perceive development opportunities in the use of modern technologies in other sectors or in foreign health care institutions, but in Slovakia they perceive the absence and insufficient implementation of new technologies in the field of health. Examples of countries that are successfully managing

digitization and modernization of healthcare sector are the Baltic States such as Estonia and Lithuania.

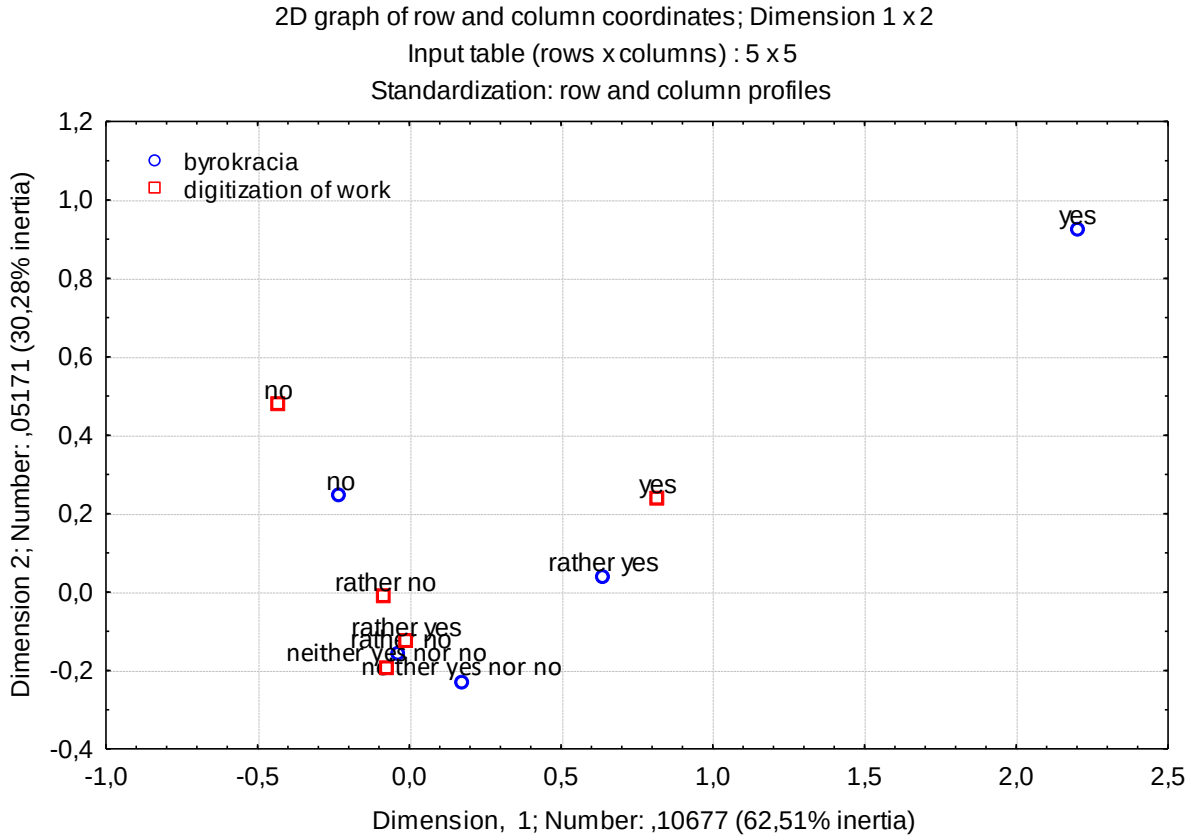

Fig. 3. Correspondence map to analyze the job satisfaction factors of nurses - digitization of work and the bureaucratic burden
Source: Author's processing by STATISTICA outputs, 2023

Case Evaluation: Correspondence analysis did not show a significant relationship when examining the relationship between education achieved and satisfaction with bureaucratic burden. However, the correspondence map depicted relationships of variables that are related. In case of examining the relationships of education achieved and satisfaction with digitization of work, the correspondence analysis did not show a significant relationship. The correspondence map shows the strength of the relationships among the variables. A significant relationship was determined by correspondence analysis of the following relationships: bureaucratic burden and digitization of nurses' work. The results clearly show that the satisfaction of digitalization is at a relatively adequate level, in contrast to the bureaucratic burden, which cannot be removed from the health system even after the application of modern technology in the form of digitalization.

It can be assumed that the digitization of work has not completely removed massive elements of bureaucratic burden. In healthcare, the process, conceptualized as the use of information and communication technologies to support clinical practice, has been developed more slowly than in other economic sectors (Neumann, et al., 2021). A major challenge for healthcare delivery is maintaining or restoring health with limited financial resources and a growing shortage of healthcare personnel. In this context, digital transformation should encompass aspects of healthcare and help to improve and streamline the work of healthcare professionals (Diebel-Fischer 2022).

In particular, the ability to apply new working methods through digitization should help to simplify and modernize work. It is evident from the respondents' answers that digitization should facilitate their work and speed up the various processes of information distribution. On the contrary, bureaucracy unnecessarily burdens nurses, where their attention should rather be paid to patients. In this respect, it can be argued that the level of digitization has not yet been fully embedded in healthcare system; hence their dissatisfaction. However, the level of satisfaction with the digitization of work is higher, in contrast to the bureaucratic burden, which is perceived very negatively.

The dependent variables level analysis: bureaucratic burden, digitalization of data and specialty level of doctors

The second important group for examining the relationships is doctors. As with nurses, adherence to administrative procedures is essential for doctors due to the nature of their work. Therefore, in this section, we will examine the variables: doctors' specialty in relation to bureaucratic burden and digitalization of work.

Table 4. Relative frequencies of doctors' responses to the analysis of specialty and bureaucratic burden

	Percentage of total (nurses_Data) Variables in rows: specialty (2) Variables in columns: bureaucracy (5)					
	1	2	3	4	5	Total
1	8,05687	8,53081	2,84360	1,895735	0,473934	21,8009
2	30,80569	27,48815	17,06161	2,369668	0,473934	78,1991
Total	38,86256	36,01896	19,90521	4,265403	0,947867	100,0000

* Variables in rows (speciality): 1 - without speciality; 2 - with speciality. Variables in columns (bureaucratic burden): 1 - completely dissatisfied; 2 - rather dissatisfied; 3 - neither satisfied nor dissatisfied; 4 - rather satisfied; 5 - completely satisfied.

Source: Author's processing by STATISTICA outputs, 2023

The χ 2 value of the test is 5.24417 at the freedom degree number df=4 (p=0.2632). The results of the correspondence analysis indicate that there is no significant relationship between the variables at the chosen significance level α=5%.

Doctors with a specialty are significantly dissatisfied with bureaucratic burden. In the current era of staff shortages in healthcare sector, it is important for health professionals to facilitate and simplify work processes. This statement is confirmed by the percentage of dissatisfaction with bureaucratic burden. As many as 58.3% of the respondents with specialty are rather dissatisfied and completely dissatisfied with the selected factor (Tab. 4).

Table 5. Relative frequencies of doctors' responses to the analysis of specialty and digitalization of work

	Percentage of total (table_doctors) Variables in rows: specialty (2) Variables in columns: digitalization (5)					
	1	2	3	4	5	Total
1	2,84360	5,68720	9,95261	2,84360	0,473934	21,8009
2	9,47867	13,74408	31,27962	18,00948	5,687204	78,1991
Total	12,32227	19,43128	41,23223	20,85308	6,161137	100,0000

* Variables in rows (specialty): 1 - without specialty; 2 - with specialty. Variables in columns (digitization of work): 1 - completely dissatisfied; 2 - rather dissatisfied; 3 - neither satisfied nor dissatisfied; 4 - rather satisfied; 5 - completely satisfied.

Source: Author's processing by STATISTICA outputs, 2023

The result of the χ 2 test is 4.88291 at the freedom degree number df=4 (p=0.2995). The results of the correspondence analysis show that there is no significant relationship between the variables at the chosen significance level α=5%.

Doctors with a specialty are significantly more satisfied with the digitization of work compared to doctors without a specialty. A total of 23.7% of doctors with specialty are satisfied with the digitalization of work. However, 31.6% of the total respondents are rather dissatisfied and completely dissatisfied with digitization of work. 41.2% cannot express an opinion on satisfaction with digitization of work and 27% of the total respondents are rather satisfied and completely satisfied with digitization (Tab. 5).

The value of the χ 2 test result is 44.6364 at the freedom degree number df=16 (p=0.0002). The results of the correspondence analysis show that there is a significant relationship between the variables at the chosen significance level of α=5%.

The results of the correspondence analysis show that 27.01% of the doctors are rather satisfied and completely satisfied with the digitization in healthcare facilities. We can observe negative attitudes in the evaluation within the level of bureaucratic burden. As many as 74.88% of the total number of doctors being surveyed are significantly dissatisfied with the selected factor of work (Tab. 6).

Table 6. Relative frequencies of doctors' responses to the analysis of bureaucratic burden and digitization of work

	Percentage of total (table_doctors) Variables in rows: digitalization (5) Variables in columns: bureaucracy (5)					
	1	2	3	4	5	Total
1	9,95261	0,94787	1,42180	0,00000	0,00000	12,3223
2	9,95261	5,21327	2,84360	0,947867	0,473934	19,4313
3	12,79261	17,26161	10,42654	0,947867	0,00000	41,2322
4	4,73934	10,42654	3,79147	1,895735	0,00000	20,8531
5	1,42180	2,36967	1,42180	0,473934	0,473934	6,1611
Total	38,86256	36,01896	19,90521	4,265403	0,947861	100,0000

* Variables in rows (digitization of work): 1 - completely dissatisfied; 2 - rather dissatisfied; 3 - neither satisfied nor dissatisfied; 4 - rather satisfied; 5 - completely satisfied. Variables in columns (bureaucratic burden): 1 - completely dissatisfied; 2 - rather dissatisfied; 3 - neither satisfied nor dissatisfied; 4 - rather satisfied; 5 - completely satisfied.
Source: Author's processing by STATISTICA outputs, 2023

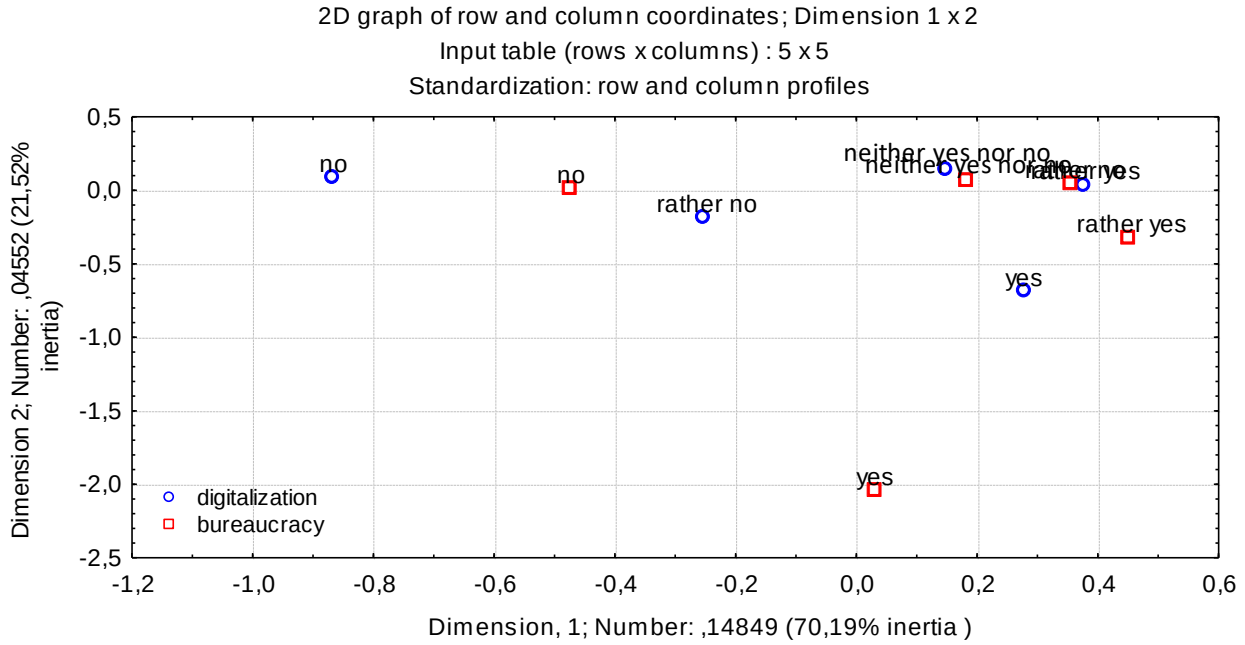

Fig. 4. Correspondence map to the analysis of doctors' job satisfaction factors - digitalization of work and bureaucratic burden
Source: Author's processing by STATISTICA outputs, 2023

Correspondence analysis (Fig. 4) shows the following relationships: based on the distribution of points on the map, doctors are more satisfied with the digitization of work, but they are more dissatisfied with the bureaucratic burden, which has a negative effect on the performance of doctors. The closest relationship was found in these aspects. The correspondence map confirms the results of the correspondence analysis, which shows that relatively respondents are satisfied with digitization, but the bureaucratic burden can be perceived from their statements as a hindrance to the performance of the medical profession. In particular, the biggest problem of administrative tasks lies in the time frame and inefficient management of documentation.

Discussion

Correspondence analysis did not show a significant relationship when examining the relationship between physicians' specialty and satisfaction with bureaucratic burden. In case of examining specialty of doctors and satisfaction with digitization of work, the correspondence analysis did not show a significant relationship. The correspondence map shows the strength of the relationships between the variables namely: the factors that influence satisfaction with the report. However, the correspondence map depicted the relationships of variables that are related to each other. Overall, it can be summed up that doctors with specialty show more satisfaction with digitalization of work compared to bureaucracy. However, dissatisfaction with bureaucratic burden should highlight the need to reduce administrative burden and improve working conditions for these

healthcare professionals. A significant relationship among the variables was demonstrated by correspondence analysis when comparing the variables: bureaucratic burden and digitization of work of doctors. The results of the analyses point out to the fact that, as in case of nurses, the expansion and application of new technologies is absent in case of doctors. New technologies and the digitalization of work in medical practice bring them a number of advantages. Some of the benefits of digitization are described in their publications as follows:

Kuhn, Jungmann (2018) state that the increasing digitization of our livelihood is changing the medical profession. Various modern digital technologies are now used in medical practice and research, especially at the doctor-patient and doctor-physician level. According to research by Gowda and team of authors (2020), administrative burdens, including documentation and order entry, are the main factors of doctors´ burnout, consuming about 50% of doctors' time. Even nurses spend about half of their time fulfilling documentation requirements. Digitization of doctors' work can have other benefits such as: faster and more accurate diagnosis proposed.

In healthcare, digitization is present in a variety of areas, with a focus on cost savings and improving quality of care. Digitization brings new opportunities thanks to increasing access to data, the power of computers and advances in machine learning. Help can be found in disease diagnosis, automated surgery, patient monitoring and scientific research. New technologies are transforming the practice of medicine and expanding the possibilities of medical practice (Sætra, Fosch-Villaronga, 2021). In healthcare, technological innovation includes all products and services aimed at improving medical services, reducing costs, and streamlining procedures to prevent, diagnose, treat, and recover patients (Kulkov, et al., 2023). A study conducted to investigate the satisfaction of doctors and nurses with the level of digitization achieved indicates that the relationship between the level of education of nurses and their satisfaction with the bureaucratic burden and digitization of work is not significant. Although nurses with more education showed bigger satisfaction with digitization, bureaucracy is a significant and mainly unfavorable factor for healthcare workers, as well as for doctors. To improve the situation, administrative procedures need to be improved and digital technologies need to be effectively integrated for real modernization and better patient care in terms of limited resources in healthcare sector. A significant relationship emerged in both cases regarding the job factors satisfaction analysis (bureaucratic burden and digitization of work), for both doctors and nurses. These relationships indicate the same preferences and level of satisfaction with the selected factors. The excessive bureaucratic burden of both nurses and doctors negatively affects their attitudes towards practicing the profession. Rather positive feedback from respondents can be observed with digitization. The biggest problem of Slovak healthcare institutions in the field of modernization is the inability to limit bureaucratization and inadequate administration. Proper implementation and application of digital tools should help to remove this burden.

Conclusions

The conducted study highlighted the significance of digital transformation in healthcare sector, pointing out to the reality of the impact on various aspects of medical practice. These claims are supported by conducted research, the results of which demonstrate that digitization can improve the speed and accuracy of diagnosis, which is a critical factor for providing optimal care to patients. However, despite these positive benefits of digitization, the administrative burden in healthcare remains a significant problem.

The findings of the study for both groups of health professionals surveyed show dissatisfaction with the significant bureaucratic burden. On the contrary, the gradual incorporation of digitization of work is bringing about a modernization effect and faster data availability. Recommendations based on the results of the study are as follows:

1. To reduce administrative elements and increase automation and digitization of tasks to free up doctors' and nurses' time,
2. To increase the integration of digital tools into medical and nursing practice. Digital tools should be designed to make healthcare professionals' jobs easier and to increase efficiency in care,
3. To monitor the level of satisfaction with working conditions, where healthcare facilities would be better able to get feedback from healthcare workers, where their ability to use and operate digital tools should also be increased. The feedback should also contribute to the question of the ability to manage digital tools and other investment opportunities.

Research limitations:

The following limitations have emerged when processing the questionnaire survey data:

Sample of respondents (doctors - 212 and nurses - 752): the survey sample size might affect the representativeness of the results.

Distribution of questionnaires and the period of data collection: the level of openness and honesty of the respondents may affect the results and their timeliness. The questionnaire was distributed from April 2022 to November 2022, the length of the period might affect the relevance and currency of the information obtained. The time period might affect the quantity and quality of information obtained.

To process the results, it is crucial to consider all factors that might shape their relevance when interpreting the results.

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FOREIGN DIRECT INVESTMENT: GLOBAL AND LOCAL FLOWS (THE CASE OF THE REPUBLIC OF NORTH MACEDONIA)

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Abstract
Foreign direct investment (FDI) is the notion that can be summarized in the form in which it represents the process in which an enterprise from one country invests capital in an existing enterprise or in a new enterprise established in another country. The standard definition of foreign direct investment is given by the Organization for Economic Cooperation and Development (OECD), according to which FDI is defined as the establishment of a lasting interest in and significant degree of influence over the operations of an enterprise in one economy by an investor in another economy. FDI has proven to have an expressed importance mainly in allowing the transfer of technology – especially in the form of new types of capital inputs – that cannot be achieved or at least in the form and volume required through financial investment or trade in goods and services. FDI has already proven that it can boost competition in the domestic input market, but also motivates the employment of domestic labor. In recent decades, the global map of inflow and outflow FDI has changed considerably. Traditionally, FDI originated from developed economies, which have recently gained significant ground in the share of FDI flows between geopolitically aligned economies. In particular during financial crises there is substantial evidence that FDI can lead many developing countries to consider it as an inflow of selected private capital and in certain cases even as a single capital inflow. Such a thing finds support in the tendency of economists who insist on the free flow of capital across national borders because it enables capital to have more favorable preconditions for return at the highest rate. However, the tradition has recently been changing, making the largest sector for FDI projects to be closely related to software and IT services. Investors see rising commodity prices, increased geopolitical unrest and political instability, as well as high inflation in an emerging market as the most likely risks at this time. The official data provided by World Bank (WB), International Monetary Fund (IMF), OECD, as well as the local National Bank and State Statistical Office are unanimous that in the last 20 years, North Macedonia has maintained a continuous increase in FDI, but unfortunately, at a comparative level with the countries of the region, it continues to lags behind. The North Macedonian authorities are progressing towards the Precautionary and Liquidity Line (PLL) objectives, including preserving public finances, reducing energy subsidies, tackling high inflation and ensuring financial stability, which will also increase the possibility real for FDI inflows.
KEY WORDS: foreign direct investment, financial, capital, input, market, economies.
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Introduction

Foreign direct investment (FDI) represents the action with the purpose of purchasing a significant number of the shares or part in the foreign business company with the purpose of influencing the management of the activity and operating policy in the market. FDI is a major driver of international economic integration. With the right legal and policy framework, FDI can provide financial stability, promote economic development and improve the welfare of societies (OECD Benchmark Definition 2008). A key feature of the FID remains that it establishes effective control of the foreign business or at least significant influence over its decision-making.

Financial markets have evolved into a more integrated global framework as a result of increasing exchange liberalization and easier market access. This integration, accelerated by increased competition among market participants, has led to the framing of new financial instruments with wide market access and lower transaction costs, attracting many investors from different countries and economies. Furthermore, the expansion of cross-border financial flows has been further accelerated by technological innovations in communication and data processing (OECD Benchmark Definition 2008).

FDI is the essential node in this rapidly developing international economic integration, also referred to as globalization. FDI provides a mechanism for creating direct, sustainable and long-term linkages between economies of scale and distinct development. Under the right policy environment, it can serve as an important tool for the development of local enterprises, and can also help improve the competitive position of both the receiving ("host") and the investing ("home") economy. In particular, FDI encourages the transfer of technology and knowledge through the so-called "know-how" between companies. The indicators included in this group are internal and external values for stocks, flows and incomes, by partner country and by industry and FDI restrictions.[1] FDI, in addition to the aforementioned positive effect on the development of international trade, is also an important source of capital for a number of host and domestic economies (OECD Benchmark Definition 2008).

Foreign investment has been a key factor in shaping the world economy since the Second World War. Alongside international trade, foreign investment gradually became a signifi cant vehicle of international business leading to economic wealth and prosperity. The establishment of liberal market economies worldwide, as well as technological breakthroughs during the last decades have elevated the importance of foreign investment (Dimopoulos 2011).

The relationship between the free movement of capital and the freedom of establishment in respect of direct investment is still a matter of debate. Although direct investment is not mentioned explicitly within Article 63(1) of the Treaty on the Functioning of the European Union (TFEU), it is generally accepted that it forms a subcategory

of capital movement. Owing to the fact that the notions of establishment and direct investment are not mutually exclusive but overlap to a great extent, the economic activity of direct investment falls generally also within the scope of Article 49 of the TFEU (Bungenberg & Griebel, Hindelang, 2011).

The earliest international legal rules concerning foreign investors and investment assumed a tripartite set of actors: the home state, the host state and the investor, of whom only the first two had legal standing. While this situation still represents the formal limits, *ratione personae*, of international law it does not fully explain recent developments in the field of foreign investment. It is not suggested here that investors, whether natural or legal persons, are acquiring international legal personality. Rather, as the protection of investors and their investments has become an established goal of many capital-importing states, they have been prepared to accept the obligation, in international law, to observe certain standards of treatment and, in most cases, to provide for the effective implementation of such obligations through the extension of direct treaty-based dispute settlement rights to investors, allowing them to use international dispute settlement procedures against the host country and/or its agents and entities. Thus investors, be they natural or legal persons, enjoy a measure of international *locus standi* before international tribunals in relation to investor protection obligations in investment agreements (Muchlinski & Ortino & Schreuer, 2008).

In the absence of a single multilateral investment treaty and worldwide investment institution, judicial interpretation and application of the applicable treaty and customary law rules often lack coherence and transparency; their input-legitimacy (for example, in terms of respect for human rights, citizen rights, and democratic governance), output-legitimacy (for example, in terms of serving the general interests of all stakeholders rather than unilaterally favoring investor interests) , and effectiveness (for example, in terms of just and legally coherent dispute settlements) remain controversial among governments, lawyers, and civil society, for example, in case of mutually inconsistent judgments, one-sided 'balancing' among public and private interests being involved, lack of appellate review procedures, high social costs of confidential arbitration awards worth millions, damages for foreign investors, and perceived lack of a 'level playing field' for all interests involved (Dupuy & Francioni & Petersmann, 2009). Consequently, with the advent of investor-state arbitration in the latter part of the twentieth century – and its exponential growth over the last devade – new levels of complexity, uncertainty and substantive expansion are emerging. States continue to enter into investment treaties, and the number of investor-state arbitration claims continues to rise (Brown & Miles, 2011).

Theoretical background

Definition

The definition of investor and investment are among the key elements determining the scope of application of rights and obligations under international investment agreements. As far as the definition of investment is concerned, most investment agreements adopt an open-ended approach which favours a broad definition of investment. They refer to "every kind of asset" followed by an illustrative but usually non-exhaustive list of assets, recognizing that investment forms are constantly evolving (OECD International Investment Law, 2008).

Why is the definition of investor and investment so important? From the perspective of a capital exporting country, the definition identifies the group of investors whose foreign investment the country is seeking to protect through the agreement, including, in particular, its system for neutral and depoliticized dispute settlement. From the capital importing country perspective, it identifies the investors and the investments the country wishes to attract; from the investor's perspective, it identifies the way in which the investment might be structured in order to benefit from the agreements' protection (OECD International Investment Law, 2008).

The definitions of FDI made by the organizations and institutions that have it as an object of treatment and that continuously follow the development trend of FDI do not differ much in essence.

- The *Organisation for Economic Co-operation and Development (OECD)*: "FDI is a category of cross-border investment in which an investor resident in one economy establishes a lasting interest in and a significant degree of influence over an enterprise resident in another economy. Such investments have the set threshold of a minimum of 10% of shares in foreign-based compensation ownership" (OECD Detailed Benchmark Definition, 1996).
- The *World Bank (WB)*: "FDI refers to the category of cross-border investment related to a resident of an economy who has control (ownership of 10% or more of the ordinary voting shares) or a significant degree of influence in the management of an enterprise that is resident in another economy".[2]
- The *International Monetary Fund (IMF)*: "The term describes a category of international investments made by an economic enterprise (direct investor) with the objective of creating a lasting interest in an enterprise resident in an economy other than that of the investor (direct investment enterprise). FDI thus includes both the initial transaction between two entities and all subsequent capital transactions between them and between related enterprises, both incorporated and unincorporated" (IMF Balance of Payments Manual, 1993).
- The *United Nations Conference on Trade and Development (UNCTAD)*: "FDI is defined as an investment that reflects a substantial interest and control by a foreign direct investor, resident in one economy, in an enterprise resident in another economy".[3]

If the definitions given by theoreticians are analyzed, not only do they not differentiate, but it can easily be

concluded that they are based on the definitions of the aforementioned organizations and institutions. Foreign investment involves the transfer of tangible or intangible assets from one country to another for the purpose of their use in that country to generate wealth under the total or partial control of the owner of the assets. There can be no doubt that the transfer of physical property such as equipment, or physical property that is bought or constructed such as plantations or manufacturing plants, constitute foreign direct investment (Sornarajah, 2010). Such definition of foreign direct investment differs from portfolio investment. Portfolio investment is normally represented by a movement of money for the purpose of buying shares in a company formed or functioning in another country. It could also include other security instruments through which capital is raised for ventures. The distinguishing element is that, in portfolio investment, there is a separation between, on the one hand, management and control of the company and, on the other, the share of ownership in it (Sornarajah, 2010).

FID can be done in various ways, including opening a subsidiary or associate company in a foreign country, acquiring a controlling interest in an existing foreign company, or through a merger or joint venture with a company foreign. Companies or governments considering an FDI generally consider target firms or projects in open economies that offer facilities and favorable conditions to foreign investors, primarily a skilled workforce and above-average growth prospects for the investor including also providing of management, technology and equipment. A key feature of the FID is that it establishes effective control of the foreign business or at least significant influence over its decision-making.[4]

FIDs are commonly categorized as horizontal, vertical, or conglomerate:

- A horizontal FDI is the most common type of FDI which mainly revolves around the investment of funds in a foreign company that belongs to the same activity as the one owned or operated by the FDI investor. Here, one company invests in another company located in another country, where both companies produce goods or provide similar services.
- In a vertical FDI, a company acquires a complementary company in another country. It occurs when an investment is made within a typical supply chain in a company, which may or may not necessarily belong to the same industry.
- In a conglomerate FDI, a company invests in a foreign company that is different to its core business (this kind of FDI often has the form of a joint venture).

The role of FDI

The role of FDI in international and local capital flows is examined in light of statistical data research and studies. FDI is considered to have taken off during the 1980s as firms from many nations expanded their international operations, mainly from the industrial economies (which accounted from the vast majority of total measured flows worldwide). This is largely a manifestation of the much discussed 'globalization' of business that has taken place during the past forty years (Graham 1995).

FDI flow, by definition, an increase in the book value of the net worth of investments in one country held by investors of another country, where the investments are under the managerial control of the investors. Most of these investments are, in fact, subsidiaries of multinational corporations (MNCs) and the investors are the parent organizations of these forms. Thus, FDI flows mainly represent the expansion of the international activities of MNCs (Graham 1995).

Because FDI inflows can take a number of different forms that will contribute more or less significantly to human development in the host country, it matters considerably which type of investment is encouraged (De Schutter & Swinnen & Wouters, 2013). The rising interest in foreign investment was mainly triggered by the widespread conviction that foreign investment contributes to the competitiveness, economic growth, and development of recipient countries. Despite the existence of conflicting empirical evidence, a common conclusion reached in the vast majority of scholarly work on this topic is that foreign investment can contribute significantly to the host country's development, adding to its economic wealth and welfare. Foreign investors bring essential economic resources, such as financial capital, advanced technology, and production techniques, production facilities and machinery, and managerial expertise which potentially allow the host economy to raise its level of domestic output, to engage in existing or undertake novel activities more efficiently, and to penetrate international markets, thus earning more tax revenues and foreign exchange and allowing competitive substitution of imports (Dimopoulos 2011).

Over the past two decades, policy makers have increasingly come to appreciate that FDI is crucial to a country's economic success. Past institutions and government strategies restrictive to FDI inflows have generally given way to those geared toward attracting and retaining such resource transfers. These have included several waves of investment liberalization, an increasing variety of investment incentives, and additional protections for foreign investor (Sauvant & Sachs, 2009).

It is widely held view that a positive relationship exists between the arrival of FDI and development, and that attracting foreign capital is essential to developing countries in order to finance their growth and to improve their access to technologies. However, beyond that general language, a number of questions remain. Perhaps the most widely studied of these concerns the relationship between the nature of the foreign investment considered and their impacts on development (Sharma & Gani 2004). On the side of the investor, FDI may be undertaken in order to gain access to natural resources or other strategic assets, such as research and development capabilities, in order to reach new consumer markets, or in order to exploit locational comparative advantage (De Shutter, Swinnen & Wouters 2013). However, it is politically tempting for the host government to invoke sovereignty reasons (and, even more precisely, the permanent sovereignty of its people over natural resources) or the need to provide basic

services such a water and electricity to its population at an affordable price, in order to justify nationalization measures or the forced negotiation of the terms of agreement with the foreign investors present (De Shutter, Swinnen & Wouters 2013).

According to UNCTAD, in order to reap the full benefits from FDI, the developing host country may need to supplement an open approach to inward investment with further policies. In particular, it may need positive measures to increase the contribution of foreign affiliates to the host country through mandatory measures such as, for example, performance requirements and through the encouragement of desired action by affiliates through. Such policy measures entail a degree of regulation. This may involve some measure of intervention in the freedom of action of the foreign investor and controls over the manner in which the investment can evolve (Muchlinski & Ortino & Schreuer, 2008).

The shift from national to international level holds equally true for international investment relations, where the demand for international investment law has amplified parallel to an increase in foreign investment flows since the end of the Second World War. In fact, foreign investment often takes place in a situation that requires international cooperation as an ordering structure, not so much because of the element of transborder flows of investment, but due to the involvement of the host country as a sovereign actor. While host country and investor initially have largely converging interests in attracting and making investments, the situation changes once an investment has been made. As the investor's option to simply withdraw his investment and re-employ it elsewhere without severe financial loss is limited, the host country has an incentive to change unilaterally the original investment terms by changing an investment contract, amending the law governing the investment, or even expropriating the investor without compensation (Schill, 2009).

FDI has been soaring in recent years. This spectacular growth has been fed by increasingly close integration of national economies, driven by worldwide competitive pressure, economic liberalization, and the opening up of new areas to investment. Developing countries have shared in the growth in FDI inflows, and quite a few of them have become a source of outflows (Foreign Direct Investment 1997). Consequently, FDI does much more than provide developing countries with financing for their growth. It brings them new technologies, management techniques, and market access as well. Thus, FDI may be stimulated by exploitation of proprietary technology or natural resources or by access to markets (Foreign Direct Investment 1997).

Mapping FDI inflows shows the extent to which host countries are integrating into the globalizing world economy. It also indicates indirectly the distribution of benefits from FDI. Understanding the pattern of FDI flows and stocks and its driving forces is important for the formulation and implementation of economic strategies and policies (World Investment Report 2001). Many factors influence the flow of FDI to developing countries, but the most obvious one is often overlooked: namely, the willingness of developing countries to allow it (World Investment Report 2001). With domestic investment in an economy being circumscribed by changes in demand and technology, high profits and low interest rates, an external stimulus to investment is often felt imperative to boost capital formation in the economy. In case of the developing economies that are typically plagued by low levels of productivity leading to low levels of wages and hence low levels of savings and investment, again perpetuating the low productivity levels, an external injection in the form of foreign investment often acts as a vehicle to break away from the 'vicious circle' (Chaudhuri & Mukhopadhyay, 2014). Recently, countries that have liberalized have benefited more from FDI. Moreover, globalization continues to blur the distinction between foreign and domestically owed enterprises, and between developed and developing countries (World Investment Report 2001).

FDI has played an important – if at times controversial – role in the growth of emerging economies. From time to time, developing countries have expressed serious misgivings about the economic, social, and political consequences of foreign investment. Most commonly, they have feared losing control to foreigners over important parts of their economies and excessive drains on profits as foreigner investors, exercising 'oligopolistic powers', make off with excessive profits. Some of these policies may have captured a larger part of the economic rents, but at the expense of reducing the investment's overall benefits (World Investment Report 2001). In addition, FDI has given the global integration process a major boost by helping link markets for capital and labor and raise wages and capital productivity in recipient countries. With newly liberalized trade and investment regimes and new technologies lowering transport and communication cost, multinational firms have espoused increasingly global strategies to capture the large savings arising from specialization and dispersion of activities. As a world network of multiple linkages has developed, intra-firm trade across national boundaries has increased sharply between parents and their affiliates in developing as well as developed countries (World Investment Report 2001).

Nevertheless, the positive impact of FDI is not always apparent and there is also a potential for negative effects to arise (Dimopoulos 2011). Indeed, a critical view of the contribution of FDI to economic growth and development to recipient countries indicates that the effects often depend on the initial conditions prevailing in the host country. Empirical evidence suggests that FDI follows development and that its positive effects are significantly greater in countries that are already developed. For example, poor human capital conditions in the recipient country decrease its absorptive capacity to take advantage of the positive spillover effects on technology transfer, entrepreneurship of domestic firms, and other linkages. Moreover, FDI may have a negative impact on the growth of the recipient country, for example in countries with imperfect competition conditions it can lead to the creation of foreign-owned monopolies, the crowding-out of domestic firms, and eventually to generation of unemployment. FDI may also potentially cause significant social and environmental harm, leading to a 'race to the

bottom', as recipient countries, in their effort to attract foreign investment, may lower, or tolerate the violation of, their environmental, labour, and other social standards. FDI can also have detrimental eff ects for capital-exporting countries, as it deprives them of capital which if invested domestically could boost local entrepreneurship and international competitiveness, and may severely aff ect employment, in particular in cases of domestic companies transferring their business abroad (Dimopoulos 2011).

Methodology

The author uses a number of scientific methods in order to carry out the research and prove the established hypotheses and achieve the intended findings regarding the flow of foreign investments on a global scale and their reflection on a national scale in North Macedonia, including: analytical, synthetic, normative, interpretive, statistical, comparative and historical method.

Results

Global inflows of FDI

Over the last decade, the share of FDI flows among geopolitically aligned economies has kept rising, more than the share for countries that are closer geographically, suggesting that geopolitical preferences increasingly drive the geographic footprint of FDI.[5] The prospects for international investment looked extremely gloomy recently, with a cascading crisis of health, climate change and economic shocks causing investor uncertainty around the world. Rising inflation, fears of a recession and turbulence in financial markets put many investment plans on hold at the beginning of this decade. In the end, international investment flows did suffer, but proved more resilient than expected (World Investment Report 2003).

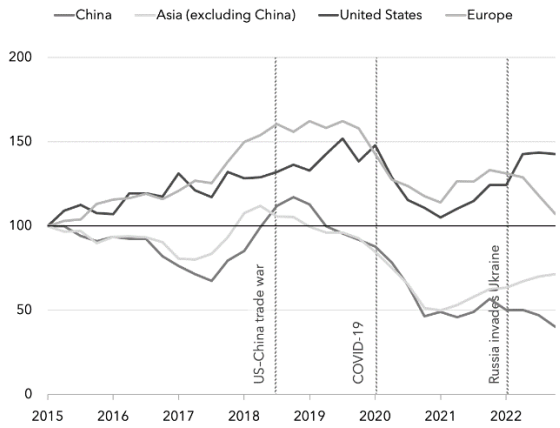

Fig. 1. FDI trends in countries (U.S., China, Asia and Europe)
Source: International Monetary Fund calculations

These trends also indicate that if geopolitical tensions continue to intensify and countries further diverge along geopolitical fault lines, FDI may become even more concentrated within blocs of aligned countries.

The marked growth in the level of FDI in recent decades, and its international scope, reflects an increase in the size and number of individual FDI transactions, as well as the increasing diversification of companies across economies and industrial sectors. Large multinational enterprises (MNEs) are traditionally the dominant players in such cross-border FDI transactions. What is noticeable is that in recent years even small and medium-sized enterprises have been increasingly involved in FDI (OECD Benchmark Definition 2008).

Chart 2 shows annual global FDI flows from 1999 to 2022 as well as quarterly and half-year trends from 2018 to 2022. Looking at half-year values, global FDI flows were up by 24% in the first half of 2022, topping any half-year level observed since 2018 before dropping by 58% in the second half of the year. Looking at quarterly values, much of the drop in global FDI flows took place in the last quarter of 2022, 95% down from the previous quarter.[6]

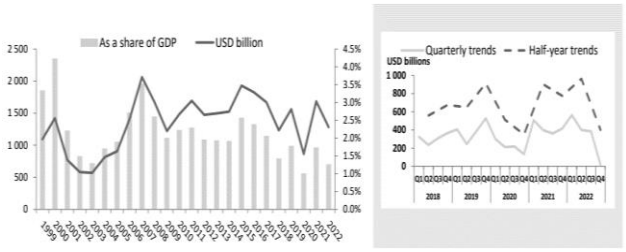

Fig. 2. Global FDI flows, 1999-2022
Source: OECD International Direct Investment Statistics database

FDI inflows to G20 economies decreased by 15%. While they were up by 7% in OECD G20 economies, they dropped by 38% in non-OECD G20 economies, largely driven by decreases in China and, to a lesser extent, in South Africa, from peak levels recorded in 2021. In contrast, FDI flows in Brazil went up by 68%, reaching a ten-year record high at USD 85 billion, due to larger reinvestment of earnings and movements in intra-company debt. Despite the drop in FDI inflows, the United States remained the top destination for FDI inflows worldwide in 2022 (USD 318 billion), followed by China (USD 180 billion) and Brazil (USD 85 billion) (Singapore and Hong Kong, China, are not listed as major FDI sources and recipients respectively, because the OECD considers that these economies are not the ultimate destinations or sources of a significant amount of their flows; instead these flows pass through on their way to and from other economies).[7]

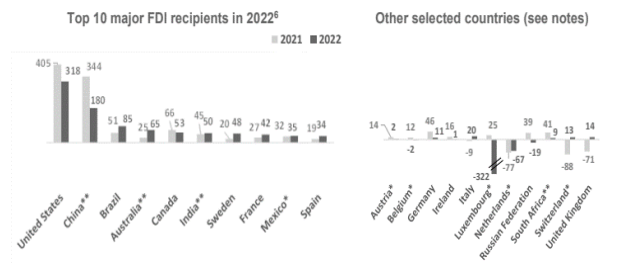

Fig. 3. FDI inflows to selected countries, 2021-22 (USD billion)
Source: OECD International Direct Investment Statistics database

After a steep drop in 2020 and a strong rebound in 2021, global FDI declined by 12% in 2022, to $1.3 trillion. The slowdown was driven by the global polycrisis: the war in Ukraine, high food and energy prices, and debt pressures. International project finance and cross-border mergers and acquisitions (M&As) were especially affected by tighter financing conditions, rising interest rates and uncertainty in capital markets. The global environment for international business and cross-border investment remains challenging in 2023. Although the economic headwinds shaping investment trends in 2022 have somewhat subsided, they have not disappeared. Geopolitical tensions are still high. Recent financial sector turmoil has added to investor uncertainty. UNCTAD expects downward pressure on global FDI to continue in 2023 (World Investment Report 2023).

FDI in North Macedonia

The official data of the World Bank argue the flow of FDI in North Macedonia. Thus in the last decade, the year 2014 marks a drastic collapse of the FDI from USD 402,458,309.8 in 2013 to USD 60,879,915.5 in 2014, to rise again with constant increases until 2020 which marks the year of the Covid-19 pandemic, where it was expected that FDI will have irrelevant figures, so only USD 7,693,779.7.[8]

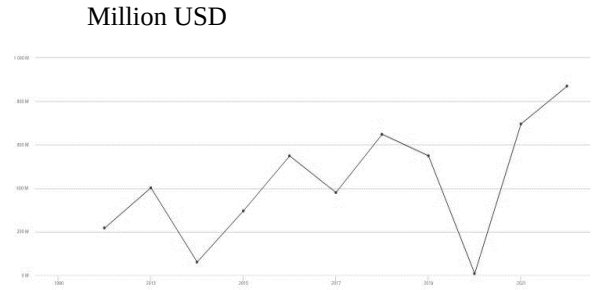

Fig. 4. FDI inflow in North Macedonia (mainly in the last decade)
Source: World Development Indicators

FDI into North Macedonia has witnessed a marked growth in foreign investment in recent years, and the aforementioned initiatives look set to encourage further interest from international companies. The facts, steps and actions mentioned above and not only resulted North Macedonia performing impressively in Investment Monitor's 2022 Inward FDI Performance Index. This means that North Macedonia, with a score of 11.5, received more than 11 times its fair share of inward greenfield FDI compared with what could be expected given its level of GDP. In that regard, North Macedonia is performing successfully in FDI terms.[9]

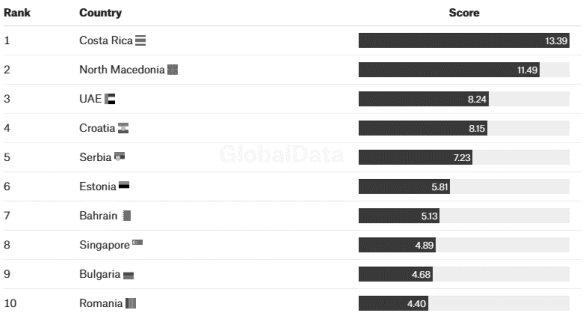

Fig. 5. Inward FDI Performance score
Source: GlobalData

Discussion

Closer economic integration is a particular feature of out times. It goes hand in hand with more intense international competition, presenting challenges as well as new opportunities for growth. This process is particularly evident in cross-border investment. Globally, direct investment flows increased during the 1990s at an annual rate of about 20% - much faster than, for example, cross-border flows, of goods and services. It is also worth noting that the investments flowed mainly between industrial countries (Herrmann & Lipsey 2003). In 2001 UNCTAD reports that from 1986 through 2000, worldwide cross-border outflows of FDI rose at an annualised rate of 26.2%, versus a rate of just 15.4% for worldwide exports of goods and services (World Investment Report 2001).

In the absence of adequate domestic savings, foreign investments provide an important avenue for the development of North Macedonia's economy. According to UNCTAD's 2022 World Investment Report, net FDI flows to North Macedonia increased significantly and reached USD 606 million in 2021, compared to USD 230 million a year earlier; while the total stock of FDI was estimated at USD 7.2 billion, around 52.2% of the country's GDP. According to figures by the Central Bank, the main investing countries in terms of stocks are Austria and the UK (EUR 913 million and 652 million, respectively), followed by Greece (EUR 612 million), the Netherlands (EUR 503 million) and Germany (EUR 471 million). Manufacturing is the sector that attracts the most FDI (34.8% of the total stock), ahead of financial and insurance activities (21.6%). Analyzed by investment activities, of the total direct investments, EUR 2,453 million or 35% were invested in the "Production" activity, while EUR 1,520 million or 21.7% were invested in the "Financial and insurance activities" activity.[10]

In order to create a legal and political platform for attracting as much foreign direct investment as possible, the Government of the Republic of North Macedonia has taken concrete steps:

- Amending and supplementing the Constitution to determine that foreign persons (in the relevant case, enterprises) in North Macedonia can acquire the right of ownership of property under conditions established by law (mainly under equal conditions as those of local persons to the condition of reciprocity) (Article 31 of Constitution of the Republic of North Macedonia, 1991). Moreover, striving to treat them equally with domestic investors, foreign Investors are guaranteed the right to freely and without additional obstacles make the free transfer of capital and invested profits. Rights acquired from invested capital cannot be reduced by law or other regulations (Article 59 of Constitution of the Republic of North Macedonia, 1991).
- Compilation of the Law on the Financial Support of Investments. This Law regulates the types, amount, conditions, manner, and procedure for granting financial support for investments of business entities which invest in the country (Article 1 of the Law on Financial Support of Investments, 2018). The purpose of this Law shall be to stimulate the economic growth and development in the Republic of North Macedonia through support of investments aimed at increasing the competitiveness of the Macedonian economy and employment (Article 3 of the Law on Financial Support of Investments, 2018). The total financial support that may be paid in accordance with this and another law may not be more than 50% of the amount of the incurred eligible costs. For large investment projects, the amount of the financial support under this Law shall amount to (Article 8 of the Law on Financial Support of Investments, 2018):
  (a) up to 50% of the eligible investment costs for an investment project of up to EUR 50 000 000;
  (b) up to 25% for the portion of the eligible investment costs for an investment project of EUR 50 000 000 to EUR 100 000 000; and
  (c) up to 17% for the portion of the eligible investment costs for an investment project exceeding EUR 100 000 000.

The following shall constitute types of financial support for investments (Article 14(1) of the Law on Financial Support of Investments, 2018):

(a) Support for new employments;
(b) Support for establishing and promoting the cooperation with suppliers from the North Macedonia;
(c) Support for establishing organizational forms for technological development and research;
(d) Support for investment projects of significant economic interest;
(e) Support for capital investments and revenues growth; and
(f) Support for purchasing assets of companies in distress.

On the other hand, the following shall constitute types of financial support for competitiveness (Article 14(1) of the Law on Financial Support of Investments, 2018):

(a) Support for increasing the competitiveness on the market;
(b) Support for conquering markets and sales growth.

- Compiling of the Law on Technological Industrial Development Zones. provides for a special tax treatment for any investor who invests in the appointed zones (Article 5 of the Law on Technological Industrial Development Zones, 2007), respectively, the purpose of this Law is to accelerate economic development by attracting foreign and domestic capital for the development of new technologies and their application in the national economy, increasing the competitiveness of the North Macedonia on the foreign trade market, increasing exports and increasing employment (Article 2 of the Law on Technological Industrial Development Zones, 2007).
- Compiling of the Law on one stop-shop system and keeping a trade register and a register of other legal entities, aims to tackle some of the administrative barriers of entry into the business life in North Macedonia. According to the Law of the One-Stop-Shop system, all types of trade companies are registered within 4 hours of submission (Article 41 of the Law on one stop-shop system, 2005). Another important feature of the One-Stop-Shop is the electronic distribution service that allows any potential investor or third party to obtain complete electronic information about the operations of companies in the country (Article 26 of the Law on one stop-shop system, 2005).
- Lowering and leveling of the flat tax rate to 10% for corporate and personal income tax purposes. Investors are eligible for reduction in the profit tax base by the amount of prior profit reinvested in tangible assets (such as real estate, facilities and equipment) and intangible assets (such as computer software and patents) used for expanding the business activities of the entity.[11] Establishing the Invest North Macedonia Agency in 2005. Its mission is to encourage and support new foreign direct investments in the country, establish and enhance business cooperation with local suppliers and promote the export potential of local companies to foreign markets.[12]
- Offering investors access to a large, low-cost labor pool, with 69% of the population within the working age group of 15-64 according to the State Statistical Office.[13]

NATO membership brings stability that can increase a country's attractiveness to foreign investors. Countries that have experienced this earlier (such as Poland, Hungary and the Czech Republic) provide the real examples of FDI growth after joining NATO.[14]

Conclusions

FDI as an investment by a party in one country into a business or enterprise in another country is always made with the intention of creating a lasting interest. FDI gains in importance with the greater integration of markets, opening of markets to receive capital, goods and workforce from various external sources, but also with the greater harmonization of legal rules in different countries. The paper summarizes the meaning and definition of foreign direct investments, the role and importance they have for the economy and global progress, its flow in the world perspective, ending with the current situation with a view from the last two decades in the Republic of North Macedonia. The paper thus provides the general overview of the flow of FDI based on the data that the OECD, IMF, WB, UNCTAD, Macedonian National Bank and Macedonian State Statistical Office continuously processes on an annual basis. In recent years, North Macedonia has been facing difficulties and obstacles for attracting foreign investors, and despite taking concrete measures to improve the investment climate, it still has not reached the desired point. What has been invested so far has had a key role in improving the local economic image, including: increased employment opportunities, increased export opportunities, the benefit of experience and technique from know-how, tax relief, as well as simplification of procedures for registration of commercial entities.

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BIBLIOMETRIC INSIGHTS INTO RESEARCH ON COMMERCIAL REAL ESTATE TENANTS' ASSESSMENT

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Abstract
The landscape of commercial real estate is dynamic and multifaceted, influenced by various economic, social, technological, and environmental factors. Understanding the evolution of research in this field and the key areas of focus and principal contributors is crucial for advancing knowledge and informing decision-making processes. This study aims to analyze the trends and patterns in publications related to assessing commercial real estate tenants, shedding light on the key topics addressed and the individuals driving research in this domain. Commercial real estate encompasses a vast and diverse sector, ranging from office spaces and retail stores to warehouses and industrial facilities. Within this sector, the dynamics of tenant assessment plays an important role in shaping property performance, investment outcomes, and market positioning. The ability to effectively evaluate potential tenants is essential for property owners, investors, lenders, and managers, as it directly impacts revenue streams, occupancy rates, and overall asset value. To address the complexities of tenant assessment, this study employs a comprehensive bibliometric approach, drawing on a wide range of scholarly literature spanning from 2000 to the present. By systematically analyzing existing research, the study aims to identify key themes, trends, and contributors in the field of commercial real estate tenant assessment. Through this analysis, it seeks to provide valuable insights into the global landscape of research in this domain. Understanding the contributions of various stakeholders can help to foster collaboration, exchange of ideas, and collective efforts to address critical challenges and advance knowledge in the field. The findings of the study have several implications for theory, practice in the commercial real estate sector. By elucidating the key themes and trends in tenant assessment research, the study contributes to theoretical frameworks that can inform future research endeavors. Moreover, the insights provided by the study can guide practical decision-making processes, such as tenant selection, lease negotiation, and property management practices.
KEY WORDS: commercial real estate, tenant assessment; bibliometric analysis.
JEL classification: L85; M10; R30

Introduction

The space within commercial properties can be viewed as a product that is subject to market dynamics. Users of commercial space, also known as tenants, require space for offices, retail stores, warehouses, and many other purposes. Suppliers of commercial space, also known as landlords, create or acquire space to satisfy tenant demands (Glickman 2014). The complexity of successful transactions, whether in the electronic space or not, in cases such as a commercial real estate deal arises from various sources. As posited by Stavrovski (2004), there exist complexity of:

- the product (commercial property's description encompasses numerous factors like location, type, price, taxes, age, condition, size, parking, heating/cooling, amenities, floors, and materials);
- the agreement to be negotiated by the participants (a real estate lease contract includes negotiable terms like start and end dates, duration, taxes, rent-free periods, parking allocation, security deposits, late fees, maintenance, insurance, utilities, rights of first offer, non-disturbance clauses, etc;
- the customer's preferences. For instance, traditional push factors like car accessibility, extension need, and location and building image remain important. Nowadays sustainability issues like reducing energy consumption and better public transportation accessibility are highly prioritised pull factors as well (accessibility, multi-tenancy, meeting facilities etc.) (Remoy et al 2014);
- the search process, including selected searching tools, also the time-consuming nature of the search process, and the difficulty in understanding the status changes of objects (Tsung-Yin et al 2022);
- the negotiation process in complex business transactions, particularly in commercial real estate, can be time-consuming and involve multiple stages and players. (Choi 2018).

A fundamental premise for a successful transaction should entail a thorough recognition of the various distinctions among customers. Landlords consider various factors when selecting tenants for their properties (Udoka et.al 2023). The assessment of commercial real estate tenants holds significant importance for various stakeholders within the real estate industry, including property owners, investors, lenders, and property managers. Assessing tenants helps property owners ensure a steady and reliable income stream. By evaluating the financial stability and creditworthiness of potential tenants, property owners can minimize the risk of late payments, defaults, or vacancies, thus safeguarding their investment returns.

The quality of tenants directly impacts the overall performance of commercial real estate properties. Some studies have attempted to explore the role of tenant quality on building performance, such as Liu et al. (2019), investigating the impact of tenant credit quality on the valuation of a building. Selecting tenants with a strong business track record, reputable brand, or stable customer base can enhance property value, occupancy rates, and leasing terms.

Effective tenant assessment supports efficient property management practices. The value contributions of properties can be optimized when property management professionals take responsibility for continuously

providing appropriate facility solutions to business challenges (Then 2005). Property managers can streamline day-to-day operations, minimize conflicts, and maintain a positive tenant-landlord relationship by selecting tenants who align with the property's use and maintenance standards.

It could also be said that the tenant's assessment can be influenced by the phase of growth or recession of the country's economy. Throughout every stage of the economic or business cycle, the condition of the economy is dictated by macroeconomic variables such as aggregate demand, employment rates, corporate profits, import volumes, interest rates, and GDP. Understanding both phases is equally important, except that one phase presents opportunities, and the other phase presents threats (Pyrantas et.al 2023).

The existing literature on commercial real estate predominantly focuses on various aspects of property investment, management, and market dynamics. It could be argued that there remains a notable gap specifically regarding the evaluation of potential tenants in commercial real estate. The explanation of this gap might be limited academic attention. Consequently, there is a scarcity of scholarly articles, research studies, and theoretical frameworks dedicated to this specific aspect of tenant assessment. It could also be mentioned complexity and variability - tenant evaluation in commercial real estate is inherently complex and variable, influenced by factors such as industry trends, economic conditions, tenant preferences, and property-specific considerations.

The value of the research lies in its comprehensive analysis and evaluation of the existing scholarly literature on the assessment of tenants in commercial real estate. By employing a bibliometric approach, the study provides insights into the volume, trends, themes, and key contributors within this specific area of research. Additionally, the identification of key areas of focus and emerging trends in tenant assessment research offers valuable guidance for future research directions in the field.

Contextual background for analysis of commercial real estate tenants' assessment

Much of the literature about commercial occupiers' property strategy is written from the perspective of the tenant, and analyses what property directors, managers or facilities managers should consider in order to maximise the utility of the premises occupied (see, for example, Ginevičius et.al. 2016; Haynes 2012; Sanderson et al 2014, Sanderson 2016).

Also commercial property tenants are on a journey to sustainability. Tenants are interested and willing to engage in discussions about sustainability initiatives (Robinson et al. 2013). At the same time that the sustainability agenda has gained purchase within the commercial property market, financialisation has also been having an impact (Rydin 2016). Motivated by the role of customer satisfaction for a firm operating, it's reasonable to expect that in the real estate sector, there is also a similar pattern in terms of the relationship between customer satisfaction, customer demand, and performance of the company: whether the customer of the building, the tenant, is satisfied with the building might also have some connection with their decision of space demand and finally the financial performance of the building (Hu 2014). According to Ovedokun et.al 2014, it is important to underline the need for pragmatic and tenant-oriented management as a means to achieving increased occupier satisfaction in commercial properties.

In the context of the real estate sector, the research literature has covered various aspects related to digitalization, such as the Internet of Things (IoT), artificial intelligence (AI) and building information management (Atkin and Bildsten 2017; Bröchner et al 2019). Thus, digitalization in the real estate sector involves a wide range of companies and other actors together forming an ecosystem. Real estate firms, defined as an actor that owns, develops and rent real estate as their primary business, have key roles in this system (Vigren et.al 2022).

The existing research on commercial real estate tenants' assessment encompasses a range of themes, methodologies in the literature. After conducting a scientific literature analysis, the themes related to the assessment of potential commercial real estate tenants could be divided into three key themes include evaluating financial viability, assessing creditworthiness, and analyzing business models of potential tenants (see Table 1).

In summary, the literature on commercial real estate tenants' assessment is characterized by diverse themes and methodologies. By synthesizing existing research and identifying areas for further investigation, it might be possible to advance knowledge and develop practical tools for effective tenant evaluation in commercial real estate.

Table 1. Key themes on commercial real estate tenants' assessment

Key theme	Authors and their insights
Financial Viability Assessment	The financial viability of tenants in commercial real estate can be assessed by considering their credit rating, financial stability, business growth, and market performance (Yao 2022). Tenant quality plays a significant role in explaining the cross-sectional variations of real estate investment trust (REIT) returns and market exposure (Wang et.al 2022). Factors such as tenant credit information, including credit rating, Altman Z-score, earnings per share forecast, price performance of publicly traded tenants, and tenant mix index, can be used to measure tenant quality (Crosby et.al 2021). Additionally, analyzing the options embedded in lease contracts, such as break options that allow tenants to move before the end of the contract, can provide insights into the owner's income and the reliability of cash flow projections (Crocker et al 2010). By combining Monte Carlo simulations for market prices and rental values with an optional model that considers tenant behavior, a more accurate assessment of the financial viability of tenants can be achieved (Amédée-Manesme 2012). Listed studies have focused on developing models and methods to assess the financial stability and viability of potential tenants. These models often incorporate financial ratios, cash flow analysis, and credit scoring techniques to evaluate tenants' ability to meet lease obligations and sustain long-term occupancy.
Creditworthiness Evaluation	The creditworthiness of tenants in commercial real estate can be assessed through various ways. For instance, one approach is to use a commercial tenant reputation authentication system based on blockchain technology, which provides a secure and transparent way to process transaction and evaluation data (Yao 2022). Another method is to utilize credit reference information, including credit rating information, to determine the creditworthiness of a commercial tenant. This information can be obtained by querying credit information and providing credit reference information for the specific tenant, as well as providing information on similar tenants with high credit ratings (Li at al 2019). Additionally, evaluating the resilience of tenants to social distancing measures can also be an indicator of their creditworthiness. Firms holding properties with tenants that are more resilient to social distancing tend to perform better, suggesting that their creditworthiness is higher (Wang et.al 2022).
Business Model Analysis	To understand the business models of potential tenants, a framework for management of machine learning models can be used to determine business criteria based on the preferences of the tenant. Multiple models can be built dedicated to the tenant, each trained and fitted to perform different combinations of processes based on the integrations of the business criteria (Masekera et.al 2018, Nielsen 2014). By utilizing a new transaction system, preferences of potential customers (tenants and landlords) can be quantitatively evaluated, allowing for the definition of search areas and allowable ranges for bargaining. The system can also generate a statistical model that presents the current market situation and future tendencies related to customer preferences (Stavrovksi 2005). Studies have examined factors such as industry dynamics, market positioning, competitive advantage, and growth prospects to assess tenants' business viability and compatibility with property objectives.

Research methodology

In pursuit of the purpose outlined in this study, the following research inquiries were posited: How has the landscape of publications concerning the assessment of commercial real estate tenants evolved in recent twenty four years? What are the key areas within the realm of commercial real estate tenants' assessment? Who are the principal contributors to this field of research? In order to meticulously refine the retrieval of pertinent information pertaining to the assessment of commercial real estate tenants, a comprehensive bibliometric analysis of relevant publications was undertaken (see Figure 1).

The search for information for the bibliometric analysis was carried out using the Web of Science Core Collection search engine from the Clarivate Analytics database in February 2024. The primary search parameters included searching by name, a timeframe from 2000 to 2024 (only 2024 January), and focusing on the analysis of articles. A search of the Web of Science Core Collection database by name was conducted using keywords business entities valuation models as potential commercial real estate tenants, commercial real estate, potential tenant assessment of commercial real estate (search summary: "business entities valuation models as potential commercial real estate tenants" (Topic) OR "commercial real estate" (Topic) OR "potential tenant assessment of commercial real estate" (All fields). Timespan: years 2000-2024. The data processing and visualization for bibliometric analysis were conducted utilizing analytical tools such as Clarivate Analytics, Microsoft Office Excel, and VOSviewer. A comprehensive search yielded 1,489 publications, which were identified based on predefined keywords. Of all publications, 72,42% (1079) were articles. The primary search encompassed all categories within the Web of Science Core Collection database. An essential step in evaluating the necessity for further detailed searches involves analyzing the distribution of primary search results across different research areas. Based on the analysis conducted using the Clarivate Analytics data analysis tool, a substantial number of search

results were identified across various categories. Specifically, a significant volume of publications were retrieved from the Business Economics, Urban Studies, Engineering, Environmental Sciences Ecology, Computer Science. In contrast, the remaining categories yielded fewer than 100 records each. Notably, certain search results were found to overlap across multiple categories. Consequently, it was deemed unnecessary to further delineate the search based on individual categories.

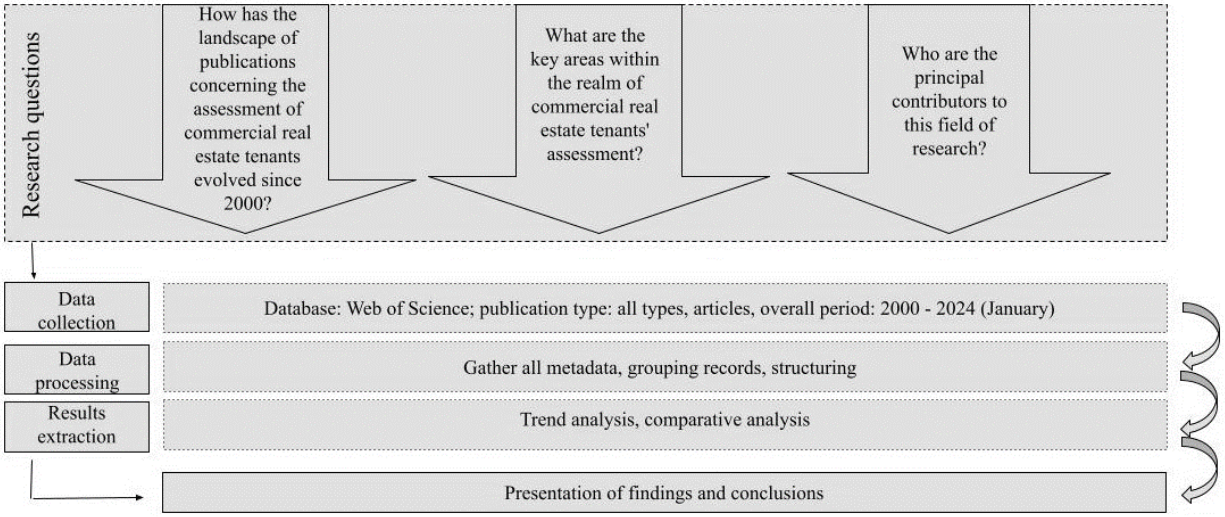

Fig. 1. Research methodology

Research results

Publication trends

Through a comprehensive examination of publication trends, documents spanning from 2000 to 2023 were analyzed, with a focus on the distribution of publications by year (see Figure 2).

Notably, there has been a substantial surge in the number of scientific papers pertaining to the subject, particularly evident since 2019. The peak in publications on this subject was observed in 2020 (145).

Considering the distribution of search results across various research areas, a notable proportion of publications were retrieved from fields such as Business Economics, Urban Studies, Engineering, Environmental Sciences Ecology, Computer Science and Construction Building Technology. The surge in scientific publications on commercial real estate between 2020 and 2024 could potentially be influenced by multiple factors and trends within economic, social, technological, environmental domains. These factors may encompass:

- Economic fluctuations: Variations in economic conditions or projections of economic development, can directly impact the commercial real estate sector and associated research endeavors. Such investigations often aim to comprehend market dynamics and devise strategic responses.
- Technological advancements. Progress in technology, particularly in the realm of data analysis tools and big data processing, empowers researchers to conduct more comprehensive analyses of commercial real estate market trends. This enables the identification of novel opportunities and assessment of risks.
- Demographic transformations. Shifts in population dynamics, urbanization patterns, and social and cultural factors can shape the demand for commercial real estate and investment prospects.
- Concerns regarding climate change and sustainability. Public apprehensions regarding climate change and the pursuit of sustainable development may stimulate fresh inquiries into the commercial real estate sector. Such research endeavors may focus on evaluating its environmental impact and exploring avenues for enhancing sustainability.

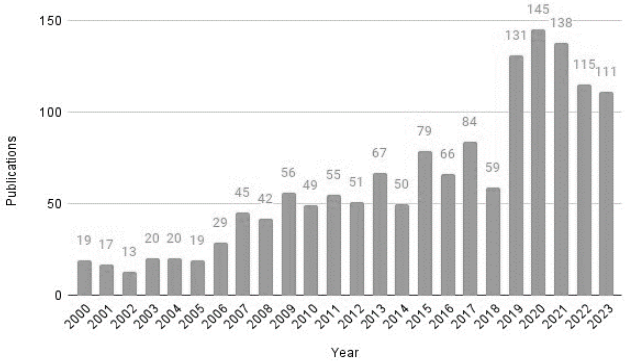

Fig. 2. Distribution of the number of publications by year (created by author, based on data from Clarivate analytics)

Hence, the heightened interest and uptick in scientific publications pertaining to relevant to the keywords under investigation in this study likely stem from the intricate interplay of these and other factors, underscoring their significance within academic research and society at large.

Figure 3 illustrates the nineteen authors who have authored the highest number of publications pertinent to the keywords under examination in this study.

Among the most prolific authors in the field, Ling D.C. shines with 17 publications to their name. Professor Ling's

works delve into various aspects such as real estate investment trusts, private commercial real estate investments including closed-end funds, performance evaluation, and commercial mortgage markets and pricing. Following closely are Freybote J. and Geltner D., both with 14 publications each. Dr. Freybote's research primarily focuses on commercial real estate investment and finance, as well as technological innovation within the real estate domain.

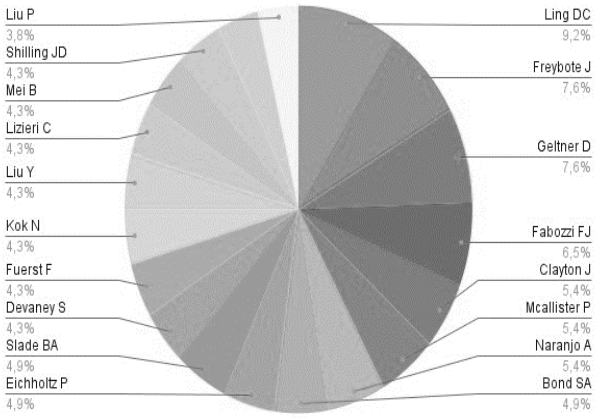

Fig. 3. Authors who generated the highest volume of publications relevant to the keywords under investigation in this study (created by author, based on data from Clarivate analytics)

Her contributions have found their place in esteemed journals like Real Estate Economics, the Journal of Real Estate Finance and Economics, and the Journal of Real Estate Research. Professor David Geltner holds the distinction of being the lead author of the highly cited textbook "Commercial Real Estate Analysis & Investments." Fabozzi F.J. follows with 12 publications covering essential aspects of bonds, analytical techniques, and portfolio strategy. Clayton J., Mcallister P., and Naranjo A. each have 10 publications attributed to their names. The remaining 231 authors collectively contribute 676 publications, averaging six or fewer publications per author.

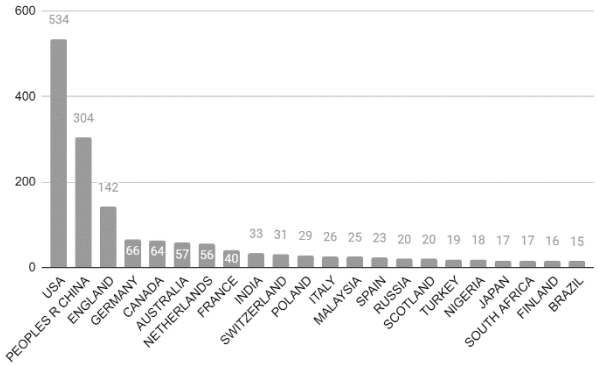

Fig. 4. Countries with the highest number of published articles related keywords under investigation in this study (created by author, based on data from Clarivate analytics)

In total, articles were published in 89 countries on the analyzed topic. Figure 4 provides information on the 22 countries in which since 2000 until 2024 January 15 and more than 15 articles on the topic was published. In this study, the countries prominently featured in the top five of most published scientific publications within the chosen key topics are the USA (534), China (304), England (142), Germany (66), and Canada (64). In Lithuania 6 articles were published during the period under review. These data indicate that articles on the analyzed topic are widely disseminated across various countries worldwide. According to the information provided, the highest number of scientific publications in this field comes from the USA, China, England, Germany, and Canada. This suggests that these countries are leading in researching this topic and actively contributing to scientific progress. Additionally, while Lithuania is not among the top countries in terms of publication count, it also has its own contribution, as six articles on this topic were published in the country during the specified period.

Key areas

Through an analysis of the pivotal areas pertinent to the keywords central to this study—specifically, business entities valuation models as potential commercial real estate tenants, commercial real estate, and potential tenant assessment of commercial real estate—a total of 5170 keywords were identified. A co-occurrence map was subsequently generated, taking into account keywords that appeared at least 5 times across all gathered documents, resulting in 328 keywords meeting this criterion. For each of these 328 keywords, the aggregate strength of co-occurrence links with other keywords was computed. The keywords demonstrating the highest total link strength were then curated, forming 9 clusters interconnected by a total of 6221 links.

Based on the significance denoted by the size of circles within each cluster, the most prevalent keywords are as follows: Cluster 1 (63 items): appraisal, asset, bias, big data, bubbles, capitalization rate; Cluster 2 (61 items): attitudes, banks, barriers, buildings, certification, climate change; Cluster 3 (55 items): access, accessibility, agglomeration, agglomeration economy, allocation, amenities; Cluster 4 (50 items): architecture, built environment, China, cities, city, commercial buildings; Cluster 5 (29 items): adjustment, bank lending, banking, business, business cycles, capital expenditures; Cluster 6 (27 items): asymmetric information, bankruptcy, capital structure, CMBS, commercial banks, cycles; Cluster 7 (21 items): agents, brokerage, commercial housing, commercial real estate market, corruption, decision making; Cluster 8 (13 items): asset pricing, bond, comovement, cross-section, illiquidity, institutional investors; Cluster 9 (9 items): behavior, COVID-19, green building, investment, office, real options (see Figure 5).

From the analysis of keywords and their co-occurrence in the field of commercial real estate tenant assessment, several conclusions can be drawn:

1.The clusters of keywords provide insight into the primary themes within commercial real estate tenant assessment research. These themes encompass a wide range of business economics topics, including appraisal methods, asset valuation, market dynamics, risk

assessment, and the impact of external factors such as climate change and economic cycles.

2.The presence of diverse keywords across multiple clusters suggests the interdisciplinary nature of research in commercial real estate. Topics such as architecture, urban planning, finance, and environmental sustainability intersect within the domain of tenant assessment, highlighting the need for a multidisciplinary approach to understanding and addressing related challenges.

3.Certain keywords, such as "COVID-19" and "green building," stand out as emerging trends in commercial real estate tenant assessment. The inclusion of these terms reflects the evolving landscape of the industry, with a growing emphasis on sustainability and resilience in the face of global challenges.

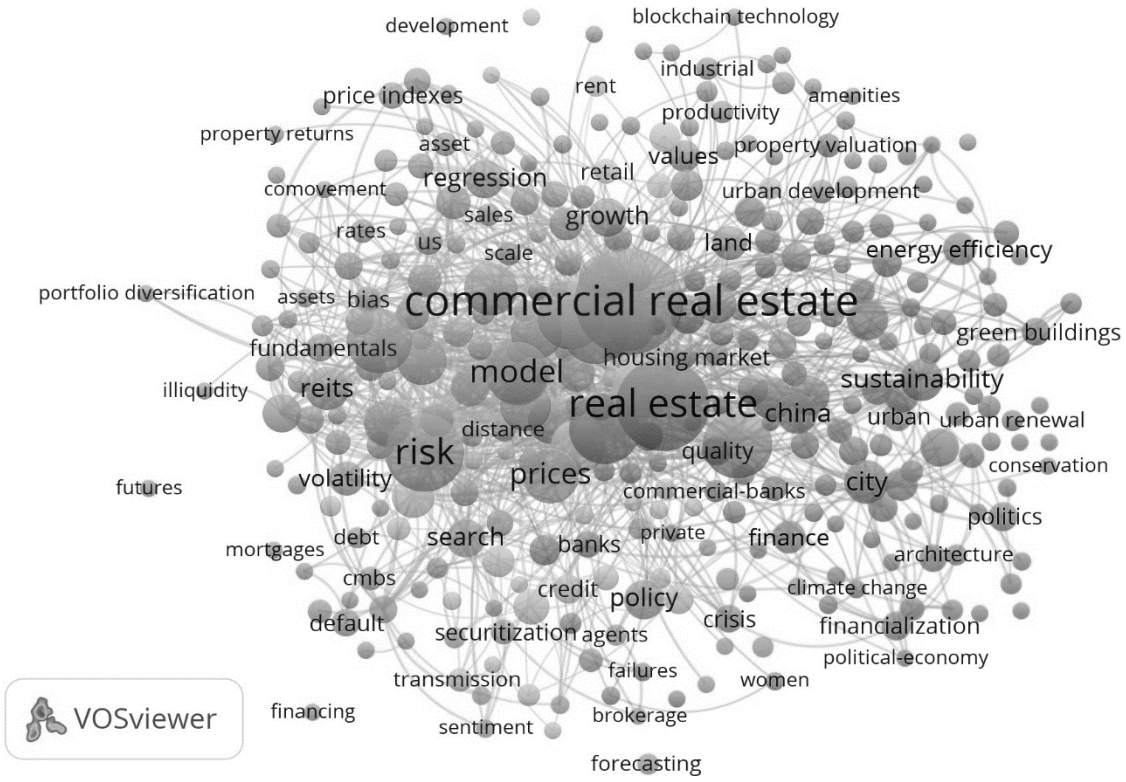

Fig. 5. Keyword co-occurrence network (created by author, based on data from Clarivate analytics with VOSviewer software)

4.The frequency of occurrence and total link strength of keywords like "commercial real estate," "risk," "real estate," and "investment" indicate these topics are central to the discourse on tenant assessment. Researchers and practitioners are likely focusing on understanding the risks associated with commercial real estate investments, evaluating property performance, and assessing market dynamics to inform decision-making processes.

Table 2. The most-cited keywords (created by author, based on data from Clarivate analytics)

Keyword	SUM, Occurrences	SUM. Totatal link strength	Keyword	SUM, Occurrences	SUM. Totatal link strength
Commercial real estate	181	682	Determinants	46	245
Risk	95	453	Prices	49	237
Real estate	133	403	Valuation	44	209
Performance	78	396	Property	43	202
Market	72	360	Information	36	196
Impact	75	360	Dynamics	35	190
Returns	67	358	Commercial real-estate	38	178
Real-estate	69	319	Markets	39	175
Investment	57	302	Models	37	164
Model	63	280	Price	32	161

The identified clusters and keywords provide valuable insights for guiding future research directions in commercial real estate tenant assessment. Areas with high occurrence and link strength, such as risk assessment and market dynamics, warrant further investigation to enhance understanding and develop innovative approaches to addressing challenges in the field. Overall, the analysis of keywords and their co-occurrence networks offers valuable insights into the prevailing themes, emerging trends, and research focus areas within commercial real estate tenant assessment. The information was thoroughly researched by employing either commonly used keywords or by seeking out the most frequently authored articles relevant to the subject matter.

Discussion

The findings underscore the intricate nature of assessing tenants in commercial real estate, which is influenced by various factors including the complexity of the properties themselves, the negotiation process, and the diverse preferences of customers. Successful transactions hinge on understanding these complexities and tailoring agreements to meet the needs of both parties. Tenant selection emerges as a critical strategic concern, as it directly impacts the performance and value of commercial properties.

Assessing commercial real estate tenants is pivotal for stakeholders like property owners, investors, lenders, and managers, aiding in risk mitigation and property performance enhancement. Studies indicate that selecting tenants with strong business histories and reputable brands can boost property value, occupancy rates, and leasing terms. Furthermore, studies cited in this article indicate that effective tenant assessment supports efficient property management practices, leading to optimized value contributions and positive tenant-landlord relationships, ultimately contributing to long-term success in the commercial real estate market. It could also be argued, that existing literature focuses on commercial occupiers' property strategy from the tenant's perspective, emphasizing factors like maximizing utility and engagement in sustainability initiatives. Similar to other industries, customer satisfaction, in this case, tenant satisfaction with the building, likely impacts space demand and financial performance. Digitalization, including IoT, AI, and building information management, is transforming the real estate sector, with real estate firms playing key roles in this ecosystem.

Scholarly literature on commercial real estate largely overlooks tenant assessment, creating a notable research gap. To address this, the paper systematically reviews existing literature through bibliometric analysis, noting a growing interest in tenant assessment since 2000, driven by economic, technological, demographic, and sustainability factors. Prolific authors in the field include Ling D.C., Freybote J., and Geltner D., whose research covers diverse aspects such as real estate investment trusts, commercial real estate finance, and technological innovation. Most publications on this topic are published in countries such as the United States, China, England, Germany and Canada. A co-occurrence map generated from keywords revealed nine clusters, highlighting prevalent themes such as appraisal methods, asset valuation, market dynamics, and sustainability. Terms like "COVID-19" and "green building" signify emerging trends, reflecting the industry's response to global challenges and the growing emphasis on sustainability and resilience. Keywords like "commercial real estate" "risk" and "investment" indicate central themes in tenant assessment research, emphasizing the importance of understanding market dynamics and evaluating investment risks.

The limitations of the study include a limited focus on specific topics and methodologies, a lack of systematic examination of potential commercial real estate tenant assessment, and dependence on available data and scholarly sources. To improve commercial real estate decision-making processes and development, further research is needed to comprehensively explore all key themes and methodologies, including the financial stability, creditworthiness, and business model analysis of potential tenants. This entails a deeper understanding of the risks and benefits that these tenants can bring and how these factors can affect the value and operation of commercial real estate. It is also necessary to investigate how different conditions and contexts can influence tenant assessment outcomes and how these factors can be utilized in the decision-making process. Empirical research and analysis across various business environments and geographic regions could be included to create a more comprehensive and reliable understanding of the potential commercial real estate tenant assessment process.

Conclusions

Commercial real estate transactions are complex due to property diversity, negotiation intricacies, and varied customer preferences. Successful transactions necessitate understanding these complexities and adopting a strategic tenant selection approach.

Assessing tenants involves evaluating their financial stability, creditworthiness, and compatibility with the property's objectives. Studies indicate that selecting tenants with strong business track records and reputable brands can enhance property value and occupancy rates. Moreover, effective tenant assessment supports efficient property management practices, leading to optimized value contributions and positive tenant-landlord relationships.

Despite the significance of tenant assessment, the existing literature on commercial real estate predominantly focuses on aspects of property investment and management. This fact suggests a need for more attention to be given to the evaluation of potential tenants. The complexity and variability inherent in tenant evaluation pose challenges, making it difficult to develop standardized models or methodologies. Consequently, there is a scarcity of scholarly articles and research studies dedicated to this specific aspect of tenant assessment.

The contribution of this study is its aim to provide a comprehensive overview of the volume, trends, themes, and key contributors within this specific research area. The results of this analysis offer insights into the landscape of

research on commercial real estate tenant assessment, highlighting key areas of focus, emerging trends, and prominent contributors. The bibliometric analysis revealed a substantial increase in publications related to commercial real estate tenant assessment, particularly since 2000. Various factors such as economic fluctuations, technological advancements, demographic transformations, and sustainability concerns likely contributed to this surge in interest. Key contributors to the field were identified, along with the countries (the world's biggest economies like USA, China, Germany) with the highest number of published articles.

Moreover, the analysis of keyword co-occurrence networks highlighted the primary themes and emerging trends within commercial real estate tenant assessment research. Themes such as financial viability assessment, creditworthiness evaluation, and business model analysis emerged as prominent areas of focus. The identified clusters and keywords highlight dominant themes such as valuation methods, asset valuation, market dynamics, global challenges and an increasing focus on sustainability and resilience.

This study sheds light on the importance of tenant assessment in commercial real estate by highlighting its important role in property performance, risk mitigation, and value enhancement. Through a comprehensive analysis of existing scholarly literature, the study reveals the multifaceted nature of tenant evaluation and its significant implications for stakeholders such as property owners, investors, lenders, and managers. By identifying key themes, trends, and contributors in this area, the study lays the groundwork for further research and development, providing insights for informed decision-making processes in commercial real estate.

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The founder of a scientific journal "Vadyba / Journal of Management" is Lithuania Business University of Applied Sciences. Since 2000, the journal publishes technology, social sciences and physic sciences-related articles. The main goal of the scientific journal articles and conducted research is to emphasize the problems and present possible solutions for the public and private organizations of the region. The articles can be both empirical and theoretical.

The submitted articles must be original, previously unpublished. It is prohibited to publish the articles of this journal in other publications.

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Books

Valackienė, A. (2005). *Crisis Management and Decision-making*. Technology, Kaunas.
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Lithuanian Emigration Statistics. (2009). Statistics Lithuania to the Government of the Republic of Lithuania. [Retrieved February 16, 2009], <http://www.stat.gov.lt/lt/news/view/?id=6819&PHPSESSID=5b1f3c1064f99d8baf757cde1e135bc0>.

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- Institution name: in lowercase letters, left alignment, 10 pt., *Italic*.
- E-mail: lowercase letters, left alignment, 10 pt., *Italic*.
- Abstracts: text size – 8 pt, title – 10 pt, **Bold**. A full stop is not put after the last main word.
- Section names: lowercase letters, left alignment, size – 11 pt., **Bold**.

- Word *Literature* – 10 pt, literature list – 9 pt.

- **Figures** and **diagrams** must be clear, schemes – grouped into a single object.

Tables and **schemes** have to be numbered and titled.

1. Table titles are written above the table in the centre.
2. Figure names are written under the figure in the centre.

The text will not be further edited.

NOTE. It is obligatory to use the prepared template for the article.

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