

FORUM SCIENTIAE OECONOMIA



Katarzyna Szczepańska-Woszczyna, Regina Bogaczyk

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Analysis of the Impact of Special Economic Zones on Macroeconomic Indicators in Poland

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Organisational Climate and Employee Engagement – a Case Study of International Corporations

KATARZYNA SZCZEPANSKA-WOSZCZYNA, REGINA BOGACZYK

Abstract

The objective of the research is to investigate and pinpoint the expected impacts of the organisational climate on employee engagement. The research was conducted by means of a CAWI online survey among employees of international organisations with branches or representative offices in Poland, as well as Polish companies with their own organisational units abroad. The survey involved 835 employees at various organisational levels of the companies. The results of the empirical research clearly showed a strong positive relationship between the organisational climate and levels of engagement in work and in the organisation. It is possible to identify the dimensions of the organisational climate that are most closely related to employee engagement in general, namely the organisation and nature of work, autonomy, rewards and motivation, flexibility, a sense of psychological security and management.

Key word

organisational climate, employee engagement, human capital management

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Introduction

Research shows that companies with a high level of employee engagement achieve better results than those in which employees show a lower level of engagement (Deszczyński, 2018, 125). Employee engagement translates into better business results (Zakobielska, 2017, 123) and customer ratings, which are higher by 10% in the group of companies with high levels of employee engagement, with a corresponding 20% increase in sales. The degree of employee engagement helps

predict the level of their achievements at work (Chusmir, 1988; Machaczka & Stopa, 2022), and the high level thereof has a significant impact on company effectiveness (Gaertner and Nollen, 1989). Employee engagement is manifested in the fact that they are more willing to take up challenges and go beyond common patterns, improve working methods and provide a positive benchmark for colleagues (Zbierowski & Gojny-Zbierowska, 2022). According to J.L. Caulfield and

A. Senger (2017) and R. Gerards (2018), engagement translates into a good workplace atmosphere, reduces the risk of conflict in the team, and helps employees feel part of the team, working together effectively for the organisation's interests. In turn, a lack of engagement results in greater employee absenteeism (Anthony-McMann et al., 2017). It also prompts them to leave the organisation (*Zaangażowanie 2022. Report*), which in turn generates costs, among others, those related to the subsequent recruitment and induction of new people to work in a given position, as well as a loss of the knowledge which experienced employees take with them when they leave. The company also loses the potential benefits of their relationships with customers and contractors which they have built throughout the period of employment. It is estimated that for the employer, the cost of non-engagement is 35% of the employee's salary. Human Capital Deloitte (2022) indicates that the phenomenon known as *the Great Resignation* is observed around the world, manifested by increased turnover and decreased engagement (Extended Tools). According to the results of surveys carried out in 2022 on a group of 975 people, as many as 80% of skilled employees are considering a change of place of employment, the most frequently indicated reasons for which were the low efficiency of organisational processes (46%), the low level of salaries (43%) and the lack of development opportunities (37%). This is confirmed by *The 2022 Global Employee Survey*, which says that the most common reasons for leaving the workplace include low salary (29%), feeling undervalued (27%) and a lack of opportunities for promotion (23%). Organisations should therefore focus their attention on the identified causes of the loss of staff and implement corrective actions.

An analysis of the literature shows that psychological and social factors are becoming increasingly important in human capital management. An increased amount

of attention is being paid to the role of the broadly understood well-being of employees, also recognising the benefits for the organisation in the form of greater employee engagement (Haffer and Haffer, 2018). At the same time, it is indicated that a favourable organisational climate helps to ensure the well-being and health of employees (Rożman et al., 2019), which plays a significant role in the functioning of the entire organisation. If it is favourable and positively assessed by its members, it contributes to their greater working comfort and overall physical and mental well-being (Viitala, Tanskanen and Sääntti, 2015; Mafini, 2016). As a background to relationships and a source of affective experiences, it influences a number of employee behaviours.

Cultural diversity, which is characteristic of most contemporary organisations, plays an important role in various areas of management, mainly including human capital management (Thai & Mai, 2023). Intercultural contacts are one of the most important factors in the personal development of employees, and the experience gained as a result of these interactions can also benefit the organisation. Cultural diversity directly affects the organisational climate.

Despite the increasing interest of researchers in the issue of engagement and the organisational climate, many questions remain open, as there are no studies which juxtapose the two phenomena and show the relationship between them, and the research results so far are ambiguous and relate to selected aspects of these issues (the theoretical gap), which makes it possible to consider this area cognitively interesting and one requiring further scientific exploration. There are also no research reports on the role of the organisational climate in building the engagement of employees of international corporations, which represents an empirical gap. Empirical research was conducted in international corporations due to the

growing number of foreign investments in Poland in recent years and the increased level of internationalisation of companies that are increasingly willing to invest abroad, employ foreigners, conduct trade and provide services in an international and intercultural environment.

In this orientation, the present study attempts to shed some light on the interplay between the organisational climate and employee engagement, involving the employees of international corporations. Its main contributions are as follows: (a) it responds to the structure of the dimensions of the organisational climate and the dimensions of employee engagement; (b) it elucidates the relationship between the organisational climate and the various components of the attitude of work engagement and organisational engagement; and (c) it reveals the dimensions of the organisational climate which are particularly relevant to the attitude of engagement in work and the organisation.

1. Literature review

Effective organisational management is determined by knowledge of the conditions and causes of people's behaviour in the organisation, their experiences in the work environment, emotions and attitudes towards work. Psychologists approach the issue of engagement from the perspective of the individual, searching for its origins in personality, character and temperament. A significant role in shaping this attitude is attributed to emotions and cognitive processes. Sociologists treat engagement as a process referring to the social context in which the employee engages in the functioning of the team. By contributing in the form of engagement, he or she contributes to the achievement of group and organisational objectives. From a managerial perspective, the effect of actions taken by the employee, the basis of which is engagement, as well as recognition of the mechanism that triggers

them will be most important. The conditions, sources and ways of stimulating it are still being sought.

The analysis of the literature indicates three different terms used by the authors, namely *commitment*, *involvement* and *engagement* (Chałupczak and J.M. Bugaj, 2020, 346; Waligóra, 2018, 105-106; Pec and Lewicka, 2022, 159). *Commitment* means attachment, affiliation, a strong emotional bond, as well as involvement in the organisation's affairs, loyalty and willingness to make an effort for the organisation (*organisational commitment*) (Korczyk, 2019; Kawka, 2017). *Involvement* means inclusion and is related to employee participation (Kobylińska and Majewski, 2023) and participation in decisions, whereas *engagement* (*work engagement*) means an emotional connection and refers to identification with the organisation and a positive attitude to working there (Stankiewicz, P.Łychmus and H.Bortnowska, 2019, 135). According to M. Łaguna et al. (2015), the difference between *involvement* and *commitment* is that *involvement* is related to the content of work, tasks and duties performed, while *engagement* refers to an attitude towards functioning within an organisation, and the strength of identification with its goals and values. However, there has been a link between *engagement* and *commitment*. According to Borkowska (2009), there are two types of *engagement*, namely passive (*commitment*), which means attachment to an organisation, and active (*involvement*), understood as being involved in the development of an organisation. Work engagement (employee engagement) is the execution of entrusted tasks with dedication and passion, but also the importance that is given to work in the value system. In turn, professional engagement expresses the degree of identification with the professional path and opportunities for the development of a given profession. The greater it is, the more effort has been put into obtaining rights and competencies in a given profession (Lewicka

and Krot, 2015). The possibility of pursuing a professional career created by the organisation significantly affects both engagement in work and affective engagement in the profession (Lewicka and Pec, 2018). Engagement in the social environment consists of finding pleasure in contacts and relationships in the team, identifying with other members of the organisation and making efforts to create and maintain a positive atmosphere of cooperation (Juchnowicz, 2010). Organisational engagement means employees identifying with its values and goals, with its mission and social image and attachment to the organisation (Griffin, 2021). It is also defined as joining the organisation by using one's own competencies to achieve its objectives (Listwan, Pocztowski and Stor, 2016).

Sun and Bunchapattanasakda (2019) identified two types of definitions of employee engagement, namely employee engagement as a multi-faceted construct (cognition, emotions and behaviours) and as a unitary construct (a positive state of mind, a dedicated willingness, the opposite of burnout). Organisational engagement is the psychological state of an employee who acts as an intermediary between individual and work resources and organisational performance (Wołpiuk-Ochocińska, 2017). Such perceived engagement determines the utilisation of one's own resources and the appropriate use of the properties of the work environment created by the organisation. According to W.H. Macey and B. Schneider (2008) and Pollak et al. (2017), engagement is a personality trait, i.e. a kind of inherent predisposition to engage, as a condition related to participation in the organisation, attachment and satisfaction with work, and as a behaviour of going beyond the defined scope and taking initiative.

It is also worth pointing out an approach to engagement based on Social Exchange Theory (SET) (Cropanzano et al., 2017; Bailey et al., 2017), which is a tendency to repay the benefits obtained when there is some

kind of transaction between the organisation and the employee. According to this theory, employee engagement is the result of their assessment of the benefits of employment within the organisation. The level of engagement is adequate given the working conditions created by the employer. The subject of the exchange is services (engagement in the execution of tasks) and support from the organisation. If employees assess the support they receive as genuine, they gain a sense of trust and become highly engaged (Zagenczyk et al., 2020; Murthy, 2017). A sense of organisational support affects job satisfaction, which in turn is reflected in the results achieved (Putsom, Sattayawaksakul, 2019). In accordance with the principle of reciprocity, employees who are convinced that their organisation supports them by providing an appropriate working environment pay it back through a higher level of engagement (Kurtessis et al., 2017; Obeng et al., 2020). If an organisation provides employees with the opportunity to meet their needs, aspirations, and ambitions, they reciprocate with their efforts. On the other hand, if employees see a discrepancy between workload and benefits, this can result in decreased engagement and quality of work.

M. Juchnowicz (2017) defines engagement as a particular type of attitude towards work related to identification with the values and objectives of the organisation and the desire to remain therein. Engagement is expressed through the readiness to pursue the interest of the organisation independently, effectively and passionately. The author also emphasises that the actions taken by engaged employees go beyond the assigned responsibilities. This is an important aspect, because without this it would be difficult to talk about engagement, but only about reliability, conscientiousness and honesty towards the employer. Therefore, engagement can be considered an added value to the established scope of the employee's responsibilities.

When considering different aspects of engagement, attention should be paid to clearly distinguishing this concept from motivation and job satisfaction (the concept of engagement is a broader category than motivation; it also includes identification with the organisation) (Sobocka-Szczapa, 2017). An important aspect of engagement is its multi-dimensional nature: intensity (a continuum from a lack of engagement to very intense engagement), direction (in a profession, work, the social environment, the organisation), dimension (cognitive, emotional, behavioural), and time variability, related to the level of energy and activity, which is at the same time a phenomenon subject to gradation; it is possible to be shaped by various activities on the part of the organisation (Kahn, 1990; Allen and Meyer, 1991). Research found that employee engagement attitudes positively correlate with the following: transformational leadership (Gerards, de Grip and Baudewijns, 2018), servant leadership (Marek, 2018), and perceived support from the organisation (Wang et al., 2019; Imran et al., 2020). Furthermore, the relationship between engagement and trust in the workplace and the broadly understood psychological benefits provided by the organisation to the employee (Victor and Hoole, 2017) were demonstrated. According to research reports, engagement correlates positively with development opportunities, the enrichment of work, the clarity of role in the organisation, the quality of work, its intensity, the feeling that work is done well, a sense of control and active coping at work (Bailey et al., 2017).

T. Kupczyk and P. Pietrakowski (2018) identify factors that are significantly related to employee engagement. They include the belief that supervisors care about employees, a sense of being appreciated for their work, the clarity of professional expectations, the ability to express their opinion and participate in decisions, a feeling that the work performed is important, supporting

the development of employees, the ability to perform tasks consistent with predispositions and competencies, and care for quality and good cooperation in the team. Engagement factors that require more attention from the managers of these companies include the relationships within teams and the atmosphere associated with good communication, trust, appreciation for employees and support for their development by their superiors.

It may be noted that some of the factors mentioned above are the essence of the organisational climate, which makes it possible to associate engagement with this area. It is the organisational climate that creates the unique character of the company and determines the working environment, affecting the functioning of employees, including their engagement. The better the employees assess the climate in the organisation to be, the more they engage in their work (Bahrami, 2016; Tokarski and Oleksa-Marewska, 2019).

The organisational climate is a unique phenomenon, defined as a collection of insights and assessments made by employees regarding the organisational environment. It reflects the reception of a set of main characteristics of the organisation by its members. It can also be understood slightly more broadly as the social and psychosocial environment which is characteristic of the organisation (Jokanović et al., 2020). The concept of the organisational climate is based on the assumption that it can be evaluated based on individual employee opinions about the working environment. The organisational climate determines not only how employees perceive the prevailing atmosphere in the working environment, but also the organisation as a whole (Seren Intepeler et al., 2019). This reflects how employees feel in such an environment (Saleem, Liang and Perveen, 2018; Saleem and Perveen, 2019). It is what the individual feels and receives. It is a place for positive emotions and

experiences in relation to working conditions in the organisation, co-workers, supervisors and the content of work. Summarised insights on interlinked elements of HR policy, including practices, organisational procedures and observation of what is expected, supported and rewarded in the organisation, coalesce into a shared perception of the organisational climate constituting a collective assessment of the conditions and situation of the organisation (Schneider et al., 2017). The analysis of the relevant literature leads to the conclusion that this is an important factor which determines the various mechanisms of human functioning in work situations. It is possible to influence changes in the attitudes and behaviours of employees and the intensification thereof in the direction desired by the organisation through the organisational climate (Kang et al., 2016). It shapes the quality of working conditions, interpersonal communication, levels of conflict, job satisfaction, employee motivation, as well as their mental and physical health and well-being.

G.H. Litwin and R.A. Stringer (1968) identified the following components of the organisational climate: loyalty, effort, a sense of humour, appreciation, formalisation, the relevance of goals, quality, clarity, a remuneration system, control, pressure, centralisation, a management style, an appraisal system, superior support, structure, autonomy, employee responsibility, flexibility, disclosure of information, conflicts, team discussions, relationships with the superior and management, participation in decisions, friendly team relationships, risk, cooperation, trust, challenges, and team engagement. This concept was developed by D.A. Kolb et al., who adopted dimensions such as autonomy, trust, an appraisal system, pressure, control, centralisation, employee appreciation, reward, responsibility, participation in decisions, friendly team relationships, relationships with superiors, effort and challenges. At the same time, he

distinguished four new components, including tradition, freedom, organisational achievements and the “spirit of professionalism” (Kolb, Rubin and McIntyre, 1971). L. Rosenstiel and R. Bögel (1992) include the following dimensions of the organisational climate: relationships between employees (atmosphere, cooperation, kindness, trust, possible conflicts), the management style of superiors: employee-oriented (support, positive motivation and reward, participation in decision-making, taking care of team relationships) or task-oriented (rigid rules, procedures, focus on effects, control, required obedience), work organisation (conditions, division of tasks, matching responsibilities to competencies, the number of responsibilities), information flow and communication (clarity of objectives, reliability of information, awareness of the role performed), representing employees’ interests (protection of employees’ rights in terms of security and adequate remuneration) and development opportunities (motivation, promotion, a level of satisfaction, appreciation). A negative assessment of any of the identified factors contributes to decreased work efficiency, so assessment and action to improve the climate can not only contribute to improving the “well-being” of employees, but consequently increase the efficiency of work.

Research into the organisational climate has concerned, among others, its relationships with the sense of security at work (Stasiła-Sieradzka, Chudzicka-Czupała and Znajmiecka-Sikora, 2020) and readiness to undertake training and transformational leadership (Puni et al., 2022). The impact of climate on employees’ affective states and the likelihood of burnout (Oleksi-Marewska, 2020) and workaholism (Oleksi-Marewska, 2019) were confirmed. The appropriate organisational climate is related to improved organisational performance; it also contributes to lower levels of absenteeism and turnover (Wziątek-Staśko and Krawczyk-Antoniuk, 2021).

Furthermore, it plays an important role in the organisation's application of various age management practices, which in turn translate into employee satisfaction and engagement. If perceived by employees as positive, it also generates positive behaviour, helping to achieve individual and organisational goals. The favourable organisational climate creates a positive organisational identity and influences the willingness of employees to make more effort to achieve organisational goals, which can be associated with engagement (Köse, 2016). The most important factor is the freedom to express ideas, which, in the authors' opinion, brings benefits such as greater innovation and confidence in generating new solutions (Yusnita, Sunaryo and Notosudjono, 2020; Szczepańska-Woszczyna, 2014). The result of managers' concern for the organisational climate is an improvement in performance and productivity (Szczepańska-Woszczyna, 2020; Obeng et al., 2020; Manuaba, Sujana and Widnyana, 2020; Ahadiat and Dacko-Pikiewicz, 2020), because the assessment of the organisational climate by employees shapes their motivation to work (Kusmaningtyas, 2020).

The literature review leads to the conclusion that the organisational climate has an impact on a number of important areas of the organisation's functioning, especially directly on its human capital, including the behaviour and attitudes of employees. Previous studies have also attempted to establish the relationship between organisational climate and employee engagement (Marzec, 2015; Shuck, Adelson and Reio, 2017; Hadi et al., 2020; Peplińska et al., 2020; Arya and Sainy, 2017; Rożman and Štrukelj, 2021), but these analyses are fragmentary. Research has shown that the organisational climate shapes the identification of employees with the organisation, their dedication to it and the quality of their work. It has been shown that appropriate communication, team collaboration and the involvement of

employees in the decision-making process have the greatest impact on engagement. A. Köse (2016) showed a positive relationship between work engagement and the organisational climate when examining teachers. The author also confirmed the relationship between the perceived support of the organisation and the assessment of the organisational climate by employees. If the organisational climate is in line with the expectations of employees, it strengthens their identification with the organisation, and the positive perception of the climate stimulates the desired behaviour, including making efforts to achieve organisational goals. Similar results were obtained in research into the relationships between the organisational climate of six dimensions (transparency, standards, responsibility, flexibility, reward and recognition, and team engagement) with teachers' engagement in emotional, cognitive and behavioural work (Abun et al., 2021).

The research results show that the organisational climate largely determines the functioning of a person in the working situation. The results of the literature review did not definitively resolve the question of its role in shaping employee engagement. There are no coherent and comprehensive studies combining these issues, especially with regard to the specificities of the climate prevailing in international corporations.

The following research questions were posed:

- RQ1:** Is there a significant relationship between the organisational climate and employee engagement in international corporations?
- RQ2:** What are the relationships between the organisational climate and the individual components of work engagement and organisational engagement?
- RQ3:** Is it possible to indicate the dimensions of the organisational climate which are particularly important to work engagement and organisational engagement?

2. Methodology

The aim of the research is to identify the relationship between the organisational climate and employee engagement in international corporations.

The research was conducted among employees of international organisations with branches or subsidiaries in Poland, as well as Polish companies with their own organisational units abroad. The research involved employees at various organisational levels of the companies, which allowed for a wide spectrum of results. The sample was randomly selected in a nationwide research panel, and the sample size was $n = 835$, which is associated with an estimate error of 3.38%.

The statistical analysis utilised PS IMAGO PRO 7.0 (IBM SPSS STATISTICS 27.0). The developed research tool was subjected to statistical verification based on the reliability factor of Cronbach's alpha (α) and confirmatory factor analysis (CFA). When assessing the adequacy of the set of variables for factor analysis, the Kaiser-Mayer-Olkin measure (KMO) and Bartlett's test of sphericity were used. The study of the relationship between the organisational climate (and its individual dimensions) and both organisational engagement and work engagement was conducted based on linear regression analysis. The analysis of the distributions of individual variables (organisational climate and employee engagement) was conducted by means of basic descriptive statistics and tests used to compare the population (Student's t -test, Mann-Whitney test, Anov test, Kruskal-Wallis test) and pairwise testing (Pearson correlation coefficient r , Spearman rho test and tests of their significance).

The research was conducted on the basis of the CAWI (Computer Assisted Web Interview) online survey technique by means of a survey questionnaire as the research tool. The questionnaire consisted of 77 statements divided into two parts: 1) a questionnaire on work engagement and

organisational engagement, 2) a questionnaire on the organisational climate.

Employee engagement was examined in two dimensions, namely work engagement and organisational engagement (with the consent of the authors, a questionnaire prepared by M. Juchnowicz, H. Kinowska and E. Rypina was used):

- as part of the scale of organisational engagement, a sub-scale related to the following components was distinguished: cognitive engagement (ZOP) – three items, behavioural (ZOB) – seven items, and emotional (ZOE) – nine items. The reliability of each of these subscales is satisfactory – the Cronbach's alpha for ZOP is 0.712, for ZOB 0.833, and for ZOE 0.895. Also, the reliability of the overall organisational engagement scale (ZO, 19 items) is high – the Cronbach's alpha is 0.935;
- as part of the scale of work engagement, a sub-scale related to the following components was distinguished: cognitive (ZPP) – three items, behavioural (ZPB) – three items, and emotional (ZPE) – nine items. The reliability of each of these subscales is satisfactory – the Cronbach's alpha coefficient for ZPP is 0.647, for ZPB 0.810, and for ZPE 0.877. Also, the reliability of the overall organisational engagement scale is high – the Cronbach's alpha is 0.924.

The responses to the scale corresponded to the following evaluations: (1) definitely not, (2) no, (3) probably not, (4) neither yes nor no (difficult to say), (5) yes, to a certain extent, (6) yes, (7) definitely. The questionnaire contains five statements with a reverse scale.

The organisational climate was assessed on the basis of a questionnaire composed of 53 items divided into 10 dimensions. The inspiration of the research tool was the Multidimensional Inventory of Organisational Climate Measurement (WIPKO) by G. Wudarzewski (2019), in which the author identified nine dimensions of the organisational climate and their

individual components, and which was updated by Regina Bogaczyk based on publications from 2012-2021. The questionnaire also included a scale to study a sense of psychological security (proposed by A.C. Edmondson (2018) and translated by A. Glińska-Neweś, J. Górka and D. Lewicka) and the scale of work overload (Mazzetti et al., 2016). The method of measuring each item (a seven-point Likert scale) and the low degree of asymmetry of variables allows for the analysis of their distributions using not only percentages, but also mean average (M) and other statistics. The reliability of measurement for each of the 10 constructs within the organisational climate scale is satisfactory, and for most of them can even be described as high. The Cronbach's alpha exceeds 0.7, and only for the "F2" Flexibility" construct is Cronbach's alpha coefficient relatively low (0.601), albeit still acceptable. The results are as follows:

F1. Management – $\alpha\text{-C} = 0.938$,

F2. Flexibility – $\alpha\text{-C} = 0.601$

F3. Communication – $\alpha\text{-C} = 0.766$

F4. Relationships within the team – $\alpha\text{-C} = 0.805$

F5. Autonomy – $\alpha\text{-C} = 0.760$

F6. Rewards and motivation – $\alpha\text{-C} = 0.872$

F7. Organisation and nature of work – $\alpha\text{-C} = 0.867$

F8. Approach to diversity – $\alpha\text{-C} = 0.684$

F9. Sense of psychological security – $\alpha\text{-C} = 0.878$

F10. Work overload – $\alpha\text{-C} = 0.684$

The reliability of the overall organisational climate is also high – the Cronbach's alpha is 0.964.

The dependent variable in the research was employee engagement in work and in the organisation, while the organisational climate was adopted as an independent variable.

3. Results and Discussion

Assessment of the relationship between the organisational climate and employee engagement

The overall organisational climate (F) is indeed statistically related to organisational engagement, in each of its terms (Table 1).

Table 1. Correlation coefficients between subscales (dimensions) of organisational climate and employee engagement

	F	Sub-scales of the organisational climate									
		F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Total engagement	0.804**	0.695**	0.712**	0.693**	0.648**	0.750**	0.741**	0.789**	0.697**	0.569**	0.315**
Organisational engagement	0.797**	0.692**	0.704**	0.687**	0.647**	0.724**	0.728**	0.785**	0.686**	0.575**	0.325**
Work engagement	0.790**	0.679**	0.702**	0.681**	0.629**	0.767**	0.738**	0.769**	0.692**	0.541**	0.288**
Organisational engagement, cognitive component	0.671**	0.582**	0.627**	0.664**	0.523**	0.590**	0.569**	0.693**	0.589**	0.471**	0.228**
Organisational engagement, behavioural component	0.747**	0.658**	0.694**	0.636**	0.595**	0.700**	0.691**	0.732**	0.646**	0.509**	0.261**

	F	Sub-scales of the organisational climate									
		F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Organisational en- gagement, emotional component	0.755**	0.649**	0.632**	0.633**	0.629**	0.677**	0.697**	0.737**	0.646**	0.571**	0.355**
Work engagement, cognitive component	0.748**	0.634**	0.692**	0.671**	0.579**	0.727**	0.720**	0.726**	0.663**	0.489**	0.246**
Work engagement, be- havioural component	0.745**	0.644**	0.677**	0.624**	0.582**	0.773**	0.682**	0.701**	0.660**	0.503**	0.206**
Work engagement, emotional component	0.719**	0.621**	0.616**	0.617**	0.586**	0.668**	0.668**	0.716**	0.622**	0.509**	0.314**

Source: based on research. **** $p < 0.001$; p – probability in Pearson's linear correlation coefficient significance test

Values of correlation coefficients between engagement measured as an average assessment of individual aspects show a strong positive correlation with the organisational climate – the correlation coefficients are high and statistically significant (Table 1). This means that engagement (overall organisational and work engagement – in all components) is higher for those employees whose overall assessment of the organisational climate is higher. The strongest link between engagement is observed in relation to the organisation and nature of work (F7), autonomy (F5), as well as rewards and motivation (F6) and flexibility (F2). Employee engagement is relatively least (albeit positively, moderately strongly and statistically) related

to a sense of psychological security (F9). This is especially true in relation to cognitive organisational and work engagement, although for other components the strength of the relationship is only slightly higher. The work overload, which is beyond the scale of the organisational climate, is also statistically significantly linked to employee engagement, although the correlation coefficients here are approx. 0.2-0.3, which indicates a weak effect size. However, the employees of multinational corporations who rate the work overload higher (meaning they experience it to a lesser extent) are, on average, more engaged.

The results indicate that the dimensions F1, F2, F5, F6, F7 and F9 (Table 2) play an important role.

Table 2. Dimensions of the organisational climate and total employee engagement

Explanatory variables	B	BETA	p	VIF
Constant	0.648		<0.001**	
F1. Management	-0.075	-0.089	0.034*	4.647
F2. Flexibility	0.108	0.106	0.004**	3.567
F5. Autonomy	0.158	0.192	<0.001**	4.229
F6. Rewards and motivation	0.177	0.219	<0.001**	4.685
F7. Organisation and nature of work	0.366	0.384	<0.001**	3.882
F9. Sense of psychological security	0.114	0.107	<0.001**	1.829
ANOVA		F(6; 828) = 298.9; $p < 0.001$ **		

Explanatory variables	B	BETA	p	VIF
R ²		0.684		
Corrected R ²		0.682		

Source: based on research. B – regression coefficient from the sample, BETA – standardised regression coefficient, p – probability in the Student t-test or ANOVA, VIF – variance inflation factor

Employee engagement is, *ceteris paribus*, higher when the organisational climate is at a higher level in terms of flexibility, autonomy, rewards and motivation, organisation and nature of work and the sense of psychological security ($B > 0$) and, perhaps surprisingly, the level of “management” is lower. In contrast, the impact of communication (F3), relationships within the team (F4), the approach to diversity (F8) and work overload (F10) is weaker (although not statistically significantly) compared to the above dimensions. While each of the dimensions of the organisational climate is important for building engagement, by juxtaposing their impact together, it turns out that engagement changes significantly if flexibility, autonomy, rewards and motivation, the organisation and nature of work, and psychological security are at a higher level, and if management is at a lower level. The organisation and nature of work (BETA = 0.384), followed by rewards and

motivation (BETA = 0.219) and autonomy (BETA = 0.192) are testament to the fact that the development of solutions that stimulate the building of the organisational climate in these dimensions is the most important factor in building employee engagement. The six dimensions of the organisational climate explained the variability of employee engagement to a significant extent (68.4%).

Organisational engagement

Linear regression analysis confirms a significant positive relationship between the organisational climate and employee engagement in the organisation (Table 3). An organisational climate rating which is higher by one point corresponds to an assessment of organisational engagement which is higher by an average of 0.853 points (on a seven-point scale). The organisational climate significantly explains the development of employee engagement in the organisation (63.5% thereof).

Table 3. Organisational climate and employee engagement in the organisation

Explanatory variables	B	BETA	p
Constant	0.608		
Total organisational climate	0.853	0.797	<0.001**
ANOVA		F(1; 833) = 1450.0; p < 0.001**	
R ²		0.635	
Corrected R ²		0.635	

Source: based on research. B – regression coefficient from the sample, BETA – standardised regression coefficient, p – probability in the Student t-test or ANOVA, VIF – variance inflation factor

Taking into account the different dimensions of the organisational climate (F1-F9) and the work overload (F10), the dimensions F2, F5, F6, F7 and F9 (Table 4) play an

important role in organisational engagement. The higher the organisational climate in terms of flexibility, autonomy, rewards and motivation, the organisation and nature of

work and a sense of psychological security (in comparison with the above dimensions, the impact of communication, team relations, approach to diversity, and work overload are insignificant, but management is as well), the higher the level of employee engagement in the organisation, *ceteris paribus*. The organisation and nature of work are the most important in this regard (BETA = 0.405). The importance of rewards and motivation is more than twice as weak (BETA = 0.183). This time autonomy plays a weaker role (BETA = 0.099) than a sense of psychological security and flexibility. The five dimensions of the organisational climate explain 66.8% of the variability of organisational engagement.

Table 4. Organisational climate and employee engagement in the organisation

Explanatory variables	B	BETA	p	VIF
Constant	0.670		<0.001**	
F2. Flexibility	0.111	0.111	0.003**	3.449
F5. Autonomy	0.080	0.099	0.016*	4.143
F6. Rewards and motivation	0.145	0.183	<0.001**	3.819
F7. Organisation and nature of work	0.379	0.405	<0.001**	3.865
F9. Sense of psychological security	0.121	0.116	<0.001**	1.697
ANOVA	F(5; 829) = 332.9; p < 0.001**			
R ²		0.668		
Corrected R ²		0.666		

Source: based on research. B – regression coefficient from the sample, BETA – standardised regression coefficient, p – probability in the Student t-test or ANOVA, VIF – variance inflation factor

The results also confirm the importance of the organisational climate for the different components of organisational engagement (Table 5). Organisational engagement in cognitive, behavioural and emotional terms is higher when the assessment of the organisational climate is higher (an increase in the assessment of the organisational climate by one point is related to the fact that cognitive organisational engagement is higher by an average of 0.714 points, behavioural engagement is higher by an average of 0.849 points, and emotional engagement is higher by an average of 0.903 points).

Table 5. Organisational climate and employee engagement in the organisation – cognitive, behavioural and emotional components

Explanatory variables	B	BETA	p
Cognitive component			
Constant	1.775		<0.001**
Total organisational climate	0.714	0.617	<0.001**
ANOVA	F(1; 833) = 681.5; p < 0.001**		
R ²		0.450	

Explanatory variables	B	BETA	p
Corrected R ²		0.449	
Behavioural component			
Constant	0.582		<0.001**
Total organisational climate	0.849	0.747	<0.001**
ANOVA		F(1; 833) = 1053.1; p < 0.001**	
R ²		0.558	
Corrected R ²		0.558	
Emotional component			
Constant	0.239		0.073
Total organisational climate	0.903	0.755	<0.001**
ANOVA		F(1; 833) = 1107.6; p < 0.001**	
R ²		0.571	
Corrected R ²		0.570	

Source: based on research. B – regression coefficient from the sample, BETA – standardised regression coefficient, p – probability in the Student t-test or ANOVA, VIF – variance inflation factor

By comparing BETA standardised coefficients as well as the coefficients of determination, it can be concluded that the organisational climate has the greatest impact on the emotional dimension of organisational engagement.

Work engagement

Linear regression analysis confirms a positive significant relationship between the

organisational climate and work engagement (Table 6). An assessment of the organisational climate which is higher by 1 point corresponds to an assessment of work engagement being higher by an average of 0.913 points (on a seven-point scale). The organisational climate explains the development of work engagement of employees in international corporations to a significant extent, namely 62.4%.

Table 6. Organisational climate and work engagement

Explanatory variables	B	BETA	p
Constant	0.335		
Total organisational climate	0.913	0.790	<0.001**
ANOVA		F(1; 833) = 1382.7; p < 0.001**	
R ²		0.624	
Corrected R ²		0.624	

Source: based on research. B – regression coefficient from the sample, BETA – standardised regression coefficient, p – probability in the Student t-test or ANOVA, VIF – variance inflation factor

Taking into account the different dimensions of the organisational climate and work overload, the dimensions F1, F2, F5,

F6, F7 and F9 (Table 7) play an important role in work engagement. The higher the organisational climate in terms of flexibility,

autonomy, rewards and motivation, the organisation and nature of work and the sense of psychological security, the higher work engagement is, *ceteris paribus*, and the higher “management” is (compared to the above dimensions, the impact of communication, team relations, approach to diversity, and work overload is again weaker, i.e. statistically insignificant), the lower the level of work engagement, *ceteris paribus*. The two dimensions of the organisational climate – the organisation and nature of work (BETA = 0.333) and autonomy (BETA = 0.319) – play

the most important role in this case, followed by rewards and motivation (BETA = 0.232). The development of solutions to support the development of the organisational climate in these three areas can contribute most to increasing the work engagement of employees in international corporations. The importance of a sense of psychological security (BETA = 0.074) and flexibility (BETA = 0.080) is weaker in this case. The six dimensions of the organisational climate are explained by the variability of work engagement to a significant extent – 67.4%.

Table 7. Organisational climate and work engagement

Explanatory variables	B	BETA	p	VIF
Constant	0.616		<0.001**	
F1. Management	-0.123	-0.138	0.001**	4.647
F2. Flexibility	0.086	0.080	0.033*	3.567
F5. Autonomy	0.278	0.319	<0.001**	4.299
F6. Rewards and motivation	0.198	0.232	<0.001**	4.685
F7. Organisation and nature of work	0.338	0.333	<0.001**	3.882
F9. Sense of psychological security	0.083	0.074	0.006**	1.829
ANOVA	F(6; 828) = 285.6; p < 0.001**			
R ²	0.674			
Corrected R ²	0.672			

Source: based on research. B – regression coefficient from the sample, BETA – standardised regression coefficient, p – probability in the Student t-test or ANOVA, VIF – variance inflation factor

The importance of the organisational climate is also confirmed in terms of different components of work engagement (Table 8).

Table 8. Organisational climate and work engagement – cognitive component

Explanatory variables	B	BETA	p
Cognitive component			
Constant	0.934		<0.001**
Total organisational climate	0.831	0.748	<0.001**
ANOVA	F(1; 833) = 1055.4; p < 0.001**		
R ²		0.559	
Corrected R ²		0.558	
Behavioural component			
Constant	0.140		0.146
Total organisational climate	0.956	0.745	<0.001**
ANOVA	F(1; 833) = 1037.4; p < 0.001**		
R ²		0.555	
Corrected R ²		0.554	
Emotional component			
Constant	0.094		0.544
Total organisational climate	0.937	0.719	<0.001**
ANOVA	F(1; 833) = 892.4; p < 0.001**		
R ²		0.517	
Corrected R ²		0.517	

Source: based on research. B – regression coefficient from the sample, BETA – standardised regression coefficient, p – probability in the Student t-test or ANOVA, VIF – variance inflation factor

From the cognitive, behavioural and emotional perspectives, work engagement is higher when the assessment of the organisational climate is as well. An increase in the assessment of the organisational climate by one point is associated with the fact that cognitive work engagement is higher by an average of 0.831 points, behavioural engagement is higher by an average of 0.956 points, and emotional engagement is higher by an average of 0.937 points. At the same time, the organisational climate has the greatest impact on behavioural work engagement.

In the analysis of the above results, particular attention is paid to the adverse impact (the regression coefficient is negative) of the dimension of management on

total engagement and work engagement. It could be assumed that a positive relationship with one's superior, including his or her management style, support, knowledge of requirements and trust, should translate into greater employee engagement. However, it turns out that although a higher assessment of management as a climate dimension is associated with a higher level of organisational engagement, work engagement and overall engagement (correlation coefficients are high and statistically significant), if the impact of all dimensions together (regression analysis) is analysed, the dimension of management shows the opposite impact on the overall level of employee engagement and work engagement.

An explanation in terms of statistical analysis may be the strong correlation of this subscale with the others because the importance of management also fits into other dimensions, such as rewards and motivation, autonomy, flexibility or communication. The following dimensions have also been found to have a less significant impact on employee engagement: communication, team relationships, and an approach to diversity.

Conclusions

The results of the empirical research clearly showed a strong positive relationship between the organisational climate and organisational and work engagement. This relationship is approximately linear, which means that employees who positively assess the organisational climate are more engaged in both work and the organisation. The high value of the coefficient of determination ($R^2 = 0.647$) indicates that the organisational climate explains overall employee engagement to a significant extent (approx. 65%), and it explains 63.5% of employee engagement in the organisation and 62.4% of work engagement.

Work engagement from the cognitive, behavioural and emotional perspectives is higher when the assessment of the organisational climate is higher. At the same time, the organisational climate has the greatest impact on the behavioural dimension of work engagement. Similarly, organisational engagement from cognitive, behavioural and emotional perspectives is higher when the assessment of all dimensions of the organisational climate is more positive, with the strongest relationship being that between the climate and the emotional component of organisational engagement.

The dimensions of the organisational climate that are most closely related to overall employee engagement can be identified, namely the organisation and nature of work,

autonomy, rewards and motivation, flexibility, a sense of psychological security and management.

Although each of the dimensions of the organisational climate is important for building engagement (as indicated by the individual values of the correlation coefficient), when their collective impact is considered, it turns out that engagement (in total) is higher if dimensions such as the organisation and nature of work (BETA = 0.384), rewards and motivation (BETA = 0.219), autonomy (BETA = 0.192), flexibility (BETA = 0.106), and a sense of psychological security (BETA = 0.107), are assessed lower, but also if the management dimension is assessed lower as well (BETA = -0.089).

The higher employee engagement in the organisation is, the better the organisational climate in terms of flexibility (BETA = 0.111), autonomy (BETA = 0.099), rewards and motivation (BETA = 0.183), the organisation and nature of work (BETA = 0.405) and the sense of psychological security (BETA = 0.116). In turn, the higher work engagement is, the better the organisational climate is assessed in terms of the organisation and the nature of work (BETA = 0.333), autonomy (BETA = 0.319), rewards and motivation (BETA = 0.232), flexibility (BETA = 0.080), and the sense of psychological security (BETA = 0.074); but also, as in the case of total engagement, if the dimension of management is lower (BETA = -0.138)*.

A deeper knowledge of the importance of the organisational climate in building employee engagement should translate into the selection of appropriate ways of shaping it. The proper identification of the prevailing climate provides knowledge of crucial areas identified by employees, and corrective actions taken can contribute to improving the comfort of employees, and consequently improve the functioning of the company. It is therefore worth searching for opportunities to influence engagement through the organisational climate.

References

- AARP Global Employee Survey (2022), OECD, Retaining Talent at All Ages, Ageing and Employment Policies, Retrieved from: <https://www.oecd.org/employment/retaining-talent-at-all-ages-00dbdd06-en.htm> (accessed: 26.05.2022).
- Abun, D., Menor, R. I., Catabagan, N. C., Magallanes, T., Ranay, F. B. (2021), Organizational climate and work engagement of employees of divine word colleges in Ilocos Region, Philippines, *International Journal of Research in Business and Social Science*, 10(1), 107-121.
- Ahadiat, A., Dacko-Pikiewicz, Z. (2020), Effects of ethical leadership and employee commitment on employees' work passion. *Polish Journal of Management Studies*, 21(2), 24-35.
- Anthony-McMann, P. E., Ellinger, A. D., Astakhova, M., Halbesleben, J. R. (2017), Exploring different operationalizations of employee engagement and their relationships with workplace stress and burnout, *Human Resource Development Quarterly*, 28(2), 163-195.
- Arya, R., Sainy, M. (2017), To study the impact of organizational climate on employee engagement in the banking sector with special reference to state bank of India, Indore, *Prestige e-Journal of Management and Research*, 4(1), 64-81.
- Bahrami, M. A., Barati, O., Ghoroghchian, M. S., Montazer-Alfaraj, R., Ezzatabadi, M. R. (2016), Role of organizational climate in organizational commitment: The case of teaching hospitals. *Osong public health and research perspectives*, 7(2), 96-100.
- Bailey, C., Madden, A., Alfes, K., Fletcher, L. (2017), The meaning, antecedents and outcomes of employee engagement: A narrative synthesis, *International journal of management reviews*, 19(1), 31-53.
- Borkowska, S. (2009), Human Resource Management and Innovation in the Business Organization. *Zarządzanie Zasobami Ludzkimi*, 2(67), 9-29.
- Caulfield, J. L., Senger, A. (2017), Perception is reality: Change leadership and work engagement. *Leadership & Organization Development Journal*, 38(7), 927-945.
- Chałupczak, M., Bugaj, J. M. (2020), Wyzwania zaangażowania organizacyjnego – wymiary modelu badawczego.
- Chusmir, L. H. (1988), An integrative process model of organizational commitment for working women and men, *Journal of Business and Psychology*, 3, 88-104.
- Cropanzano, R., Anthony, E. L., Daniels, S. R., & Hall, A. V. (2017), Social exchange theory: A critical review with theoretical remedies, *Academy of management annals*, 11(1), 479-516.
- Deszczyński, B. (2018), Empowerment pracowników w przedsiębiorstwach branży usług biznesowych, *Studia Oeconomica Posnaniensia*, 6(4).
- Edmondson, A. C. (2018), The fearless organization: Creating psychological safety in the workplace for learning, innovation, and growth. John Wiley & Sons.
- Extended Tools, The Great Unknown. Zarządzanie ludźmi w dobie pandemii, nowych modeli pracy oraz Great Resignation, Retrieved from: <https://lp.extended.tools/raporty-o-trendach>, (accessed 20.04.2023).
- Gaertner, K. N., Nollen, S. D. (1989), Career experiences, perceptions of employment practices, and psychological commitment to the organization, *Human relations*, 42(11), 975-991.
- Gerards, R., de Grip, A., Baudewijns, C. (2018), Do new ways of working increase work engagement?, *Personnel Review*, 47(2), 517-534.
- Griffin, R. (2021), Fundamentals of management. Cengage Learning.
- Hadi, S., Tjahjono, H. K., El Qadri, Z. M., & Prajogo, W. (2020), The influence of organizational justice and positive organizational behavior: systematic review and call for future research, *The Journal of Social Sciences Research*, 6(1), 67-84.
- Haffer, J., Haffer, R. (2018), Osobiste a zespołowe zaangażowanie w pracę, *Organizacja i Kierowanie*, 3 (182), 49-76.

- Imran, M. Y., Elahi, N. S., Abid, G., Ashfaq, F., & Ilyas, S. (2020), Impact of perceived organizational support on work engagement: Mediating mechanism of thriving and flourishing, *Journal of Open Innovation: Technology, Market, and Complexity*, 6(3), 82.
- Jokanović, B., Zivlak, N., Okanović, A., Čulibrk, J., & Duđak, L. (2020), The model of knowledge management based on organizational climate, *Sustainability*, 12(8), 3273.
- Juchnowicz, M. (2010), Zarządzanie kapitałem ludzkim a poziom zaangażowania pracowników, *Zarządzanie Zasobami Ludzkimi*, 1(3-4), 57-66.
- Juchnowicz, M. (2017), Organizacja samoangażująca w realiach polskich, *Edukacja Ekonomistów i Menedżerów*, 45(3), 11-22.
- Kahn, W. A. (1990), Psychological conditions of personal engagement and disengagement at work, *Academy of management journal*, 33(4), 692-724.
- Kang, J. H., Matusik, J. G., Kim, T. Y., & Phillips, J. M. (2016), Interactive effects of multiple organizational climates on employee innovative behavior in entrepreneurial firms: A cross-level investigation, *Journal of Business Venturing*, 31(6), 628-642.
- Kawka, T. (2017), Zaangażowanie i partycypacja finansowa – fundamenty kształtowania wysokiej motywacji pracowników we współczesnej przestrzeni organizacyjnej, *Edukacja Ekonomistów i Menedżerów*, 43(1), 27-39.
- Kobylińska, U., Majewski, P. (2023), Kulturowe aspekty partycypacji – ujęcie teoretyczne, *Zarządzanie Zasobami Ludzkimi*, 150(1), 94-111.
- Kolb, D. A., Rubin, I.M., McIntyre, J. M. (1971). *Organizational psychology: an experimental approach*, Prentice Hall, Englewood Cliffs.
- Korczyk, J. (2019), Kreowanie zaangażowania pracowników poprzez wolontariat, *Zeszyty Naukowe Wyższej Szkoły Ekonomii i Informatyki w Krakowie*, (15), 79-101.
- Köse, A. (2016), The Relationship between Work Engagement Behavior and Perceived Organizational Support and Organizational Climate, *Journal of Education and Practice*, 7(27), 42-52.
- Kupczyk, T., Pietrakowski, P. (2018), Czynniki zaangażowania pracowników jako determinanty zmian w zarządzaniu zasobami ludzkimi, *Przedsiębiorczość i Zarządzanie*, 19(10).
- Kurtessis, J. N., Eisenberger, R., Ford, M. T., Buffardi, L. C., Stewart, K. A., Adis, C. S. (2017), Perceived organizational support: A meta-analytic evaluation of organizational support theory, *Journal of management*, 43(6), 1854-1884.
- Kusmaningtyas, A. (2020), The Influence of Transformational Leadership, Organizational Climate, and Job Stress on Competence, Work Motivation, and Performance. In 17th International Symposium on Management (INSYMA 2020), 115-119.
- Lewicka, D., Krot, K. (2015), The model of HRM-trust-commitment relationships, *Industrial Management & Data Systems*, 115(8), 1457-1480.
- Lewicka, D., Pec, M. (2018), The impact of human resources management on job involvement, The mediating role of vertical trust, *Folia Oeconomica Stetinensia*, 18(2), 34-45.
- Listwan, T., Pocztowski, A., & Stor, M. (2016), Managing human resources in Poland, Managing human resources in Central and Eastern Europe, 90-131.
- Litwin, G.H., Stringer, R.A. (1968), Motivation and organizational climate, division of research.
- Łaguna, M., Mielniczuk, E., Żaliński, A., Wałachowska, K. (2015), Przywiązanie do organizacji i zaangażowanie w pracę – koncepcje teoretyczne i problemy terminologiczne, *Medycyna Pracy*, 66(2), 277-284.
- Macey, W. H., Schneider, B. (2008), The meaning of employee engagement, *Industrial and organizational Psychology*, 1(1), 3-30.
- Machaczka, K., & Stopa, M. (2022). The influence of remote work in particular during the Covid-19 pandemic on changes in human behaviour patterns within organisations. *International Entrepreneurship Review*, 8(2), 67-78. <https://doi.org/10.15678/IER.2022.0802.05>
- Mafini, C. (2016). The contribution of organisational climate to employee well-being, *Journal of Applied business research (JABR)*, 32(4), 1157-1168.

- Manuaba, I. B. P., Sujana, I. W., & Widnyana, I. W. (2020), Influence of leadership and organizational climate on employee performance with job satisfaction as intervening variable at Denpasar National Polytechnic, *International Journal of Contemporary Research and Review*, 11(01), 21718-21728.
- Marek, A. (2018), Zarządzanie talentami w świetle teorii przywództwa służebnego, *Nowoczesne Systemy Zarządzania. Modern Management Systems*, (1), 27-37.
- Marzec, I. (2015), Rola klimatu organizacyjnego w kształtowaniu zaangażowania pracowników ośrodków pomocy społecznej na Śląsku, *Studia Ekonomiczne*, 232, 146-155.
- Mazzetti, G., Schaufeli, W. B., Guglielmi, D., Depolo, M. (2016), Overwork climate scale: Psychometric properties and relationships with working hard, *Journal of Managerial Psychology*, 31(4), 880-896.
- Meyer, J. P., Allen, N. J. (1991). A three-component conceptualization of organizational commitment, *Human resource management review*, 1(1), 61-89.
- Murthy, R. K. (2017). Perceived organizational support and work engagement, *International Journal of Advanced Educational Research*, 2(3), 72-74.
- Obeng, A. F., Quansah, P. E., Cobbinah, E., Danso, S. A. (2020), Organizational climate and employee performance: Examining the mediating role of organizational commitment and moderating role of perceived organizational support, *International Journal of Human Resource Studies*, 10(3).
- Oleksi-Marewska, K. (2020), Organizational climate as a mediating factor between occupational stress and prosocial organizational behaviours in knowledge-based organizations.
- Oleksi-Marewska, K. (2019), Związek między klimatem organizacyjnym a występowaniem zjawiska pracoholizmu w przedsiębiorstwach zatrudniających pracowników wiedzy, *Edukacja Ekonomistów i Menedżerów*, 51(1), 69-79.
- Pec, M., Lewicka, D. (2022), Zaangażowanie pracowników a przywiązanie organizacyjne – próba usystematyzowania pojęć, *Organization and Management*, 191(2), 157-171.
- Peplińska, A., Kawalec, K., Godlewska-Werner, D., & Połomski, P. (2020), Work Engagement, Organizational Commitment and the Work Satisfaction of Tax Administration Employees: The Intermediary Role of Organizational Climate and Silence in the Organizations, *Human Resource Management/Zarządzanie Zasobami Ludzkimi*.
- Pollak, A., Chrupała-Pniak, M., Rudnicka, P., Paliga, M. (2017), Work engagement-A systematic review of polish research.
- Puni, A., Hilton, S. K., Mohammed, I., & Korankye, E. S. (2022), The mediating role of innovative climate on the relationship between transformational leadership and firm performance in developing countries: the case of Ghana, *Leadership & Organization Development Journal*, 43(3), 404-421.
- Putsom, W., Sattayawaksakul, D. (2019), The relationship of perceived organizational support and organizational commitment to well-being as mediated by job satisfaction in not-for-profit organization, *Journal of Business, Governance, and Information Technology*, 1(1), 16-29.
- Rosenstiel, L., Bögel, R. (1992), Betriebsklima geht jeden an, Bayerischen Staatsministerium für Arbeit, Familie und Sozialordnung, Monachium.
- Rożman, M., & Štrukelj, T. (2021), Organisational climate components and their impact on work engagement of employees in medium-sized organisations, *Economic Research-Ekonomska Istraživanja*, 34(1), 775-806.
- Rożman, M., Treven, S., Mulej, M., & Čančer, V. (2019), Creating a healthy working environment for older employees as part of social responsibility, *Kybernetes*, 48(5), 1045-1059.
- Saleem, M., Liang, Z. J., & Perveen, N. (2018), The Role of Organizational Climate and Its Impact on Industrial Turnover, *Human Resource Management Research*, 8(1).
- Saleem, M., & Perveen, N. (2019), Organizational climate and its impact on firm financial performance, *J. Hum. Resour. Manag.*, 1, 47-60.

- Schneider, B., González-Romá, V., Ostroff, C., & West, M. A. (2017), Organizational climate and culture: Reflections on the history of the constructs in the Journal of Applied Psychology, *Journal of applied psychology*, 102(3), 468.
- Seren Intepeler, S., Esrefgil, G., Yilmazmis, F., Bengu, N., Gunes Dinc, N., Ileri, S., & Dirik, H. F. (2019), Role of job satisfaction and work environment on the organizational commitment of nurses: a cross-sectional study, *Contemporary nurse*, 55(4-5), 380-390.
- Shuck, B., Adelson, J. L., & Reio Jr, T. G. (2017), The employee engagement scale: Initial evidence for construct validity and implications for theory and practice, *Human Resource Management*, 56(6), 953-977.
- Sobocka-Szczapa, H. (2017), Culture of the Organization and Motivating Employees, *Przedsiębiorczość i Zarządzanie*, 18(1.2), 61-72.
- Stankiewicz, J., Łychmus, P., and Bortnowska, H. (2019), Autonomous teams as a way to increase the engagement of nonprofit members (case study), *Management*, 23(1).
- Stasiła-Sieradzka, M., Chudzicka-Czupała, A., Znajmiecka-Sikora, M. (2020), Work safety climate. Comparison of selected occupational groups, *PLoS one*, 15(12), e0243056.
- Sun, L., Bunchapattanasakda, C. (2019), Employee engagement: A literature review, *International Journal of Human Resource Studies*, 9(1), 63-80.
- Szczepańska-Woszczyzna, K. (2014), The importance of organizational culture for innovation in the company. *Forum Scientiae Oeconomica* 2(3), 27-39.
- Szczepańska-Woszczyzna, K. (2020), Management theory, innovation, and organisation: A model of managerial competencies. Routledge.
- Thai, Q.H., & Mai, K.N. (2023). An evolution of entrepreneurial culture studies: A systematic literature review and future research agenda. *Entrepreneurial Business and Economics Review*, 11(2), 31-62. <https://doi.org/10.15678/EBER.2023.110202>
- Zbierowski, P., & Gojny-Zbierowska, M. (2022). Talented enough to be a business leader? An alternative approach to entrepreneurs' traits. *Entrepreneurial Business and Economics Review*, 10(1), 175-187. <https://doi.org/10.15678/EBER.2022.100112>
- Tokarski, S., & Oleksa-Marewska, K. (2019), The importance of organisational climate and commitment of knowledge workers for increasing the competitive advantage of enterprises, *WSB Journal of Business and Finance*, 53(1), 13-21.
- Victor, J., Hoole, C. (2017), The influence of organisational rewards on workplace trust and work engagement, *SA Journal of Human Resource Management*, 15(1), 1-14.
- Viitala, R., Tanskanen, J., & Sääntti, R. (2015), The connection between organizational climate and well-being at work, *International Journal of Organizational Analysis*, 23(4), 606-620.
- Waligóra, Ł. (2018), Dimensions of engagement of employees. Review of tests, *World Scientific News*, (112), 96-106.
- Wang, X., Liu, L., Zou, F., Hao, J., & Wu, H. (2017), Associations of occupational stressors, perceived organizational support, and psychological capital with work engagement among Chinese female nurses, *BioMed research international*, 2017.
- Zbierowski, P., & Gojny-Zbierowska, M. (2022). Talented enough to be a business leader? An alternative approach to entrepreneurs' traits. *Entrepreneurial Business and Economics Review*, 10(1), 175-187. <https://doi.org/10.15678/EBER.2022.100112>

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Changes in Cargo Transport in the European Union in the Face of the COVID-19 Pandemic

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Abstract

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A major shift has been observed recently in the transport industry due in no small part to the COVID-19 pandemic. The purpose of this paper was to determine the changes that occurred on the cargo transport market during that period. In order to examine these changes, an analysis of which mode of transport was most popular in the European Union during 2019-2021 was conducted. For this purpose, a comparative analysis of secondary data which demonstrated whether the proportions of specific modes of transport in the overall volume of cargo shipments were similar before the declaration of the COVID-19 pandemic and during the time when the pandemic unfolded was carried out. The results of the study confirmed the prevalence of road transport, and the market position of that mode of transport was further strengthened during the pandemic. The review further covered the shifts in the proportions of the specific modes of transport in the EU member states during the study period. The review established that these shifts were comparable across all the member states, even though the most dramatic change occurred with regard to road transport. Finally, a linear regression model was developed to investigate whether a linear relationship exists between the volume of cargo shipments undertaken by means of road transport and the external and internal factors defined in the literature on the subject as having had the greatest impact on the transport services market.

Key words

transport, cargo transport in the European Union, COVID-19 pandemic.

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Introduction

The paper takes up the subject of cargo transport in the European Union immediately after the declaration of the COVID-19 pandemic and during the

subsequent period of that pandemic. The majority of the existing body of research published during that period and relating to the subject matter of this study focused on the presentation of the situation in air and sea transport in Asian countries. The authors of this paper, on the other hand, intended to present the changes that occurred in all modes of cargo transport in specific European Union member states. Not only did the study demonstrate the restructuring of cargo transport in the European Union, but it also identified the mode of transport which underwent the most rapid transformation. In addition, the authors decided to examine whether a statistically significant linear relationship existed between the external and internal factors defined in the literature as having had the greatest impact on cargo transport before the pandemic. These statistics were developed for one of the most popular European modes of transport, namely road transport.

1. Literature review

Transport means the movement of people or cargo from a starting point to a destination using adequate means of transport for the specific modes of transport. In light of the subject matter of this article, special attention is paid further in the paper to one type of transport, specifically cargo transport, which plays an important part in the economy (Pawlak, 2015; Sośniak and Szkutnik, 2020) as it stimulates economic growth. At the same time, it should be noted that economic growth strongly affects cargo transport as well (Kulpa, 2009). What can be inferred from the above is that any changes affecting the economy are also relevant to transport, while any disruptions to transport processes determine the economic situation. Hence, it should be noted at this point that

the relationship between transport and economic growth is multifaceted, complex, and dynamic, shifting along with the changes that take place in the more or less distant environment (Bernacki, 2010). Demand for transport services is therefore not only formed on the national level but also on the European (Suproń, 2016) and global levels.

In addition to the prevailing economic situation, there are other factors influencing the demand for transport services as well. Among all the determinants of transport services, external, internal and institutional factors are mentioned (Pawłowska, 2009; Pawłowska, 2015). External factors obviously include factors originating from outside the transport sector. In this case, one should primarily mention the fuel and energy market (Kozłowski et al., 2016; Dieaconescu et al., 2022), the aforementioned condition of the economy, demographic changes, technological changes and social changes (Kulińska et al., 2018; Grondys et al., 2021). The factors from inside the transport sector include the changes occurring within the infrastructure (Banerjee et al., 2020; Gnap et al., 2021; Daroń, 2022) as well as the changes in the technologies employed in transport (e.g. in vehicles, fuels, infrastructure facilities, etc.). Institutional factors, on the other hand, are the drivers of transport business decisions as well as the development of the transport sector stemming from the policies pursued (Pawłowska, 2015; Berg, 2017).

The empirical part of the article focuses on the external and internal growth factors applicable to transport. Taking the aforementioned areas of influence into account, secondary EUROSTAT data were reviewed. This was followed by the selection of quantitative data which best represent the studied area of influence. Consequently, a list was produced which is presented in Table 1.

Table 1. Groups of external and internal factors determining the market for transport services with corresponding quantitative variables defining the specific areas of influence

Specification of factors	Area of influence of the specific group of factors	Numerical data representing the area of influence of the specific group of factors
External factors	Fuel and energy market	• Oil and oil products supplied to the domestic market; • Petrol stocks; • Diesel stocks.
	State of the economy	• Gross Domestic Product (GDP); • GDP per capita; • Harmonised Index of Consumer Prices (HICP);
	Demographic changes	• Total fertility rate; • Crude death rate.
	Technology changes	• Research and development expenditure, in million €; • Research and development expenditure, in € per capita; • Internet access in households.
	Social changes	• Population; • Unemployment rate.
Internal factors	Transport infrastructures (differ by mode of transport)	• Length of railway lines; • Length of motorways.
	Volume of shipments (differs by mode of transport)	• Cargo transport by rail; • Road transport of cargo; • Inland waterway cargo transport; • Cargo transport by sea; • Cargo and mail transport by air.

Source: own research

The data presented in Table 1 were used to estimate the linear regression model. 13 different data types were allocated to external transport determinants, while seven types of quantitative data were distinguished among the internal drivers. The areas of influence identified could be described with a higher volume of numerical data. However, the authors of the article placed emphasis on the completeness of the selected data and on the data referring to the 2013-2021 perspective.

Two events had the greatest impact on the cargo transport sector during the last

two decades. The first of these was the global economic crisis on the financial and banking markets, which peaked during 2008-2009 (Kłos, 2009) and which greatly affected the global economy, thus having an impact on the condition of the transport industry. The other occurrence that had a significant impact on cargo transport service providers was the COVID-19 pandemic (Nundy et al., 2021; Zhang et al., 2021; Mofijur et al., 2021), declared by the World Health Organization (WHO) on 11 March 2020. For a certain time, the pandemic led to a partial shutdown of the economies of

many countries (Gomes and Lopes, 2022; Ahmed et al., 2020), disrupting mobility and transport (Rovňák et al., 2022) and bringing about significant changes on the freight transport market (Łacka and Suproń, 2021).

Since 2020, research papers have begun to mention the impact the pandemic has had on transport. Initially, researchers from various parts of the world would focused on analysing the effect of COVID-19 on air transport (e.g. Nižetić, 2020; Li, 2020; Yong-feng et al., 2020; Rahman et al., 2020; Robinson et al., 2020; Forsyth et al., 2020; Serrano and Kazda, 2020). Besides that, a large volume of articles studied the effect of the pandemic on the transport preferences and behaviours of the general population (Labonté-LeMoyné et al., 2020; Chan et al., 2020; Barbieri et al., 2020; Song and Choi, 2020; Wielechowski et al., 2020; Navickas et al., 2022), while cargo transport matters were only rarely mentioned (Choi and Park, 2020). More papers on cargo transport were published in 2021. Again, the emphasis in these papers was primarily on air transport (Shaban et al., 2021; Bartle et al., 2021; Bierwirth et al., 2021), followed by sea transport (Narasimha et al., 2021; Rahmawan Destyanto et al., 2021; Delibasic, 2022). However, research on the impact of the pandemic on road transport has recently been published (Fang, 2021; Gabedavaa and Khvedelidzeb, 2021). During the following years (2022-2023), research papers were published on cargo transport in Europe as well (Zaharia et al., 2022, Settembri and Kumar, 2023; Elbert et al., 2023). What was clearly missing was a publication describing the changes that occurred in cargo transport in the European Union, which would cover the changes of their structure during the crucial period after the declaration of the COVID pandemic. This article was developed by the authors focusing on an examination of that particular period.

2. Methodology

The research for this paper covered cargo transport in the European Union. The purpose of the research was to present the changes that occurred in cargo transport during the period of the COVID-19 pandemic and to determine whether a statistically significant relationship exists between the external and internal factors relevant to this mode of transport.

The main research problems have been stated as follows:

- What were the changes in the proportions of specific modes of transport in cargo shipments in 2020 compared to 2019?
- Does a statistically significant dependence exist between the volume of shipments carried in cargo transport and the external and internal factors affecting the transport services market?

Certain research hypotheses have been developed on the basis of the research problems.

The first primary hypothesis was as follows:

H1: The utilisation of specific modes of transport as percentages of the entire volume of cargo shipments in the European Union in 2020 (the year in which the COVID-19 pandemic was declared) did not change significantly in comparison to 2019 (the year preceding the pandemic).

This hypothesis was extended with a secondary hypothesis, as follows:

H1.1: The changes in the proportions of specific modes of transport within the entire volume of cargo shipments were similar across the European Union member states.

Another research hypothesis is also defined in the article, as follows:

H2: A linear relationship exists between the volume of shipments carried within the territory of the European Union

and the quantitative data representing the external and internal drivers of the transport service market.

The following secondary hypotheses were defined on the basis of the second primary hypothesis:

H2.1: A linear relationship exists between the dependent variable, i.e. the volume of shipments carried by road, and the predictors, i.e. the quantitative data representing the external factors affecting cargo transport in the European Union;

H2.2: A linear relationship exists between the dependent variable, i.e. the volume of shipments carried by road, and the predictors, i.e. the quantitative data representing the internal factors affecting cargo transport in the European Union;

One of the quantitative research methods, i.e. document analysis, was used in the course of verifying the first research hypothesis. Among the documents covered

by the analysis were data published on the official Web pages of the Statistical Office of the European Union (EUROSTAT) and the Central Statistical Office of the Republic of Poland (GUS). The use of secondary data originating from the aforementioned sources and the application of the linear regression model facilitated the verification of the second research claim.

3. Research results

3.1. Analysis of secondary data

The research was divided into two stages. Stage one covered the analysis of secondary data, including the volume of cargo shipments in the European Union member states measured in thousands of tonnes. In the course of the analysis, the structure of cargo shipments in 2019 and 2020 (the year before and immediately after the declaration of the COVID-19 pandemic by the WHO) was determined; the results are presented in Table 2.

Table 2. Structure of cargo shipments in the EU member states by mode of transport during 2019-2020

Mode of transport	2019	2020	Change in 2020 vs. 2019 [pp.]
Road	52.0%	53.3%	1.30
Rail	12.0%	11.5%	-0.50
Pipeline	3.0%	2.8%	-0.20
Inland waterway	4.1%	4.0%	-0.10
Sea	28.8%	28.2%	-0.60
Air	0.1%	0.1%	0.00

Source: own research based on Żegluga Śródlądowa w Polsce w latach 2020 i 2021 [Inland shipping in Poland in 2020 and 2021] (2022), Główny Urząd Statystyczny, Urząd Statystyczny w Szczecinie [Central Statistical Office of the Republic of Poland, Statistical Office in Szczecin], Warszawa, Szczecin, 2022, Ośrodek Statystyki Morskiej [Maritime Statistics Centre], p. 81

Considering the data presented in Table 2, it is reasonable to draw the conclusion that, across all modes of cargo transport, road

transport accounted for the highest proportion of total transport in both the years covered by the analysis, followed by sea, rail,

inland navigation, pipeline, and air transport. By comparing the structure of cargo shipping across all modes of transport during the two years of analysis, a relative increase was noticed only in the case of road transport, in this case by 1.3 percentage points. Decreases were recorded for sea transport (-0.6 pp.), rail transport (-0.5 pp.), pipeline transport (-0.2 pp.) and inland water transport (-0.1 pp.). Only for air transport did the situation remain unchanged. The results of the study have brought about the positive verification of the first research hypothesis, namely that the percentages of specific modes of transport across the entire volume of cargo shipments in the European Union in 2020 (the year in which the COVID-19 pandemic was declared) did not change significantly in comparison to 2019 (the year preceding the pandemic).

The next stage of research aimed to verify whether the change in proportions of specific modes of transport in terms of the overall cargo shipping volume, defined in percentage points, was similar across all the member states of the European Union. This task involved gathering the available data on cargo shipments for the particular modes of transport, measured in thousands of tonnes. The structure of shipments was determined in the 27 EU member states on this basis. Afterwards, the estimated percentages were compared, taking the years 2019, 2020 and 2021 into account. The assumption was that a minor difference between the values would be present when the gap is lower or equal to 10 percentage points. The gap was determined on the basis of the following formula:

$$R = x_{max} - x_{min}$$

where x is the difference between the studied variables, given in percentage points.
Shipments of cargo by road were reviewed first (Table 3). The list comprises

26 member states as the volumes of cargo shipped by road were not available for Malta for the period of analysis.

Table 3. Cargo shipments by road transport as percentages of total cargo shipments in the European Union member states and the difference in percentages during the period of analysis

EU Member State	2019	2020	2021	2020-2019 percentage difference [pp.]	2021-2020 percentage difference [pp.]
Belgium	39.50%	39.06%	37.80%	-0.44	-1.26
Bulgaria	59.78%	66.30%	69.47%	6.52	3.17
Czechia	81.58%	81.99%	81.87%	0.41	-0.12
Denmark	61.09%	63.35%	62.21%	2.26	-1.14
Germany	77.09%	78.09%	76.92%	1.00	-1.17
Estonia	32.43%	30.30%	31.53%	-2.13	1.23
Ireland	74.67%	72.91%	73.76%	-1.76	0.85
Greece	64.47%	61.85%	60.31%	-2.62	-1.54

EU Member State	2019	2020	2021	2020-2019 percentage difference [pp.]	2021-2020 percentage difference [pp.]
Spain	73.45%	74.46%	75.46%	1.01	1.00
France	76.09%	76.77%	77.75%	0.68	0.98
Croatia	63.07%	61.60%	62.87%	-1.47	1.27
Italy	57.70%	58.54%	58.11%	0.84	-0.43
Cyprus	79.74%	77.65%	79.79%	-2.09	2.14
Latvia	41.66%	52.78%	56.77%	11.12	3.99
Lithuania	45.71%	48.35%	50.88%	2.64	2.53
Luxembourg	82.55%	81.37%	81.40%	-1.18	0.03
Hungary	73.23%	71.96%	75.57%	-1.27	3.61
Netherlands	40.57%	41.92%	41.17%	1.35	-0.75
Austria	72.83%	72.51%	73.27%	-0.32	0.76
Poland	79.73%	80.60%	80.41%	0.87	-0.19
Portugal	61.41%	59.29%	60.86%	-2.12	1.57
Romania	62.79%	66.57%	67.30%	3.78	0.73
Slovenia	67.58%	70.67%	70.99%	3.09	0.32
Slovakia	75.16%	74.99%	73.45%	-0.17	-1.54
Finland	62.87%	63.85%	64.36%	0.98	0.51
Sweden	65.23%	66.46%	66.76%	1.23	0.30
			R	13.74	5.53

Source: own research based on EUROSTAT data

Compared to 2019, the largest negative difference for the percentage of road transport in all cargo shipping volume in 2020 was observed for Greece, at a level of -2.62 pp. The most significant decrease during 2020-2021, on the other hand, was recorded for Slovakia, at -1.54 pp. The largest growth in percentage terms in both the first and the second period of analysis occurred in Latvia, initially 11.12 pp., and subsequently 3.99 pp. It should be noted that in 2019 and 2020, the

gap for all the established values was at 13.74, whereas it was 5.53 for 2020 and 2021. It may therefore be concluded that the change in proportions of the particular modes of transport in cargo shipments in the member states was diverse in the first period of analysis, whereas this diversity was only slight in the second period.

Subsequently, rail transport data were analysed, the results of which are presented in Table 4.

Table 4. Cargo shipments by rail transport as percentages of total cargo shipments in the European Union member states and the difference in percentages during the period of analysis

EU Member State	2019	2020	2021	2020-2019 percentage difference [pp.]	2021-2020 percentage difference [pp.]
Bulgaria	7.80%	7.97%	7.97%	0.17	0.00
Czechia	15.99%	16.21%	16.29%	0.22	0.08
Denmark	3.10%	3.06%	2.52%	-0.04	-0.54
Germany	8.75%	8.14%	9.00%	-0.61	0.86
Estonia	24.39%	20.57%	25.43%	-3.82	4.86
Ireland	0.16%	0.23%	0.20%	0.07	-0.03
Spain	1.25%	1.13%	1.15%	-0.12	0.02
France	4.28%	4.23%	4.46%	-0.05	0.23
Croatia	11.23%	11.44%	11.23%	0.21	-0.21
Italy	5.56%	5.68%	6.13%	0.12	0.45
Latvia	23.44%	16.78%	15.16%	-6.66	-1.62
Lithuania	25.03%	24.13%	22.97%	-0.90	-1.16
Luxembourg	6.58%	6.57%	6.27%	-0.01	-0.30
Hungary	18.89%	19.85%	17.53%	0.96	-2.32
Netherlands	2.51%	2.45%	2.50%	-0.06	0.05
Austria	18.58%	18.95%	18.84%	0.37	-0.11
Poland	12.37%	11.73%	12.10%	-0.64	0.37
Portugal	3.69%	3.81%	3.75%	0.12	-0.06
Romania	14.39%	12.40%	12.60%	-1.99	0.20
Slovenia	16.13%	15.08%	14.60%	-1.05	-0.48
Slovakia	18.64%	18.48%	23.69%	-0.16	5.21
Finland	8.94%	9.36%	9.98%	0.42	0.62
Sweden	9.90%	9.76%	9.82%	-0.14	0.06
R				7.62	7.53

Source: own research based on EUROSTAT data

Four member states were not included in the analysis of statistical data in this case. Malta and Cyprus do not have railway systems, whilst data was unavailable for Belgium and Greece. The most significant negative shift in the proportion of rail transport within cargo shipments during 2019-2020 was

observed in Latvia, while the largest positive shift occurred in Hungary. In as many as 15 cases, the negative or positive shift did not exceed 0.5 percentage points. Moreover, based on the research assumptions, the gap of 7.62 between the analysed values provides grounds for inferring that the changes in the

proportions of specific modes of transport in the overall volume of cargo shipments in the member states were insignificant during 2019-2020. The difference for 2020-2021 was 7.53, which is another indication of minor shifts in the proportion of rail transport in the total volume of cargo shipments in the EU member states. Interestingly, following the initial increase of the share of such shipments in 2019-2020 in Hungary, this proportion recorded the largest decrease in the subsequent

period of analysis, by 2.32 percentage points. On the other hand, following a minor decline in the significance of rail transport in Slovakia during the first period of analysis, the change in this area was highest in the subsequent interval, at 5.21.

Another mode of transport studied was inland waterway transport, for which data from 17 EU member states were available for analysis. The results of the analysis are presented in Table 5.

Table 5. Cargo shipments by inland water transport as percentages of total cargo shipments in the European Union member states and the difference in percentages during the period of analysis

EU Member State	2019	2020	2021	2020-2019 percentage difference [pp.]	2021-2020 percentage difference [pp.]
Belgium	21.66%	22.32%	22.61%	0.66	0.29
Bulgaria	9.63%	9.21%	7.99%	-0.42	-1.22
Czechia	0.13%	0.07%	0.06%	-0.06	-0.01
Germany	4.93%	4.71%	4.83%	-0.22	0.12
France	2.99%	2.85%	2.67%	-0.14	-0.18
Croatia	5.05%	5.40%	4.84%	0.35	-0.56
Italy	0.02%	0.05%	0.06%	0.03	0.01
Lithuania	0.01%	0.00%	0.07%	-0.01	0.07
Luxembourg	9.60%	10.42%	10.50%	0.82	0.08
Hungary	3.11%	3.37%	2.76%	0.26	-0.61
Netherlands	21.03%	21.38%	21.65%	0.35	0.27
Austria	1.54%	1.60%	1.50%	0.06	-0.1
Poland	0.15%	0.14%	0.11%	-0.01	-0.03
Romania	8.14%	7.62%	7.05%	-0.52	-0.57
Slovakia	2.58%	2.67%	2.85%	0.09	0.18
Finland	0.12%	0.12%	0.14%	0.00	0.02
Sweden	0.09%	0.13%	0.28%	0.04	0.15
R				1.34	1.51

Source: own research based on EUROSTAT data

Upon consideration of the changes in the proportions of inland waterway transport to overall cargo shipping in the European

Union during 2019-2020, the largest negative shift occurred in Romania, while the largest positive shift was in Luxembourg.

During 2020-2021 Belgium had the most significant positive change and Bulgaria had the greatest negative shift. For the first period of analysis, the gap between the analysed values was at 1.34, followed by 1.51 for the second period. Hence, we may infer that, as

in the case of rail transport, the change in inland waterway shipments as a proportion of the total volume of cargo transport was insignificant as well.
Another mode of transport reviewed was transport by sea (Table 6).

Table 6. Cargo shipments by maritime transport as percentages of total cargo shipments in the European Union member states and the difference in percentages during the period of analysis

EU Member State	2019	2020	2021	2020-2019 percentage difference [pp.]	2021-2020 percentage difference [pp.]
Belgium	38.64%	38.40%	39.30%	-0.24	0.90
Bulgaria	16.17%	12.29%	11.29%	-3.88	-1.00
Denmark	34.13%	32.50%	34.18%	-1.63	1.68
Germany	7.08%	6.90%	7.16%	-0.18	0.25
Estonia	43.16%	49.12%	43.03%	5.96	-6.09
Ireland	25.10%	26.78%	25.97%	1.68	-0.82
Greece	35.41%	38.13%	39.66%	2.73	1.53
Spain	23.67%	23.11%	22.13%	-0.56	-0.97
France	14.07%	13.97%	13.09%	-0.09	-0.88
Croatia	16.00%	16.34%	16.01%	0.34	-0.33
Italy	29.95%	29.45%	29.53%	-0.50	0.08
Cyprus	20.17%	22.28%	20.14%	2.11	-2.14
Latvia	33.35%	29.37%	27.64%	-3.99	-1.73
Lithuania	23.69%	23.27%	22.21%	-0.42	-1.06
Malta	99.77%	99.77%	99.53%	0.00	-0.24
Netherlands	35.78%	34.15%	34.58%	-1.63	0.43
Poland	4.97%	4.76%	4.92%	-0.21	0.16
Portugal	33.62%	35.89%	34.38%	2.28	-1.51
Romania	12.99%	11.79%	11.65%	-1.20	-0.14
Slovenia	16.28%	14.24%	14.40%	-2.04	0.16
Finland	28.01%	26.62%	25.47%	-1.39	-1.15
Sweden	24.76%	23.63%	23.13%	-1.13	-0.50
R				9.94	7.77

Source: own research based on EUROSTAT data

Minor changes in the proportions of sea transport were recorded in the first and second study intervals. The gap of the values was 9.94 percentage points and at 7.77 pp., respectively. This proportion grew most significantly during 2019-2020 in Estonia, to reach 5.96 pp. However, in the same member state, the growth in the relative use of this type of transport fell by as much as 6.09 pp. during 2020-2021, to ultimately reach a lower value than before the WHO declaration of the

pandemic. A 3.98 pp. decrease was recorded for Latvia in the first period of analysis, while the largest growth in the second period of analysis occurred in Denmark. However, this growth was offset by a decrease in the relative proportion during 2019-2020.

The least significant percentage shifts occurred for air transport. The gaps defined for this mode of transport would equal 0.40 and 0.24 in the first and second period of analysis, respectively (Table 7).

Table 7. Cargo shipments by air transport as percentages of total cargo shipments in the European Union member states and the difference in percentages during the period of analysis

EU Member State	2019	2020	2021	2020-2019 percentage difference [pp.]	2021-2020 percentage difference [pp.]
Belgium	0.19%	0.23%	0.28%	0.04	0.05
Bulgaria	0.02%	0.01%	0.01%	-0.01	0.00
Czechia	0.02%	0.01%	0.02%	-0.01	0.01
Denmark	0.09%	0.06%	0.09%	-0.03	0.03
Germany	0.11%	0.11%	0.13%	0.00	0.02
Estonia	0.01%	0.01%	0.01%	0.00	0.00
Ireland	0.07%	0.07%	0.07%	0.00	0.00
Greece	0.02%	0.02%	0.02%	0.00	0.00
Spain	0.04%	0.03%	0.04%	-0.01	0.01
France	0.11%	0.10%	0.11%	-0.01	0.01
Croatia	0.01%	0.01%	0.01%	0.00	0.00
Italy	0.06%	0.05%	0.06%	-0.01	0.01
Cyprus	0.09%	0.07%	0.07%	-0.02	0.00
Latvia	0.01%	0.01%	0.02%	0.00	0.01
Lithuania	0.01%	0.01%	0.01%	0.00	0.00
Luxembourg	1.27%	1.64%	1.84%	0.37	0.20
Hungary	0.03%	0.03%	0.04%	0.00	0.01
Malta	0.23%	0.23%	0.47%	0.00	0.24
Netherlands	0.10%	0.10%	0.11%	0.00	0.01
Austria	0.04%	0.03%	0.04%	-0.01	0.01

EU Member State	2019	2020	2021	2020-2019 percentage difference [pp.]	2021-2020 percentage difference [pp.]
Poland	0.01%	0.01%	0.01%	0.00	0.00
Portugal	0.08%	0.06%	0.07%	-0.02	0.01
Romania	0.01%	0.01%	0.01%	0.00	0.00
Slovenia	0.01%	0.01%	0.01%	0.00	0.00
Slovakia	0.01%	0.01%	0.01%	0.00	0.00
Finland	0.05%	0.04%	0.04%	-0.01	0.00
Sweden	0.02%	0.02%	0.02%	0.00	0.00
R				0.40	0.24

Source: own research based on EUROSTAT data

Upon reviewing the data presented in Table 7, it may be concluded that air transport was least susceptible to changes in the use of this mode of transport as a proportion of the overall cargo shipped across the European Union during 2019-2021. Moreover, no decrease in this percentage was recorded in any of the Member States in the second period of analysis. In the first period of study, the most significant drop occurred in Denmark, but this change in proportion was balanced by

a subsequent increase in the following period. The highest increase in 2019-2020 occurred in Luxembourg (0.37 pp.) and in 2020-2021 in Malta (0.24 pp.).

The official EUROSTAT Web pages present the data illustrating the volumes of cargo shipments in transport via pipelines for seventeen member states. On the basis of such data, the use of this mode of transport as a percentage of the overall volume of cargo transport was determined (Table 8).

Table 8. Cargo shipments by pipeline as percentages of total cargo shipments in the European Union member states and the difference in percentages during the period of analysis

EU Member State	2019	2020	2021	2020-2019 percentage difference [pp.]	2021-2020 percentage difference [pp.]
Bulgaria	6.60%	4.22%	3.27%	-2.38	-0.95
Czechia	2.29%	1.72%	1.77%	-0.57	0.05
Denmark	1.59%	1.02%	1.00%	-0.57	-0.02
Germany	2.05%	2.05%	1.97%	0.00	-0.08
Greece	0.11%	0.00%	0.00%	-0.11	0.00
Spain	1.59%	1.28%	1.22%	-0.31	-0.06
France	2.47%	2.08%	1.92%	-0.39	-0.16
Croatia	4.64%	5.21%	5.04%	0.57	-0.17

EU Member State	2019	2020	2021	2020-2019 percentage difference [pp.]	2021-2020 percentage difference [pp.]
Italy	6.72%	6.23%	6.11%	-0.49	-0.12
Latvia	1.53%	1.06%	0.41%	-0.47	-0.65
Lithuania	5.56%	4.23%	3.86%	-1.33	-0.37
Hungary	4.74%	4.79%	4.10%	0.05	-0.69
Austria	7.01%	6.90%	6.35%	-0.11	-0.55
Poland	2.77%	2.77%	2.46%	0.00	-0.31
Portugal	1.21%	0.95%	0.93%	-0.26	-0.02
Romania	1.68%	1.60%	1.40%	-0.08	-0.20
Slovakia	3.61%	3.85%	0.00%	0.24	-3.85
			R	2.95	3.90

Source: own research based on EUROSTAT data

For transport via pipelines, the gap determined for the two periods of analysis was insignificant as well, at 2.95 percentage points and 3.9 pp., respectively. During 2019-2020, the largest positive shift of 0.57 pp. occurred in Croatia. In 2020 and 2021, on the other hand, this growth rate was at 0.05 pp. in the Czech Republic. The most significant decreases were recorded for Bulgaria during the first period (-2.39 pp.) and for Slovakia during the second period (-3.85 pp.).

The results of the study provided grounds for the positive verification of one of the specific hypotheses, stating that the changes in proportions of specific transport modes within the entire volume of cargo shipments were similar across the European Union member states. For all specific cases, there was a minor shift in the proportions of specific modes of transport in the overall cargo shipping volume, at less than 10 percentage points. However, it should be emphasised that as we analyse the gap defined for the difference in percentages during the specific periods for the EU member states, the most prominent changes occurred in 2020 in the case of road transport. It may therefore

be concluded that this mode of transport was most susceptible to the impact of the COVID-19 pandemic.

3.2. Linear regression model

The second stage of research aimed to produce an answer to the second research question of whether a statistically significant dependence between the volume of cargo transport shipments and the external and internal factors affecting the market of transport services exists. In order to arrive at an answer to that research question, a second research hypothesis was stated as follows: a linear relationship exists between the volume of shipments carried within the territory of the European Union and the quantitative data representing the external and internal drivers of the transport service market. Whereas road transport played an essential role in shipping cargo in the European Union during the study periods, this mode of transport was taken into account in the process of gathering data and building a linear regression model.

External factors, i.e. 13 types of quantitative data representing five areas of influence, were analysed first. A linear regression

model was used to investigate the existence of a linear relationship between variables.

The general form of the model can be shown in the following formula:

$$Y_t = \alpha_0 + \alpha_1 X_1 + \varepsilon_1$$

In this model, the value of α_1 tells us how many units the response variable Y will change by if the explanatory variable X increases by one unit.

At first, an explanation of variable Y was attempted, i.e. the volume of cargo shipments by road transport in particular European Union member states (measured in thousands of tonnes) during the period of 2013-2021, depending on predictors such as:

X1 – oil and oil products supplied to the domestic market;

X2 – petrol stocks;

X3 – diesel stocks;

X4 – Gross Domestic Product (GDP);

X5 – GDP per capita;

X6 – Harmonised Index of Consumer Prices (HICP);

X7 – total fertility rate;

X8 – crude death rate.

X9 – research and development expenditure, in million €;

X10 – research and development expenditure, in € per capita;

X11 – Internet access in households;

X12 – population;

X13 – unemployment rate.

For the specified explanatory variables, coefficients of variation were calculated on the basis of the following formula:

$$V = \frac{s}{\bar{x}} \cdot 100\%$$

where:

V – coefficient of variation

s – standard deviation

$\bar{x}$ – arithmetic mean of the variable value

The calculations for the variables under consideration are shown in Table 9.

Table 9. Linear regression model explanatory variables for external factors – selected descriptive statistics

Variable X	Arithmetic mean	Standard deviation	Coefficient of variation
X ₁	481,207.88	21,379.81	4.44%
X ₂	14,610.00	417.73	2.86%
X ₃	49,677.64	3,172.45	6.39%
X ₄	29,078.89	2,174.38	7.48%
X ₅	100.00	0.00	0.00%
X ₆	102.72	3.28	3.19%
X ₇	1.54	0.02	1.42%
X ₈	4,715,158.44	318,710.72	6.76%
X ₉	282,427.81	30,765.35	10.89%
X ₁₀	634.37	66.37	10.46%
X ₁₁	85.49	5.32	6.22%
X ₁₂	445,036,453.00	2,073,053.53	0.47%
X ₁₃	8.77	1.82	20.78%

Key: Explanatory variables which were included in the estimated form of the linear regression model.

Source: own research findings

Following the analysis of the coefficients of variation, it has been determined that only three explanatory variables could be included in the modelling process in this case. The assumption was that in order for the explanatory variables to be included in the model, the

coefficient of variation had to be equal to or higher than 10%. These variables included research and development expenditures (measured in € per capita) and the variable rate of unemployment. At this point, the linear regression model was presented as follows:

$$Y_t = \alpha_0 + \alpha_1 X_{9t} + \alpha_2 X_{10t} + \alpha_3 X_{13t} + \varepsilon$$

Regression statistics were determined for these variables (Table 10) as well as a summary of statistics (Table 11).

Table 10. Regression statistics for the analysed variables: volume of shipments and external factors

Regression statistics	
R-multiple	0.941804
R-squared	0.886995
Adjusted R-squared	0.819192
Standard error	179956.9
Observations	9

Source: own research findings

Table 11. Summary of statistics for the analysed variables: volume of shipments and external factors

	Coefficients	Standard error	t Stat	p-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intersection	1104422.9	311570.5	3.544697	0.01648	303505.6	1905340.3	303505.6	1905340.3
X ₉	-292.397	242.7051	-1.20474	0.28221	-916.291	331.4959	-916.291	331.4959
X ₁₀	136087.1	109812.8	1.239265	0.270243	-146196	418369.8	-146196	418369.8
X ₁₃	-202292	159003.1	-1.27225	0.259239	-611022	206438.6	-611022	206438.6

Source: own research findings

Considering the general form of the model and the determined coefficients, Table 11 presents the estimated form of the model:

$$\hat{Y}_t = 1\,104\,422.9 - 292.397 X_{9t} + 136\,087.1 X_{10t} - 202\,292 X_{13t}$$

The coefficient of determination R^2 was estimated at 0.886995 in this case, which means that the regression line estimated on the basis of the variables was well adjusted to the data. Further steps were intended

to verify whether the explanatory variables were statistically significant, i.e. whether $p < 0.05$. As it transpired from the study results presented in Table 11, none of the explanatory variables (X₉, X₁₀, X₁₃) met this criterion.

Therefore, the secondary hypothesis that a linear relationship exists between the dependent variable, i.e. the volume of shipments carried by road, and the predictors, i.e. the quantitative data representing the external factors affecting cargo transport in the European Union, has not been verified.

Verification of the subsequent secondary hypothesis required the collection of secondary data representing the areas of influence of the internal factors on the cargo transport in the European Union during 2013-2021. As in the preceding case, an explanation of variable Y was attempted, i.e. the volume of cargo shipments by road

transport in the particular European Union Member States (measured in thousands of tonnes). The following variables were included among the predictors (explanatory variables) in this case:

- X1 – length of railway lines
- X2 – length of motorways
- X3 – cargo transport by rail
- X4 – inland waterway cargo transport
- X5 – gross weight of goods transported at all ports
- X6 – cargo and mail transport by air

Here, coefficients of variation were again calculated for the specified explanatory variables (Table 12).

Table 12. Linear regression model explanatory variables for internal factors – coefficient of variation

Variable X	Arithmetic mean	Standard deviation	Coefficient of variation
X ₁	197,973.58	7,876.08	3.98%
X ₂	69,158.77	1,490.72	2.16%
X ₃	1,500,704.00	46,355.46	3.09%
X ₄	533,121.67	18,802.17	3.53%
X ₅	3,406,627.89	129,553.17	3.80%
X ₆	13,001.56	1,151.80	8.86%

Source: own research findings

Whereas only those explanatory variables were to be included in the linear regression model for which the coefficient of variation was at least 10%, none of the values presented in Table 12 met this criterion. Hence, it is not possible to build a linear regression model that would verify the existence of a linear relationship between the dependent variable, i.e. the volume of shipments carried by road, and the predictors, i.e. the quantitative data representing the internal factors affecting cargo transport in the European Union. As a consequence, the latter secondary research hypothesis could not be verified. In summary, the study has demonstrated that the second research hypothesis, according to which a linear relationship exists between

the volume of shipments carried within the territory of the European Union and the quantitative data representing the external and internal drivers of the transport service market, could not be verified.

4. Discussion

In the course of the research procedures, it has been concluded that the COVID-19 pandemic certainly had an impact on the transport sector. These changes were noticeable among the European Union member states as well. The essential conclusion of the study is that the situation strengthened the position of road transport in terms of the overall volume of cargo shipping. Moreover,

the proportions of such shipments in the EU member states during the study period changed most dynamically. It was further found that the least significant percentage shifts were recorded for air transport. Other conclusions were as follows:

1. 2020, i.e. the year in which the COVID-19 pandemic was declared, was a period of significant changes on the transport services market. This outcome is consistent with the results of K. Jureczka's (2022) research, which noted that the transport, shipping and logistics sector was most disrupted by the COVID-19 pandemic in March and April 2020. Moreover, as A. Pomykała (2020) noted, the economic slowdown period in spring stressed the importance of well-functioning supply chains in many countries, as well as the need to respond quickly to the variability of the environment.
2. In 2021, which was the subsequent study period, the situation on the cargo transport market was less dynamic than in the first period of study. In addition, K. Jureczka (2022) noted that the COVID-19 pandemic forced transport companies to implement new solutions in their operations in order to be able to survive. Among these new developments, there was an intense growth of digitalisation in transport. As emphasised by T. Rokicki and K. Wojtczuk (2021), the solutions developed at that time may come useful in the event of another crisis (not only a subsequent pandemic).
3. During the pandemic, the proportion of road transport in the European Union increased. If we compare 2019 and 2020, the growth rate was at 1.3 percentage points. Conversely, decreases were recorded for the other modes of transport. This conclusion is consistent with the results obtained by M. Menes (2022), who stated that the extensive use of road transport for cargo shipments is still characteristic of developed economies,

notwithstanding the high costs involved in this type of transport. Moreover, K. Jureczka (2022) observed that the number of shipments carried by road vehicles increased in 2020 (compared to 2019), which could have led to an increase in the proportion of this mode of transport in overall cargo shipping.

4. A minor change in the proportions of specific modes of transport within the overall cargo shipping volumes was observed during 2019-2021 in the European Union member states. The most significant differences (determined by means of the calculation of the gap for the studied values) occurred for road transport, albeit only for 2020. In addition, the gap determined for maritime transport in the same year was nearly 10 percentage points.
5. The following transport modes were least susceptible to the shifts in proportions, in the order below: air transport, inland waterway transport, and transport by pipelines. The reason may be the fact that such shipments are generally a low proportion of the entire volume of shipments, and the economic situation during the pandemic has only affected them to a negligible extent.
6. Three predictors could be used to build a linear regression model for the volume of cargo shipping in road transport in the European Union and the external factors for modelling: research and development expenditures in million €; research and development expenditures in € per capita; and the unemployment rate. However, the conclusion drawn from the modelling process was that the distinguished variables were not statistically significant.
7. A linear regression model could not be defined for the internal factors affecting the volume of cargo shipments by road in the European Union because of the low variability of the studied variables.

Conclusions

Apart from the economic situation, other factors that determine the demand for transport services exist. These factors can generally be divided into external, internal and institutional ones. The situation in the more or less distant environment is also relevant to the volume of cargo shipped. This was recently noticeable during the COVID-19 pandemic, when the transport sector experienced certain interim difficulties related to shipment planning and organisation, which was emphasised in research by Xiang et al. (2021), Lu et al. (2021), Perkumienė et al. (2021), and Dominiak (2022). In many cases, a change of approach was necessary for business operations, particularly the need for a more flexible approach to the services provided, or placing less emphasis on the costs of operations. The role of these measures was to survive the period of hardship. After a certain period of time (approximately one year), the situation on the transport market stabilised, as emphasised by researchers such as K. Jureczka (2022). Tzvetkova (2021) noted that the transport sector in the European Union was still required to face a great deal of difficulty in order to overcome the negative consequences of the COVID-19 pandemic. A certain stabilisation in cargo transport after 2021 was verified by the relevant research. A change in proportions of shipped cargo was observed in almost all modes of transport, albeit air transport was an exception, with the lowest differences in percentages during the study periods. The changes during the pandemic were most dynamic in road transport. In this case, the change in the volume of this mode of transport as a percentage of the overall cargo shipping volume determined for the period of 2019-2020 was the highest, whereas it was no longer so significant in the subsequent period of study, i.e. 2020-2021. Obviously, there were certain limitations to the studies. Specifically, data availability

was an issue. For some member states, no official data were available for specific modes of cargo transport. Moreover, examining the transport market conditions in 2022 was not feasible because EUROSTAT had not published the complete data for that period as at the date of submission of this paper. Therefore, it will be more feasible to verify the cargo transport situation in the European Union after 2022 by means of subsequent research.

References

- Ahmed, R. R., Streimikiene, D., Rolle, J-A, & Duc, P. A. (2020), The COVID-19 Pandemic and the Antecedents for the Impulse Buying Behavior of US Citizens. *Journal of Competitiveness*, 12(3), 5–27. DOI: 10.7441/joc.2020.03.01
- Banerjee, A., Duflo, E., Qian, N. (2020), On the road: Access to transportation infrastructure and economic growth in China, *Journal of Development Economics*, 145, 102442. DOI: 10.1016/j.jdeveco.2020.102442.
- Barbieri D.M., Lou B., Passavanti M., Hui C., Lessa D.A., Maharaj B. Banerjee A., Wang F., Chang K., Naik B., Yu L., Liu Z., Sikka G., Tucker A., Foroutan Mirhosseini A., Naseri S., Qiao Y., Gupta A., Abbas M., Fang K., Ghasemi N., Peprah P., Goswami S., Hessami A., Agarwal N., Lam L., Adomako S. (2020), A survey dataset to evaluate the changes in mobility and transportation due to COVID-19 travel restrictions in Australia, Brazil, China, Ghana, India, Iran, Italy, Norway, South Africa, United States. *Data in Brief*. 2020 Dec; 33:106459. DOI: 10.1016/j.dib.2020.106459.
- Bartle, J. R., Lutte, R. K., Leuenberger, D. Z. (2021), Sustainability and air freight transportation: Lessons from the global pandemic, *Sustainability*, 13(7), 3738. DOI: 10.3390/su13073738.
- Berg, C. N., Deichmann, U., Liu, Y., Selod, H. (2017), Transport policies and development, *The Journal of Development Studies*, 53(4), 465-480. DOI: 10.1080/00220388.2016.1199857.

- Bernacki, D. (2010), Wzrost gospodarczy a popyt na przewozy towarowe w Polsce, *Zeszyty Naukowe Uniwersytetu Szczecińskiego*, 603, 17-36.
- Bierwirth, B., Brylka, R., Schwanecke, U. (2021), Business process transformation in air cargo Logistics, *Global Challenges of Digital Transformation of Markets*, 77-92.
- Chan, H. F., Skali, A., Savage, D. A., Stadelmann, D., Torgler, B. (2020), Risk attitudes and human mobility during the COVID-19 pandemic, *Scientific reports*, 10(1), 19931. DOI: 10.1038/s41598-020-76763-2.
- Choi, J. H., Park, Y. H. (2020), Investigating paradigm shift from price to value in the air cargo market, *Sustainability*, 12(23), 10202. DOI: 10.3390/su122310202.
- Daroń, M. (2022), Planning of International Transport in the Context of the Condition of Transport Infrastructure in Selected EU Countries, in: K.S. Soliman (Eds.), *Business Excellence and Innovation Management: a 2025 Vision to Sustain Economic Development in the Era of Pandemic* (pp. 2973-2982), International Business Information Management Association (IBIMA), April 1-2, 2020, Seville, Spain.
- Delibasic, M. (2022), Institutional Imbalance of Interests in Maritime Transport and Sustainable Development, *Transformations in Business & Economics*, 21(1), 263-273.
- Dieaconescu, R. I., Belu, M. G., Gheorghe, M. (2022), Impact of Oil Price Evolution on Logistics Industry, *Romanian Economic Journal*, 25(84), 3-18, DOI: 10.24818/REJ/2022/84/01.
- Dominiak, J. (2022), Wpływ pandemii COVID-19 na zmiany w sektorze usług w Polsce, *Prace Komisji Geografii Przemysłu Polskiego Towarzystwa Geograficznego*, 36(2), 126-136. DOI: 10.24917/20801653.362.8
- Elbert, R., Roeper, F., Vanelslender, T., Cavallaro, F. (2023), Freight operations in the European Union during the COVID-19 pandemic: A multicountry comparison, *Transportation Amid Pandemics*, 143-152. DOI: 10.1016/B978-0-323-99770-6.00021-1.
- Fang, T. (2021, February), Research on one belt one road international road transport development strategies under regular epidemic prevention situation, *International Conference on Public Management and Intelligent Society (PMIS)*, Shanghai, China, 2021, s. 337-340. DOI: 10.1109/PMIS52742.2021.00082.
- Forsyth, P., Guiomard, C., Niemeier, H. M. (2020), Covid-19, the collapse in passenger demand and airport charges, *Journal of air transport management*, 89, 101932. DOI: 10.1016/j.jairtraman.2020.101932.
- Gabedavaa, G., Khvedelidze, P. (2021), Impact of COVID19 on Ports and Maritime Transport (Georgian Ports Response to COVID19), 21st Annual General Assembly of the International Association of Maritime Universities Conference, IAMU AGA 2021, 46-54.
- Gnap, J., Senko, Š., Kostrzewski, M., Bridziková, M., Czöddorová, R., Říha, Z. (2021), Research on the relationship between transport infrastructure and performance in rail and road freight transport – A case study of Japan and selected European countries, *Sustainability*, 13(12), 6654. DOI: 10.3390/su13126654.
- Gomes, S., Lopes, J. M. (2022), Consequences of the pandemic constraints on the supply chain of companies: an exploratory approach, *Polish Journal of Management Studies*, Vol. 26, No.2. DOI: 10.17512/pjms.2022.26.2.10.
- Grondys, K., Urbański, M., Sudyka, J. (2021), Expert evaluation of road infrastructure management, *Roads and Bridges-Drogi i Mosty*, 20(4), 465-492. DOI: 10.7409/rabdim.021.028.
- <https://ec.europa.eu/eurostat>.
- Jarocka, M. (2016), Innovative pricing policy for transport services. *Studia Ekonomiczne, Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach*, nr 306, 59-69.
- Jureczka, K. (2022), Branża TSL w obliczu pandemii Covid-19, *Zeszyty Naukowe Wyższej Szkoły Zarządzania Ochroną Pracy w Katowicach*, nr 1(18), 7-13.

- Kłos, Z. (2010), Wpływ kryzysu gospodarczego na funkcjonowanie rynku usług transportowych w Polsce, *Zeszyty Naukowe Uniwersytetu Szczecińskiego. Ekonomiczne Problemy Usług*, nr 46.
- Kozłowski, R., Gajewski, R., Pilichowska, K. (2016), Wpływ ceny ropy naftowej na eksport usług transportowych w Europie, in: B. Glinkowska (Eds.), *Internacjonalizacja przedsiębiorstw. Uwarunkowania – procesy – wyniki badań* (pp. 215-229), Łódź: Wydawnictwo Uniwersytetu Łódzkiego. DOI: 10.18778/8088-492-2.17.
- Kulinska, E., Wojtynek, L., Dendera-Gruszka, M. (2018), Sytuacja polskich przedsiębiorstw na rynku usług transportowych, *Zeszyty Naukowe Szkoły Głównej Gospodarstwa Wiejskiego w Warszawie. Ekonomika i Organizacja Logistyki*, 3 (1), 83-95. DOI: 10.22630/EIOL.2018.3.1.8.
- Kulpa, T. (2009), Transport ładunków – klasyfikacja i przegląd modeli podróży, *Zeszyty Naukowo-Techniczne Stowarzyszenia Inżynierów i Techników Komunikacji w Krakowie. Seria: Materiały Konferencyjne*, 90, z. 148, 155-176.
- Labonté-LeMoyne, É., Chen, S. L., Coursaris, C. K., Sénécal, S., Léger, P. M. (2020), The unintended consequences of COVID-19 mitigation measures on mass transit and car use, *Sustainability*, 12(23), 9892. DOI: 10.3390/su12239892.
- Li, T. (2020), A SWOT analysis of China's air cargo sector in the context of COVID-19 pandemic, *Journal of air transport management*, 88, 101875. DOI: 10.1016/j.jairtraman.2020.101875.
- Lu, L., Peng, J., Wu, J., Lu, Y. (2021), Perceived impact of the Covid-19 crisis on SMEs in different industry sectors: Evidence from Sichuan, China, *International Journal of Disaster Risk Reduction*, 55(24), 1-9. DOI: 10.1016/j.ijdr.2021.102085.
- Łącka, I., Suproń, B. (2021), The impact of COVID-19 on road freight transport: evidence from Poland, *European Research Studies Journal*, volume XXIV, special Issue 3, 319-333.
- Menes, M. (2022), Miejsce i rola transportu towarowego w gospodarce polskiej na tle Unii Europejskiej, *Transport Samochodowy*, 66(2), 10-16. DOI: 10.5604/01.3001.0016.2051.
- Mofijur, M., Fattah, I. R., Alam, M. A., Islam, A. S., Ong, H. C., Rahman, S. A., Najafi G., Ahmed S.F., Uddin Md. A., Mahlia, T. M. I. (2021), Impact of COVID-19 on the social, economic, environmental and energy domains: Lessons learnt from a global pandemic, *Sustainable production and consumption*, 26, 343-359. DOI: 10.1016/j.spc.2020.10.016.
- Narasimha, P. T., Jena, P. R., Majhi, R. (2021), Impact of COVID-19 on the Indian seaport transportation and maritime supply chain, *Transport Policy*, 110, 191-203. DOI: 10.1016/j.tranpol.2021.05.011.
- Navickas, V., Grecikova, A., Kordos, M., Sramka, M. (2022), The Information and Communications Technologies Usage within the Covid-19 Pandemic Issue, *Transformations in Business & Economics*, 21, (1), 101-113.
- Nižetić, S. (2020), Impact of coronavirus (COVID-19) pandemic on air transport mobility, energy, and environment: A case study, *International Journal of Energy Research*, 44(13), 10953-10961. DOI: 10.1002/er.5706.
- Nundy, S., Ghosh, A., Mesloub, A., Albaqawy, G. A., Alnaim, M. M. (2021), Impact of COVID-19 pandemic on socio-economic, energy-environment and transport sector globally and sustainable development goal (SDG), *Journal of Cleaner Production*, 312, 127705. DOI: 10.1016/j.jclepro.2021.127705.
- Pawlak, P. (2015), *Badania popytu przedsiębiorstw na usługi transportowe w Polsce Wschodniej*, TTS Technika Transportu Szynowego, 22.
- Pawłowska, B. (2009), Challenges for implementation of sustainable transport development in global economy, in: *Globalizacja a jej społeczno-ekonomiczne dśledky '09*, Elektroniczý zborník príspevkov z Medzinárodnej Vedeckej Konferencie: 29.09–1.10.2009, Rajecké Teplice, Slovenská Republika.
- Pawłowska, B. (2015), Analiza czynników kształtujących popyt na usługi transportowe Unii Europejskiej, *Zeszyty Naukowe. Problemy Transportu i Logistyki/Uniwersytet Szczeciński*, 30, 87-104. DOI: 10.18276/ptl.2015.30-07.

- Perkumienė, D., Osamede, A., Andriukaitienė, R., Beriozovas, O. (2021), The impact of COVID-19 on the transportation and logistics industry, *Problems and perspectives in management*, 19(4), 458-469. DOI: 10.21511/ppm.19(4).2021.37.
- Pomykała, A. (2020), Sektor towarowy w okresie walki ze skutkami Covid-19, *TTS Technika Transportu Szynowego*, nr 10.
- Rahman, N. A. A., Rahim, S. A., Ahmad, M. F., Hafizuddin-Syah, B. A. M. (2020), Exploring COVID-19 pandemic: Its impact to global aviation industry and the key strategy, *International Journal of Advanced Science and Technology*, 1829-1836.
- Rahmawan Destyanto, A., Huang, Y., Verbraeck, A. (2021, May), Examining the spatiotemporal changing pattern of freight maritime transport networks in Indonesia during COVID-19 outbreaks, in *Proceedings of the 4th Asia Pacific Conference on Research in Industrial and Systems Engineering*, 590-597.
- Robinson, J. (2020), Thoughts on the post-pandemic new normal in air travel, *Journal of Airport Management*, 15(1), 6-19.
- Rokicki, T., Wojtczuk, K. (2021), Operation of a transport company during the COVID-19 pandemic, in: T. Rokicki (Eds.), *Społeczno-ekonomiczne skutki pandemii COVID-19* (pp. 44-53), Warszawa: Wydawnictwo SGGW.
- Rovňák, M., Kalistová, A., Štofejová, L., Benko, M., Salabura, D. (2022), Management of sustainable mobility and the perception of the concept of electric vehicle deployment, *Polish Journal of Management Studies*, Vol. 25, No .2. DOI: 10.17512/pjms.2022.25.2.17.
- Serrano, F., Kazda, A. (2020), The future of airports post COVID-19, *Journal of Air Transport Management*, 89, 101900. DOI: 10.1016/j.jairtraman.2020.101900.
- Settembri, P., Kumar, R. (2023), The Good, the Bad and the Rest: How the European Union Responded to the COVID-19 Pandemic in the Transport Sector, *European Journal of Risk Regulation*, 1-17. DOI: 10.1017/err.2023.7.
- Shaban, I. A., Chan, F. T. S., Chung, S. H. (2021), A novel model to manage air cargo disruptions caused by global catastrophes such as Covid-19, *Journal of Air Transport Management*, 95, 102086. DOI: 10.1016/j.jairtraman.2021.102086.
- Song, K. H., Choi, S. (2020), A study on the behavioral change of passengers on sustainable air transport after COVID-19, *Sustainability*, 12(21), 9207. DOI: 10.3390/su12219207.
- Sośniak, S., Szkutnik, J. (2020), Development and innovation of polish land transport, *International Interdisciplinary Scientific Journal (CZ-WNS)*, issue 3, 1-16.
- Suproń, B. (2016), Uwarunkowania i perspektywy rozwoju polskiego sektora transportu drogowego w aspekcie zmian strukturalnych zachodzących w Unii Europejskiej, *Europa Regionum*, 27, 205-221.
- Tzvetkova, S. (2021), The Effect of COVID-19 on Land Transport Within the European Union and Guidelines for its Stable Development, *European Journal of Sustainable Development*, 10(4). DOI: 10.14207/ejsd.2021.v10n4p20.
- Wielechowski, M., Czech, K., Grzęda, Ł. (2020), Decline in Mobility: Public Transport in Poland in the time of the COVID-19 Pandemic, *Economies*, 8(4). DOI: 10.3390/economies8040078.
- Xiang, S., Rasool, S., Hang, Y., Javid, K., Javed, T., Artene, A. E. (2021), The effect of COVID-19 pandemic on service sector sustainability and growth, *Frontiers in psychology*, 12, 1178. DOI: 10.3389/fpsyg.2021.633597.
- Zaharia, S. E., Pietreanu, C. V., Flăminzeanu, M. C. (2022, June), Air Cargo Transport development in Central and Eastern Europe and Baltic countries, 2022 IEEE 6th International Conference on Logistics Operations Management (GOL), 1-10.
- Zhang, J., Hayashi, Y., Frank, L. D. (2021), COVID-19 and transport: Findings from a world-wide expert survey, *Transport policy*, 103, 68-85. DOI: 10.1016/j.tranpol.2021.01.011.
- Żegluga śródlądowa w Polsce w latach 2020 i 2021 (2022), Główny Urząd Statystyczny, Urząd Statystyczny w Szczecinie, Warszawa, Szczecin, 2022, Ośrodek Statystyki Morskiej.

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An Attempt at a Simplified Determination of the Brand Value of a University

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Abstract

The motivation for the analyses conducted as part of this paper was the development of an analytical tool to help build a university's brand value. The implementation of the adopted goal should provide a tool supporting activities aimed at creating the university's brand by leaders managing education at university level. The research hypothesis was that it is possible to determine a university's brand by using a synthetic measure of a university's brand value. The main scientific contribution of this article is the indication of variables that have not previously been used to determine the university's brand and which occur in IT systems related to the functioning of universities, so they can be used to support a more objective determination of a university's brand value. The analytical method used and the analyses carried out on that basis showed that synthetic measures can support the creation of a university brand. However, the very construction of a synthetic measure of a university's brand value that reflects reality requires the introduction of additional variables from IT systems and variables resulting from properly constructed surveys in the field of determining a university's brand value.

Key words

university brand, synthetic measure, TOPSIS-CRITIC

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1. Introduction

Currently, all over the world, universities (including lower-level schools) are struggling with intense competition among themselves, mainly due to maintaining a significant number of places for students

(even if this number does not decrease, the number of prospective students is decreasing) and demographic decline (Novo-Corti et al., 2018; Yu et al., 2018). Contemporary universities are heavily involved in

competition for students, and one of the effective mechanisms that can connect them with potential students is their brand (Latif et al., 2021). Competition between universities can take various dimensions, but one of the important factors therein, which allows for a competitive advantage to be developed, is certainly the strengthening of a university's brand (Le, 2019). This situation forces universities to market their services, which in turn leads to the perception of students as customers of services provided by universities, and forces universities to position themselves as corporate brands (Yu et al., 2018). Globalisation has increased the demands on higher education and thus increased competition between universities. The Internet is but one of the tools that is considered a means of increasing competitiveness (Maresova et al., 2020).

Some research on university branding indicates that there are no clear indications that the best brands change significantly from year to year. Unlike typical market products, the quality of the university's brand may not result directly from its marketing or branding programme. The statement quoted in the previous sentence may not be true in the case of urban universities, because at such universities there are ways to improve the brand through marketing activities (Bunzel, 2007).

There are several definitions of a brand; however, due to the specificity of education, it can be assumed that a brand is a "promise" made to the buyer (student) by the seller (university) as to the features and advantages of the service (studies) (Davis, 2002). A brand in higher education is defined as everything that an institution expresses about itself (Alam et al., 2022). Building a university brand allows students to identify the quality of educational services offered (Harvey, 1996). Other researchers define the university brand as a student's feelings and emotions related to the experience of using the university's educational services (McNally and

Speak, 2002). According to other views, the university brand shows the quality of educational processes occurring at the university in a simplified way (Bulotaite, 2003).

When discussing a university's brand, we most often associate it with emotions related to the university, so it is advisable to conduct such branding activities that will create and at the same time consolidate the positive image of the university (Chapleo, 2010; Chapleo, 2011). When defining a university's brand, it is necessary to consider both the factors affecting the quality of educational services as well as the results describing the quality of educational services provided by universities (Sultan and Ho, 2014).

The concept of university branding is completely different from branding in the market sector. A university brand has different dimensions, understood as expressions, opinions and beliefs. It can therefore be assumed that a university's brand is determined by the link between the university's values and the expectations of stakeholders (students) (Nha and Leblanc, 2001). The basic aspect of brand awareness is understood as the strength of the brand in the mind of the consumer (Keller, 2020). Brand awareness has a strong influence on student decisions and the overall impression of a university's institutional value. The university brand indicates the university's ability to meet students' requirements, building trust in the university's competence in providing high-quality educational services to students (Alam et al., 2022). The analyses carried out in Vietnam on a group of private universities showed that the brand plays a decisive role in the choice of a university. The aforementioned studies also analysed the creation of brand trust through student satisfaction with the educational services offered by the university (Le, 2019).

Some researchers point out that the choice of a university by a prospective student depends on the possibility of taking up a job after graduation (Atay and Yildirim,

2010). Despite the satisfaction of students with the technical equipment available at the university, such as the canteen, laboratories, and access to computers, these are not the key factors determining the choice of university (Malik et al., 2010). The university branding model is sometimes presented as consisting of advertising, career guidance during the recruitment process, and activities known as “word of mouth”. These activities lead to the improvement of the university’s image in the eyes of students and thus to the improvement of the university’s reputation; as a result, student loyalty increases (Nguyen and Nguyen, 2015).

Currently, there is not a great deal of research focusing on university brands. One of the best known concepts is an internal brand equity assessment (teachers, administration employees) and external brand equity assessment (students) (Le, 2019).

The analysis of the impact of the Internet on the university’s brand value can be based on determining the number of fans, as well as the content, style, promotion and frequency of posts (Maresova et al., 2020). In some analyses, attention is paid to the sense of security among university students, which is why one of the factors determining the university brand is the analysis of safety reports on university campuses, particularly including sexual crimes (Gregory, 2012). The basic theory of brand equity analysis is based on customers; in this context it is assumed that the differential effect caused by consumer reactions to brand marketing activities is due to consumers’ specific brand awareness (Keller, 1993).

In one research paper, the brand equity study consisted in determining the level of students’ approval of six key brand features grouped in two groups of indicators, i.e. brand awareness and brand value. Brand value was assessed on the basis of overall satisfaction with the service, loyalty and brand preferences, while brand awareness was determined on the basis of brand

awareness and brand image. The brand awareness dimension was defined by brand recognition. On the other hand, the brand image was defined by product-related attributes, non-product-related attributes, and the symbolic and functional benefits of the brand (Alam et al., 2022). Brand image is defined as the perception of the brand reflected in consumers’ memories (Keller, 1993). Product-related attributes are characteristics that are considered essential to the performance of a product and are strongly associated with that product. The quality of education and physical facilities related to the provision of educational services are considered attributes related to the product, educational fee, speed of service by staff, admission criteria and degree of employment of graduates (Kurz et al., 2008; Chen, 2008).

Other features associated with the brand are external attributes related to the purchased product; these attributes include, among others, relations between students and the faculty, the range of the faculty’s influence, the history of the faculty, scientific and didactic excellence and reliability in terms of conducting classes with students (Chen, 2008; Kurz et al., 2008).

Symbolic attributes are related to brand identity and personality. These factors are responsible for recreating the emotional reactions evoked by the brand. We can also find claims that symbolic attributes focus on social support and external self-esteem. Customers strive to emphasise the uniqueness of the brand only because it can communicate the self-image of customers (Plummer, 2000).

In the analysis of university brands, the most frequently used variables are:

- in terms of brand recognition (advertisements in newspapers and magazines, sponsorship of sports events or other events, special articles about the university in newspapers and magazines, university brochures, posters, leaflets, etc., sources of obtaining information about

- the university, and knowledge of the services provided by the university) (Aaker, 2011; Aaker, 2003; Keller, 1993),
- in terms of attributes related to the product (evaluation of the quality of education, evaluation of the quality of teaching staff, attractiveness of equipment, conditions for obtaining education, and the approach of administrative staff) (Aaker, 2011; Aaker, 2003; Keller, 1993),
 - in terms of attributes not related to the product (value for money, affordability, the location of the university, a leading position in the provision of educational services, the reputation of the university, the level of protection of university facilities, and the number of years on the education market) (Aaker, 2011; Aaker, 2003; Keller, 1993),
 - in terms of functional benefits of the brand (additional attractions outside the study programme, support for intellectual development, providing reasons to be proud and thus building self-esteem, creating prospects for better employment) (Aaker, 2011; Aaker, 2003; Keller, 1993),
 - in terms of symbolic benefits of the brand (trustworthiness, competence, the prestige of the university in the environment, and didactic discipline) (Aaker, 2011; Aaker, 2003; Keller, 1993),
 - in terms of brand value (order of preferences in choosing a university by a candidate for studies, and the level of trust in the university) (Aaker, 2011; Aaker, 2003; Keller, 1993).

The concept of a brand in higher education, in particular, may be based on identity, reputation, company image and visual identity, analysed through the prism of marketing experiences (Dal Buono and Fortezza, 2017). An important element of branding is institutional communication; as such, special attention should be paid to the fact that trust in the cultural and educational role of the university cannot result only from

tradition, but must be continuously created through communication activities.

The use of the language of marketing in the area of higher education is surprising, because it is most often perceived as contradictory to the goals identified with the university environment, such as education, or the transfer of knowledge developed over the years resulting from scientific research, which is difficult to associate with generating profit (Dal Buono and Fortezza, 2017). The development of a university's brand may be understood as the effective use of institutional communication, which allows for greater recognition of the university and thus allows the university to strengthen the value of public recognition. Competition between universities mainly adopts student achievement as a factor differentiating the university's brand (Dal Buono and Fortezza, 2017). The university brand is a tool supporting the choices of candidates for studies and their families, as well as many other recipients to whom the university must communicate the value generated by it in the educational process. The university brand should guarantee the target recipients (students) that their expectations are fulfilled through the tangible and intangible elements of the education system. Some analyses may include the statement that the university's brand includes prestige, sincerity, attractiveness, spontaneity, conscientiousness and a cosmopolitan dimension. In addition, these activities are supported by brand loyalty, positive word of mouth and the willingness of graduates to support the university (Rauschnabel et al., 2016). In terms of branding a university, it is difficult to define what a successful university is.

2. Methodology

Research on university brands is usually based on surveys addressed to various stakeholder groups. In the presented study, the

university's brand (understood as a ranking position) was determined on the basis of reliable data from IT systems. The source of data for analysis was the portal <https://ela.nauka.gov.pl/pl> [accessed: 1 December 2022]. The data collected on this portal are characterised by a high degree of credibility as they are taken directly from the databases of the analysed universities; moreover, data on graduate salaries are taken from the institution responsible for recording salaries in Poland, namely the Social Insurance Institution.

The analysis covered universities offering master's (second degree) studies in the field of computer science in Poland. The selected period of analysis covered the years

2014-2020 and resulted from limitations in the availability of ELA system data.

The article proposes an original synthetic measure of university brand value. The aim was to suggest an analytical tool to support problem solving by leaders managing higher educational institutions. This measure was constructed on the basis of publicly available feedback describing the functioning of a university, and is intended to allow for the calculation of brand strength in relation to competition.

Variables used in synthetic measures were divided into stimulants (beneficial impact) and destimulants (adverse impact). Stimulants were subjected to zero unitarisation in accordance with Formula 1:

$$\text{stimulant: } z_{ij} = \frac{x_{ij} - \min_i \{x_{ij}\}}{\max_i \{x_{ij}\} - \min_i \{x_{ij}\}}, (i = 1, 2, \dots, n; j = 1, 2, \dots, k; z \in [0, 1])$$

where $\min_i \{x_{ij}\}$ – the minimum value of function j , $\max_i \{x_{ik}\}$ – the maximum value of function j , and i – the object (in this case, a farm).

Destimulants were subjected to zero unitarisation according to Formula 2:

$$\text{destimulant: } z_{ij} = \frac{\max_i \{x_{ij}\} - x_{ij}}{\max_i \{x_{ij}\} - \min_i \{x_{ij}\}}, (i = 1, 2, \dots, n; j = 1, 2, \dots, k; z \in [0, 1])$$

where $\min_i \{x_{ij}\}$ – the minimum value of function j , $\max_i \{x_{ik}\}$ – the maximum value of function j , and i – the object (in the case analysed, a farm).

The weights for the variables used were determined using the TOPSIS-CRITIC method. In this method, the standard deviation and the correlation between the variables are used by calculating the inverse matrix. It was assumed

that values exceeding 10 are too large and thus show excessive correlation between the variables (Borychowski et al., 2020). The weights of the variables were determined by the following formulas (Rostamzadeh et al., 2018):

$$w_j = \frac{c_j}{\sum_{k=1}^m c_k}, j = 1, 2, \dots, m; c_j = s_{j(z)} \sum_{k=1}^m (1 - r_{ij}), j = 1, 2, \dots, m,$$

where c_j – the measure of the information capacity of feature j , $s_{j(z)}$ – the standard deviation calculated from the normalised values of feature j , and r_{ij} – the correlation coefficient between features j and k .

In the next step, the weight coefficients were multiplied by the normalised values of the variables. In the next stage, the Euclidean distances of individual units from

the pattern and the anti-pattern of development were determined. For these activities, the following formulas were used:

$$d_i^+ = \sqrt{\sum_{j=1}^k (z_{ij}^* - z_{ij}^+)^2} - \text{distance from the pattern of development},$$

$$d_i^- = \sqrt{\sum_{j=1}^k (z_{ij}^* - z_{ij}^-)^2} - \text{distance from the anti - pattern of development},$$

where:

$$z_j^+ = (\max(z_{i1}^*), \max(z_{i2}^*), \dots, \max(z_{ik}^*)) = (z_1^+, z_2^+, \dots, z_i^+) \\ z_j^- = (\min(z_{i1}^*), \min(z_{i2}^*), \dots, \min(z_{ik}^*)) = (z_1^-, z_2^-, \dots, z_i^-)$$

At the next stage, the value of the synthetic feature q_1 was determined according to the following formula (6):

$$q_i = \frac{d_i^-}{d_i^+ + d_i^-}, (i = 1, 2, \dots, n)$$

Variables used to construct the synthetic – university brand measure:

- number of graduates (strength of impact of the brand on the labour market),
- time of seeking employment (months),
- Relative Earnings Index – the graduate's remuneration from all sources in the first year after graduation in relation to the average earnings in his/her place of residence. The greater the value, the better. Values above 1 mean that, on average, graduates earn above the average wage in their place of residence. On the other hand, values below 1 mean that, on average, graduates earn below the average wage in their place of residence.

Relative Unemployment Index – the unemployment rate of graduates in the first year after graduation in relation to the overall unemployment rate in their place of residence. The lower the value, the better. Values below 1 mean that, on average, unemployment among graduates is lower than the unemployment rate in their place of residence. On the other hand, values above 1 mean that, on average, unemployment among graduates is higher than the unemployment rate in their place of residence.

Table 1 presents a list of variables and weights used in the TOPISIS-CRITIC analysis.

Table 1. The list of variables used to create the synthetic measure and weights of the variables

Year	Weight value for variables			
	Number of graduates (stimulant)	Time of searching for a full-time job (months) (destimulant)	Relative Earnings Index (stimulant)	Relative Unemployment Index (destimulant)
2014	0.372485	0.239486	0.195432	0.192597
2015	0.333230	0.218700	0.239534	0.208536
2016	0.284569	0.261873	0.196138	0.257420
2017	0.319474	0.183706	0.256630	0.240190
2018	0.276663	0.229581	0.229964	0.263792
2019	0.284344	0.262839	0.236376	0.216442
2020	0.283921	0.263023	0.199666	0.253390

Source: own elaboration

3. Brand value of universities in Poland – a case study

The synthetic measures determined show that in the scope of the analysed second-cycle studies in the field of computer science (second-cycle studies), the highest values were shown by AGH (2014, 2015, 2019, 2020) and PWroc. (2016, 2017, 2018) (Table 3). It is therefore interesting in this context to check which variables influenced the ranking position of the listed universities. Particular attention is paid to the value of the Relative Earnings Index variable, which in the case of AGH has a value from 2.01 in 2014, through 2.16 in 2015, to a decrease in the value of this variable to 1.71 in 2019 and 1.47 in 2020. At the same time, an inverse correlation between the Relative Earnings Index and the number of graduates should be noted; the lowest number of graduates was in 2014 (82 people) and the highest in 2020 (224 people). Each of the values discussed affects the value of the university's brand, as the number of graduates determines the number of 'private' ambassadors of the university, expressing their opinion about the completed studies and thus contributing to increasing

the popularity of the university. The second value, i.e. the Relative Earnings Index, indicates the main achievement of graduates in the labour market (Dal Buono and Fortezza, 2017). Other important variables indicating the success of graduates in the labour market are the time taken to find employment, counted in months, which in the case of AGH UST graduates does not exceed 1.5, and the Relative Unemployment Index, which does not exceed 0.3 (Table 2). Similar correlations to those described were also found in the case of PWroc., but in this case, apart from 2014 (35 graduates), much higher numbers of graduates were found, i.e. in the range from 139 to 174, so at the same time the brand of this university gained a large impact of graduates.

At the other end of the scale are the universities with the lowest synthetic measure of the university brand, comprising three universities: WULS-SGGW (2015, 2020) and UWM (2017-2019) and PRz (2014) (Table 3). It should be noted that these universities had a very low number of graduates, from 10 (2014 in the State University of Technology) to 11-13 (UWM) and 17 and 19 (SGGW) (Table 2).

Table 2. Summary of data

University	Variable	Year							Mean
		2014	2015	2016	2017	2018	2019	2020	
AGH	x ₁	82	88	88	110	79	170	224	120.14
	x ₂	1.02	0.91	0.79	1.20	1.41	0.96	1.04	1.05
	x ₃	2.01	2.16	2.09	1.55	1.87	1.71	1.47	1.84
	x ₄	0.04	0.19	0.07	0.05	0.26	0.10	0.16	0.12
PG	x ₁	48	26	140	121	149	98	98	97.14
	x ₂	0.76	0.71	0.44	0.64	0.78	0.87	1.22	0.77
	x ₃	1.79	2.08	1.68	1.83	1.72	1.63	1.46	1.74
	x ₄	0.08	0.20	0.24	0.10	0.40	0.36	0.58	0.28
UJ-WMiI	x ₁	29	60	42	51	50	36	40	44.00
	x ₂	1.25	1.24	0.41	1.09	1.04	0.78	2.30	1.16
	x ₃	1.67	1.66	1.65	1.75	1.81	1.66	1.26	1.64
	x ₄	0.00	0.15	0.05	0.00	0.20	0.20	0.20	0.11
UJ-WFaiIS	x ₁	11	43	35	37	38	47	32	34.71
	x ₂	0.00	2.00	2.13	1.52	0.93	1.39	1.21	1.31
	x ₃	1.55	1.18	1.22	1.24	1.60	1.50	1.42	1.39
	x ₄	0.46	0.24	1.10	1.52	0.64	1.44	0.70	0.87
P Wroc.	x ₁	35	139	145	174	151	164	106	130.57
	x ₂	2.27	1.49	1.36	1.20	1.48	1.53	1.43	1.54
	x ₃	1.53	1.30	1.35	1.31	1.34	1.34	1.38	1.36
	x ₄	0.10	0.24	0.33	0.13	0.35	0.44	0.38	0.28
PJATK	x ₁	28	17	12	19	18	16	34	20.57
	x ₂	1.13	0.29	3.00	2.62	2.82	1.55	1.33	1.82
	x ₃	1.45	1.35	1.18	1.26	0.69	1.08	1.24	1.18
	x ₄	0.34	0.33	0.25	3.60	0.33	1.10	0.32	0.90
UG	x ₁	35	47	34	31	31	22	36	33.71
	x ₂	1.08	2.77	2.76	2.43	2.75	1.61	3.04	2.35
	x ₃	1.40	0.88	1.13	1.27	0.97	1.03	1.04	1.10
	x ₄	0.54	0.52	0.18	0.59	1.13	0.32	0.48	0.54

University	Variable	Year							Mean
		2014	2015	2016	2017	2018	2019	2020	
WAT	x ₁	44	13	48	45	42	67	40	42.71
	x ₂	2.06	0.83	2.50	2.29	2.26	2.40	1.81	2.02
	x ₃	1.39	1.67	1.08	1.37	1.10	1.11	1.23	1.28
	x ₄	0.00	0.97	0.11	0.07	0.30	1.41	0.04	0.41
UW	x ₁	11	57	52	54	45	60	60	48.43
	x ₂	1.20	2.24	3.83	1.50	2.65	2.61	1.56	2.23
	x ₃	1.38	1.00	1.76	1.48	1.82	1.42	1.69	1.51
	x ₄	0.00	0.00	0.00	0.05	0.12	0.68	0.47	0.19
PP-WI	x ₁	116	98	117	107	133	140	147	122.57
	x ₂	1.31	1.63	1.84	2.08	1.61	1.31	2.12	1.70
	x ₃	1.37	1.22	1.11	1.12	1.28	1.25	1.23	1.23
	x ₄	0.15	0.65	0.36	0.36	0.27	0.63	0.41	0.40
PL	x ₁	17	57	65	47	47	63	42	48.29
	x ₂	0.44	0.49	0.70	0.67	0.62	0.98	1.00	0.70
	x ₃	1.32	1.28	1.47	1.37	1.62	1.16	1.30	1.36
	x ₄	0.09	0.17	0.06	0.50	0.34	0.20	0.34	0.24
PW	x ₁	40	13	90	82	115	111	97	78.29
	x ₂	1.93	0.75	1.06	1.00	1.71	1.21	1.79	1.35
	x ₃	1.27	2.26	1.57	1.76	1.43	1.41	1.41	1.59
	x ₄	0.09	0.00	0.32	0.14	0.16	0.26	0.10	0.15
PP – WE	x ₁	45	30	25	25	30	13	14	26.00
	x ₂	1.90	1.87	1.00	3.00	3.58	2.09	2.00	2.21
	x ₃	1.10	0.99	1.08	1.02	1.18	0.92	1.30	1.08
	x ₄	0.48	0.21	0.27	0.48	0.20	1.86	0.00	0.50
UL	x ₁	16	24	38	31	36	34	30	29.86
	x ₂	1.77	1.00	3.03	2.89	2.42	1.83	1.60	2.08
	x ₃	1.07	1.26	0.99	0.78	0.91	1.18	0.89	1.01
	x ₄	1.20	0.68	0.63	0.55	0.39	0.75	1.32	0.79
PŚ	x ₁	127	109	121	122	114	118	95	115.14
	x ₂	1.91	1.74	1.87	1.89	1.75	1.82	2.12	1.87
	x ₃	1.03	0.99	1.16	0.98	1.14	1.19	0.96	1.06
	x ₄	0.36	0.58	0.39	0.71	0.82	0.95	0.28	0.58

University	Variable	Year							Mean
		2014	2015	2016	2017	2018	2019	2020	
PKosz.	x ₁	23	13	26	37	35	16	23	24.71
	x ₂	0.94	2.23	1.75	2.62	2.03	2.25	1.50	1.90
	x ₃	1.01	0.85	0.72	0.81	0.99	0.99	1.18	0.94
	x ₄	0.22	1.75	0.96	1.31	0.40	1.52	0.99	1.02
PL	x ₁	68	67	48	84	91	74	58	70.00
	x ₂	1.53	1.66	1.85	1.88	2.23	1.98	3.36	2.07
	x ₃	1.01	1.33	1.07	0.86	0.91	0.93	0.89	1.00
	x ₄	0.56	0.53	0.57	0.39	0.70	1.45	0.93	0.73
WSB	x ₁	17	39	58	38	38	26	20	33.71
	x ₂	0.13	0.45	0.23	0.79	0.71	0.56	0.00	0.41
	x ₃	0.97	1.23	1.15	1.01	0.99	0.74	1.29	1.05
	x ₄	0.32	0.07	0.10	1.40	0.05	1.04	0.00	0.43
SGGW	x ₁	20	17	32	38	15	28	19	24.14
	x ₂	1.83	2.77	1.76	1.17	1.50	1.39	0.64	1.58
	x ₃	0.93	1.14	1.11	1.10	1.42	0.99	1.15	1.12
	x ₄	0.37	2.43	0.46	0.08	0.92	0.45	0.36	0.72
UŚ	x ₁	15	20	33	42	28	49	23	30.00
	x ₂	0.91	2.12	3.04	1.97	2.89	1.21	3.06	2.17
	x ₃	0.87	0.83	0.85	0.94	1.08	0.91	1.01	0.93
	x ₄	0.49	0.32	1.46	1.00	0.54	0.32	1.51	0.81
UWM	x ₁	15	23	20	11	13	13	25	17.14
	x ₂	2.91	1.88	3.00	5.44	2.78	1.10	1.88	2.71
	x ₃	0.87	0.64	0.76	0.44	0.69	0.93	0.72	0.72
	x ₄	0.64	1.99	1.65	4.33	1.16	0.94	1.78	1.78
ZUT	x ₁	37	40	46	39	40	30	32	37.71
	x ₂	2.85	1.48	2.44	2.39	1.00	1.19	3.28	2.09
	x ₃	0.70	0.86	0.88	0.86	0.94	0.87	0.72	0.83
	x ₄	0.64	0.63	0.78	0.82	0.66	0.06	1.15	0.68
PO	x ₁	51	42	39	33	40	40	42	41.00
	x ₂	3.61	3.39	1.78	1.55	2.07	1.97	1.97	2.33
	x ₃	0.66	0.73	0.82	1.09	0.92	0.89	0.85	0.85
	x ₄	1.24	0.93	1.45	0.99	0.78	2.17	2.04	1.37

University	Variable	Year							Mean
		2014	2015	2016	2017	2018	2019	2020	
PRZ	x_1	10	95	90	104	75	78	39	70.14
	x_2	4.00	1.80	2.24	2.23	1.95	2.35	2.35	2.42
	x_3	0.52	0.80	1.01	0.91	0.91	0.92	0.93	0.86
	x_4	1.71	0.57	0.99	0.48	0.85	1.28	0.65	0.93

Source: own elaboration

Legend: x_1 – number of graduates, x_2 – time of searching for a full-time job (in months), x_3 – Relative Earnings Index, x_4 – Relative Unemployment Index, AGH – AGH University of Science and Technology in Krakow, GUT – Gdańsk University of Technology, UJ-WMiI – Jagiellonian University – Faculty of Mathematics and Computer Science, UJ-WFAiIS – Jagiellonian University – Faculty of Physics, Astronomy and Applied Computer Science, P Wroc. – Wrocław University of Science and Technology, PJATK – Polish-Japanese Academy of Computer Technology, UG – University of Gdańsk, WAT – Military University of Technology, UW – University of Warsaw, PP-WI – Poznań University of Technology – Faculty of Computer Science, PŁ – Łódź University of Technology, PW – Warsaw University of Technology, PP – WE – Poznań University of Technology – Faculty of Electrical Engineering, UŁ – University of Łódź, PŚ – Silesian University of Technology, PKosz. – Koszalin University of Technology, PL – Lublin University of Technology, WSB – WSB University in Dąbrowa Górnicza, SGGW – Warsaw University of Life Sciences, UŚ – University of Silesia, UWM – University of Warmia and Mazury, ZUT – West Pomeranian University of Technology, PO – Opole University of Technology, PRz – Rzeszów University of Technology

When analysing the average values of the synthetic university brand measure, it is notable that the average values of this measure above 0.5 were obtained by the following universities (in order from highest to lowest): PWroc., AGH, PP-WI, PG, PŚ and PW. The order of universities in this ranking is not surprising because it is consistent with the well-known ranking of universities in Poland that provide education in the field of computer science at master's level (Table 3, <https://2021.ranking.perspektywy.pl/ranking/ranking-academic-universities>, accessed: 9 December 2022)

The last five universities in the ranking include PP-WE, the Faculty of Electrical

Engineering of the Poznań University of Technology, which will most likely discontinue its computer science course, as a new Faculty of Computer Science has been established at the same university (already rising as high as third in the rankings of the value of the synthetic brand measure). In addition, the bottom five places also include PJATK, a private university that educates a relatively small number of students (12-34) (Table 2), and three universities that have not yet developed a tradition in education in the field of computer science (second degree), namely PKosz., SGGW and UWM (Table 3).

Table 3. Synthetic indicator of the university's brand

University	Synthetic measure of the university's brand							
	2014	2015	2016	2017	2018	2019	2020	Mean
AGH	0.7184	0.7344	0.5711	0.6069	0.4782	0.9862	0.9872	0.7261
PG	0.5671	0.5331	0.9549	0.6742	0.9773	0.5413	0.3999	0.6640
UJ-WMiI	0.4817	0.5709	0.2255	0.2454	0.2681	0.1466	0.1242	0.2946
UJ- WFAiIS	0.4499	0.4256	0.1735	0.1597	0.1812	0.2167	0.0859	0.2418
P Wroc.	0.4411	0.7146	0.9807	0.9759	0.9860	0.9604	0.4381	0.7853
PJATK	0.4455	0.4629	0.0190	0.0523	0.0385	0.0206	0.0954	0.1621
UG	0.4511	0.3483	0.1662	0.1229	0.1312	0.0577	0.1055	0.1976
WAT	0.4755	0.4287	0.2709	0.2086	0.2103	0.3441	0.1240	0.2946
UW	0.4202	0.4483	0.3015	0.2637	0.2322	0.2995	0.2191	0.3121
PP-WI	0.7792	0.5879	0.7889	0.5886	0.8689	0.8087	0.6333	0.7222
PŁ	0.4529	0.5497	0.3983	0.2208	0.2464	0.3184	0.1334	0.3314
PW	0.4514	0.5237	0.5862	0.4354	0.7389	0.6241	0.3953	0.5364
PP – WE	0.4239	0.3875	0.0979	0.0863	0.1243	0.0124	0.0089	0.1631
UŁ	0.2841	0.4144	0.1963	0.1229	0.1669	0.1339	0.0767	0.1993
PŚ	0.7070	0.5823	0.8189	0.6805	0.7317	0.6687	0.3858	0.6536
PKosz.	0.4184	0.1921	0.1059	0.1597	0.1596	0.0226	0.0436	0.1574
PL	0.5212	0.5103	0.2708	0.4477	0.5652	0.3886	0.2099	0.4163
WSB	0.4315	0.5041	0.3457	0.1657	0.1811	0.0829	0.0287	0.2485
SGGW	0.3503	0.1603	0.1507	0.1656	0.0171	0.0957	0.0241	0.1377
UŚ	0.3739	0.3378	0.1592	0.1902	0.1095	0.2293	0.0453	0.2065
UWM	0.2526	0.2089	0.0639	0.0255	0.0149	0.0054	0.0535	0.0892
ZUT	0.3016	0.3865	0.2559	0.1719	0.1957	0.1083	0.0869	0.2153
PO	0.2670	0.2666	0.2034	0.1351	0.1959	0.1724	0.1339	0.1963
PRz	0.0000	0.5185	0.5864	0.5703	0.4493	0.4141	0.1195	0.3797

Source: own elaboration

Key: AGH – AGH University of Science and Technology in Krakow, GUT – Gdańsk University of Technology, UJ-WMiI – Jagiellonian University – Faculty of Mathematics and Computer Science, UJ-WFAiIS – Jagiellonian University – Faculty of Physics, Astronomy and Applied Computer Science, P Wroc. – Wrocław University of Science and Technology, PJATK – Polish-Japanese Academy of Computer Technology, UG – University of Gdańsk, WAT – Military University of Technology, UW – University of Warsaw, PP-WI – Poznań University of Technology – Faculty of Computer Science, PŁ – Łódź University of Technology, PW – Warsaw University of Technology, PP – WE – Poznań University of Technology – Faculty of Electrical Engineering, UŁ – University of Łódź, PŚ – Silesian

University of Technology, PKosz. – Koszalin University of Technology, PL – Lublin University of Technology, WSB – WSB University in Dąbrowa Górnicza, SGGW – Warsaw University of Life Sciences, UŚ – University of Silesia, UWM – University of Warmia and Mazury, ZUT – West Pomeranian University of Technology, PO – Opole University of Technology, PRz – Rzeszów University of Technology.

Conclusions

This paper reviews the literature on many factors determining the value of a university's brand. Some of these factors can only be determined on the basis of questions addressed to stakeholders (external and internal). Therefore, the authors of the article are aware that the synthetic measure of a university's brand presented herein merely represents an attempt to indicate the direction of further research leading to the determination of a university's brand.

The method presented may be used as an auxiliary measure to determine the value of a university's brand. The small number of selected variables used to determine the synthetic measure of the value of a university's brand may raise objections; however, the advantage of these variables is their unquestionable value. Usually, the brand is determined on the basis of surveys, which by their nature are less accurate, due to the differing views of respondents on the brand being assessed.

The results obtained may be used as a guideline for the use of a larger spectrum of variables to determine a university's brand. In further research, the number of variables providing unquestionable values (often referred to as hard) should certainly be increased and the synthetic measure of a university's brand should be enriched with data obtained from surveys of both internal and external stakeholders.

References

- Aaker, D. A., (2003), The Power Of The Branded Differentiator. MIT Sloan Management Review, 45(1), 83-87.
- Aaker, D. A., (2011), Managing Be, New York, The Free Press.
- Alam, W., Adnan, A., Yousafzai, M. T., (2022), Development Of Typology For University Brands Through Brand Knowledge And Brand Equity. Middle East Journal Of Management, 9, 682-705.
- Atay, L. & Yildirim, H. M., (2010), Determining Factor That Affect Satisfaction Students In Undergraduate Tourism Education. International Multidisciplinary Journal Of Tourism, 5, 73-87.
- Balmer, J. M. T., Greyser, S. A., (2002), Managing The Multiple Identities Of The Corporation. California Management Review, 44, 72-+.
- Bennett, R., Ali-Choudhury, R., (2007), Components Of The University Brand: An Empirical Study. In: Melewar, T. C. (Ed.) Intangible Economies: Brand, Corporate Image, Identity And Reputation In The 21st Century, Proceedings Of The 3rd Annual Colloquium Of The Academy Of Marketing's Brand. Corporate Identity And Reputation Sig, Brunel University, 12-13 September 2007.
- Borychowski, M., Stepień, S., Polcyn, J., Tosović-Stevanović, A., Calović, D., Lalić, G., Zuza, M., (2020), Socio-Economic Determinants Of Small Family Farms' Resilience In Selected Central And Eastern European Countries. Sustainability, 12.
- Bulotaite, N., (2003), University Heritage – An Institutional Tool For Branding And Marketing. Higher Education In Europe, 28(4), 449-454.

- Bunzel, D. L., (2007), Universities Sell Their Brands. *Journal Of Product And Brand Management*, 16, 152-+.
- Chapleo, C., (2010), What Defines “Successful” University Brands? *International Journal Of Public Sector Management*, 23, 169-+.
- Chapleo, C., (2011), Branding A University: Adding Real Value Or ‘Smoke And Mirrors’? In: Molesworth, M., Scullion, R., Nixon, E. (Eds.) *Marketisation Of Higher Education And The Student As Consumer*. Abingdon: Routledge.
- Chen, L. H., (2008), Internationalization Or International Marketing? Two Frameworks For Understanding International Students’ Choice Of Canadian Universities. *Journal Of Marketing For Higher Education*, 18(1), 1-33.
- Dal Buono, V., Fortezza, F., (2017), Universities’ Experience With Brand. The Role Of Design In Managing University Communication And Branding. *Design Journal*, 20, S705-S720.
- Davis, S., (2002), Implementing Your Bam2 Strategy: 11 Steps To Making Your Brand A More Valuable Business Asset. *Journal Of Consumer Marketing*, 19(6), 503-513.
- De Chernatony, L., Dall Olmo Riley, F., Harris, F., (1998), Criteria To Assess Brand Success. *Journal Of Marketing Management*, 14, 765-81.
- Gregory, J., (2012), University Branding Via Securitization. *Topia-Canadian Journal Of Cultural Studies*, 65-86.
- Hart, S., Murphy, J., (1998), *Brands: The New Wealth Creators*, Palgrave, Basingstoke.
- Harvey, J. A., (1996), Marketing Schools And Consumer Choice. *International Journal Of Educational Management*, 10(4), 26-32.
- Jevons, C., (2006), Universities: A Prime Example Of Branding Gone Wrong. *Journal Of Product & Brand Management* 15(7), 466-7.
- Keller, K. L., (1993), Conceptualizing, Measuring, And Managing Customer-Based Brand Equity. *Journal Of Marketing*, 57, 1-22.
- Keller, K. L., (2020), Leveraging Secondary Associations To Build Brand Equity: Theoretical Perspectives And Practical Applications. *International Journal Of Advertising*, 39, 448-465.
- Kurz, K., Scannell, J., Veeder, S., (2008), Willingness To Pay: Making The Best Case For Institutional Value And Return On Investment. *University Business*, 11(5), 31-32.
- Latif, K. F., Afzal, O., Saqib, A., Sahibzada, U. F., Alam, W., (2021), Direct And Configurational Paths Of Knowledge-Oriented Leadership, Entrepreneurial Orientation, And Knowledge Management Processes To Project Success. *Journal Of Intellectual Capital*, 22, 149-170.
- Le, Q. H., (2019), Factors Affecting Brand Values Of Private Universities: A Case Study Of Ho Chi Minh City University Of Technology (Hutech). *Journal Of Asian Finance Economics And Business*, 6, 159-167.
- Malik, M. E., Danish, R. Q., Usman, A., (2010), The Impact Of Service Quality On Students’ Satisfaction In Higher Education Institutes Of Punjab *Journal Of Management Research* 2(2), 1-11.
- Maresova, P., Hruska, J., Kuca, K., (2020), Social Media University Branding. *Education Sciences*, 10, 14.
- McNally, D., Speak, K. D., (2002), Be Your Own Brand. *American Salesman*, 47(7), 29-30.
- Nguyen, T. S., Nguyen, T. M., (2015), Advertising Factors Affecting The Image And Reputation Of Foreign Trade University. *Scientific Journal Of Ho Chi Minh City Open University*, 44(5), 28-37.
- Nha, N., Leblanc, G., (2001), Corporate Image And Corporate Reputation In Customers’ Retention Decisions In Services. *Journal Of Retailing And Consumer Services*, 8(4), 227-236.
- Novo-Corti, I., Badea, L., Tirca, D. M., Aceleanu, M. I., (2018), A Pilot Study On Education For Sustainable Development In The Romanian Economic Higher Education. *International Journal Of Sustainability In Higher Education*, 19, 817-838.
- Plummer, J. T., (2000), How Personality Makes A Difference. *Journal Of Advertising Research*, 40, 79-83.
- Rauschnabel, P. A., Krey, N., Babin, B. J. & Ivens, B. S. 2016. Brand Management In Higher Education: The University Brand Personality Scale. *Journal Of Business Research*, 69, 3077-3086.

- Rostamzadeh, R., Keshavarz Ghorabae, M., Govindan, K., Esmaili, A., Nobar, H. B. K., (2018), Evaluation Of Sustainable Supply Chain Risk Management Using An Integrated Fuzzy Topsis- Critic Approach. *Journal Of Cleaner Production*, 175, 651-669.
- Sultan, P., Ho, Y. W., (2014), An Integrated-Process Model Of Service Quality, Institutional Brand And Behavioural Intentions: The Case Of A University. *Managing Service Quality*, 24(5), 487-521.
- Temple, P., (2006), Branding Higher Education: Illusion Or Reality? *Perspectives*, 10(1).
- Urde, M., (2003), Core Value Based Corporate Brand Building. *European Journal Of Marketing*, 37 (7/8), 1017-40.
- Yu, Q. L., Asaad, Y., Yen, D. A., Gupta, S., (2018), Imo And Internal Branding Outcomes: An Employee Perspective In Uk He. *Studies In Higher Education*, 43, 37-56.

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Analysis of the Impact of Special Economic Zones on Macroeconomic Indicators in Poland

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Abstract

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A Special Economic Zone (SEZ) is a designated geographical area with specific economic regulations and incentives to promote foreign investment and boost economic growth. The present study aims to analyse the impact of SEZs on the macroeconomic indicators of Poland. This study investigates the relationship between Poland's Special Economic Zones and the Polish economy from 1998 to 2020, employing a vector autoregressive model using ordinary least squares regression to analyse time series data on annual SEZ tax exemptions (TEx_SEZs) and macroeconomic indicators, such as GDP, foreign direct investment, employment growth rate, and per capita income. The methodology includes descriptive analysis, correlation analysis, augmented Dickey-Fuller (ADF) tests for stationarity, an Engle-Granger two-step cointegration test to estimate the long-run equilibrium relationship, and Granger causality analysis to explore whether TEx_SEZs influence economic growth. The results of regression analysis indicates that the total tax exemption for Special Economic Zones (TEx_SEZs) does not directly contribute to economic growth, the employment growth rate, and per capita income in Poland, aligning with the non-causal relationship found between TEx_SEZs and GDP. However, the study shows that TEx_SEZs have a statistically significant and positive impact on Poland's foreign direct investment (FDI), implying that SEZ tax incentives can effectively attract FDI and stimulate economic growth. While the reliance of this study on secondary data and the limited depth of the analysis constitute limitations, future research should employ diverse datasets, case studies, and interviews to address these constraints and explore the socioeconomic and environmental impacts of special economic zones in Poland and other countries.

Key words

Special Economic Zone, macroeconomic growth, Poland.

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Introduction

Investment activities are one of the basic categories describing the state, functioning and development opportunities of any type of organisation, particularly business organisations. An analysis of the literature indicates that the concept of planning investment activities is multifaceted (Pujer, 2016). There are many ways of defining and describing it, including indicative parametric and non-parametric methods for describing organisational and economic investments (Patusiak et al., 2016, Dinu, 2015). Therefore, investment policy is one of the ways to achieve structural change. Among the many tools that have been used around the world over the years, Special Economic Zones (SEZs) have gained popularity. Over the past four decades, SEZs have emerged as state-created economic enclaves designed to attract domestic and foreign investors to foster regional economic growth (Pastusiak et al., 2018; Michałek, 2023). They allow indirect implementation of the state setting through the use of autonomous market units operating under competitive conditions (Dorożyński et al., 2021). There are many types of this instrument, albeit often unique due to the institutional characteristics of a country. An example of such an arrangement are the zones operating in Poland (Krynska, 2010). The reason for selecting Poland for the analysis is its highly extensive network of Special Economic Zones (SEZs) and its significant role in the Polish economy, particularly in terms of fostering local and national economic interactions. Regional development is the growth of a region's economic potential, accompanied by a steady improvement in the living conditions of its residents and increased competitiveness (Blau et al., 2020; Szczepańska-Woszczyna et al., 2022). On the other hand, territorial policy is defined in the literature as intentional and deliberate actions by the authorities to regulate certain areas of inter-territorial development (Mutalimov et al., 2021). The

prerogative of the zone is to create favourable conditions for the companies operating there, as well as the use of existing industrial plants and infrastructure while supporting the restructuring process of the industrial centre.

1. Literature review

In 1994, Poland introduced Special Economic Zones (SEZs), primarily located in underdeveloped regions. The main purpose behind creating these zones was to stimulate local economic growth by attracting capital investments, facilitating regional job opportunities, promoting exports, and revitalising outdated industrial areas. The envisioned objectives of SEZs encompassed enhancing the competitiveness of products and services while fostering technological progress (Lizińska and Marks-Bielska, 2013).

Countries worldwide have implemented zonal projects, irrespective of their socio-political system or economic development level. These projects have led to the emergence of diverse types of zones, characterised by various forms and classifications, operating within different macroeconomic environments. While their motivations, expectations, and operational models may vary, their shared objective is creating an attractive investment climate to lure domestic and foreign investors. These zones were established to bolster and stimulate economic development in specific regions and, in some cases, to address structural issues faced by those areas, as exemplified by Poland. A key anticipation of these projects was that foreign capital inflows would spur economic growth and initiate the exchange of knowledge, transfer advanced technologies and innovations, and facilitate access to world-class marketing and management systems. This approach aimed to create a conducive environment for fostering economic progress and development, with the

infusion of foreign expertise and resources playing a pivotal role in achieving these objectives (Nazarczuk and Cicha-Nazarczuk, 2021; Akhmetshina et al., 2017; Kanungo, 2016; Pakdeenurit et al., 2014; Palit, 2010).

Special Economic Zones (SEZs) were envisioned as a vital component of development policies designed to stimulate the advancement of underdeveloped regions. Their primary objective was attracting investors to areas deemed unprofitable or facing economic challenges (Wiedermann and Trojak, 2009). By offering various investment incentives, such as income tax exemptions, access to utility infrastructure, and support for investment implementation, these regions were expected to become more appealing to potential investors, particularly large industrial companies. Initially, SEZs were intended to be established selectively, with only a few designated zones, to foster local economic growth and address labour market challenges in those specific areas (Pastusiak, 2011).

The primary objectives of Special Economic Zones (SEZs), as stated in the law dated 20 October 1994 (Ustawa z dnia 20 października 1994 r. o specjalnych strefach ekonomicznych, 1994), are as follows:

- Fostering the advancement of particular economic sectors,
- Encouraging the development and implementation of novel technical and technological solutions within the national economy,
- Facilitating the expansion of exports,
- Enhancing the competitiveness of manufactured products and services rendered,
- Utilising existing industrial resources and economic infrastructure effectively,
- Generating new employment opportunities,
- Ensuring the sustainable utilisation of untapped natural resources.

A Special Economic Zone (SEZ) is a targeted policy designed to draw foreign direct

investment (FDI), stimulate employment opportunities, and bolster economic reforms. Particularly for developing economies, an SEZ holds the potential to act as a catalyst for progress by inviting foreign investors who can significantly enhance the productivity of local companies, boost revenues, and expand market shares through the introduction of cutting-edge technologies and the establishment of new enterprises (Dubinina, 2022).

The creation of Special Economic Zones results from the gradual integration of the global economy. Special Economic Zones are the result of integration by macro agreements (Gosek, 2022). Regional integration, involving the unity of nations in a common framework of economic, social and international policies, is carried out between countries undertaking international political tasks (Ficek & Gawlik, 2022). The first independent economic zone introduced a typical Special Economic Zones focused on export activities and basic services for entrepreneurs through tax exemptions. Thus, it can be said that these were tax-exempt areas. The first zones of this type were established in Central America and later in the Far East in the mid-1960s (Nazmi, 2015). Creating Special Economic Zones in many countries did not mean that the country establishing them would benefit from uniform economic zone conditions (Dargas-Draganik et al., 2022). Moreover, the size and specificity of the zones were often determined solely by economic conditions. If this zone arouses investor interest, it is likely that the area will expand and change from a “small area” to a “large area” (Aggarwal, 2019).

Due to their nature, zones can be divided into large and small zones and industrial and energy zones. A large zone covers a large area (Brezdeń and Szymytkie, 2019). Countries with such zones are mainly developing countries or countries with large areas of their own. The exceptions are Liechtenstein, Monaco and Hong Kong, where investment opportunities are strictly

regulated (Kuczynska-Chalada et al., 2020). A large zone usually covers the entire city and its residents. The largest group of countries (regions) are small zone countries. Zones usually cover from a few hectares to dozens of hectares. Most often, they are single zones located within closed economic enclaves. Such zones are industrial in nature and are not inhabited by people. Another type of economy is the so-called Specific Zone Industry (Lin, 2021). Selected industrial activities are carried out in the following countries: France, Germany, Mexico, USA, China, India, South Korea and Taiwan. This zone includes services supporting industry, banking and tourism. The last type of zone is performance-specific or zones for specific activities. The term 'zone' is somewhat overused in this case. This is because it is possible to find companies that have certain rights but at the same time meet strict conditions (Sleszynski and Wiedermann, 2020).

The relationship between economic policies and macroeconomic conditions has garnered significant attention as they serve as potential drivers of economic performance within a nation. Economic policies wield the power to influence various aspects of an economy, including investments in human capital, infrastructure, and other key areas. Hall and Charles (1999) assert that government policies can play a pivotal role in supporting specific industries during critical stages of their development (Hall and Charles, 1999). To facilitate foreign-invested manufacturing and services for export, countries establish Special Economic Zones (SEZs) that adopt liberal laws and economic policies. In essence, the creation of SEZs symbolises a political regime's commitment to achieving economic transformation in a non-market economy (Pan et al., 2016).

A study by Lipták, Klasová and Kovác focused on five crucial macroeconomic parameters that are deemed highly influential in driving institutional changes within economic policies. These parameters include

the gross domestic product, which was calculated based on market prices per capita in euros. Additionally, they considered inflation measured through the Harmonised Index of Consumer Prices and wages, which were evaluated as real income per individual in euros. To assess employment dynamics, they analysed the employment rate of the population aged between 20 and 64. Lastly, the researchers examined expenditures on research and development, computed per capita in euros. By investigating these key indicators, the study aimed to gain valuable insights into the implications of institutional change in the realm of economic policies (Lipták, Klasová and Kovác, 2015). In another study, the results show that SEZs have demonstrated a highly beneficial influence on the advancement of the least developed regions in Poland, whereas their impact on relatively more affluent areas was modest or even unfavourable (Ambroziak and Hartwell, 2018).

A study conducted in the context of Thailand reveals the establishment of Special Economic Zones (SEZs) in 10 border provinces in 2015 and 2016. However, the SEZ program did not attract significant investment into the zones as intended, and the analysis shows that it did not lead to macroeconomic development. Provinces with SEZs did not experience higher GDP growth compared to those without, and poverty reduction progress was not significantly different. These findings cast doubt on the effectiveness of Thailand's SEZs and suggest the need for more substantial cost advantages for firms within the zones compared to non-SEZ areas. Additionally, it suggests that investing in education and specialised training for workers could help offset increasing labour costs and boost productivity (Durongkaveroj, 2023). However, another study conducted in India provides a different perspective, namely that the establishment of Special Economic Zones (SEZs) had a significant impact on rural economies as it generated demand for substantial amounts

of land, leading to immediate changes in their economic and social landscape and exacerbating rural poverty. However, as time passed, the adverse effects of SEZs on rural poverty gradually diminished. Interestingly, the influence of SEZs on urban poverty differed from their impact on rural poverty. Moreover, districts with multiple SEZs experienced more pronounced effects than those with only one or two SEZs. On the whole, SEZs did have positive economic effects, but this transformation may also have heightened inequalities between rural and urban areas (Aggarwal and Kokko, 2022).

The literature review has provided a comprehensive overview of the existing research and scholarly works on the topic at hand. By synthesising and analysing the findings of various studies, it has become evident that there are common themes and divergent perspectives within the field. While some gaps in the literature have been identified, this review lays a solid foundation for the subsequent research and serves as a valuable resource for understanding the current state of knowledge in this area. Moving forward, building upon these insights will undoubtedly contribute to a deeper understanding and further advancements in the subject matter.

2. Methodology

Economic theories, when observed in different environments, experience shocks (positive or negative). Given the inevitable and varying economic environments, the methodology provides the evidence to support any result, thus reconciling the mismatch between economic theories and their ability to thrive in different environments which sometimes arises. Ultimately, the impact of tax changes on the size of the economy is an empirical question. Policymakers and researchers have always been interested in how potential changes in the tax system impact the overall economy. Evidence by Piketty, Saez and Stantcheva (2014) on tax rates and economic

growth between 1960 and 2010 from 18 OECD countries using regression analysis reveals that there is a weak correlation between growth in real GDP per capita and tax rate. In order to attract more FDI, countries introduce different tax incentives, such as tax holidays, investment allowances and exemptions. Shafiq et al. (2021) examined the impact of taxation on foreign direct investment in Pakistan using time series data (1985-2020), autoregressive distributed lag (ARDL) and error correction model (ECM) techniques used for empirical analysis. The study concludes that low taxes provide the impetus for foreign investment and the long-run relationship between taxes and FDI in Pakistan.

This study examined the relationship between special economic zones (“tax havens”) in Poland and the Polish economy using time series data from between 1998 and 2020. The vector autoregressive model was employed using the ordinary least squares regression method. Firstly, the author identified and gathered data on Special Economic Zones in Poland, specifically the annual total amount of tax exemptions (TEx_SEZs). Macroeconomic data for Poland were collected, including gross domestic product, foreign direct investment, employment growth rate, and per capita income over a specific period. The second step in the methodology was data analysis. Descriptive analysis was conducted on the collected data to understand the trends, patterns, and distributions of the variables. Correlation analysis examined the initial relationships between TEx_SEZs and macroeconomic indicators. The augmented Dickey-Fuller (ADF) test was used to test for unit roots, and the test results revealed per-capita income and foreign direct investment to be stationary while GDP, employment growth rate and TEx_SEZs are non-stationary. Non-stationary time series can cause a spurious regression (Gujarati, 2022), where a significant relationship is observed between variables, although no true relationship exists. The Engle-Granger two-step cointegration

test was employed to test whether a cointegrating relationship exists between the variables and estimate the long-run equilibrium relationship between them. The cointegration test results revealed that a cointegration relationship between the variables exists. The vector autoregression (VAR) model was used to model the relationship between Special Economic Zones and macroeconomic performance in Poland, considering factors such as data quality, control variables, and potential lagged effects. The mean residual test of model accuracy was performed to validate our regression results. In the final step of the methodology, Granger causality analysis was performed to investigate whether TEX_SEZs Granger-causes economic growth in Poland. The researchers utilised time series forecasting techniques (VAR model) to forecast the future value of FDI based on the presence and characteristics of TEX_SEZs .

Research Questions

1. What is the nature of the relationship between Special Economic Zones and macroeconomic indicators in Poland?
2. How do Special Economic Zones impact economic growth, foreign direct investment, employment growth rate and per capita income in Poland?

$$\begin{aligned} GDP_t &= \beta_1 + \phi_{11}UEM_{(t-1)} + \phi_{12}FDI_{(t-1)} + \phi_{13}PCAP_{(t-1)} + \phi_{14}Tex_SEZs_{(t-1)} + e_{1t} \\ UEM_t &= \beta_2 + \phi_{21}GDP_{(t-1)} + \phi_{22}FDI_{(t-1)} + \phi_{23}PCAP_{(t-1)} + \phi_{24}Tex_SEZs_{(t-1)} + e_{2t} \\ FDI_t &= \beta_3 + \phi_{31}GDP_{(t-1)} + \phi_{32}UEM_{(t-1)} + \phi_{33}PCAP_{(t-1)} + \phi_{34}Tex_SEZs_{(t-1)} + e_{3t} \\ PCAP_t &= \beta_4 + \phi_{41}GDP_{(t-1)} + \phi_{42}UEM_{(t-1)} + \phi_{43}FDI_{(t-1)} + \phi_{44}Tex_SEZs_{(t-1)} + e_{4t} \\ Tex_SEZs_t &= \beta_5 + \phi_{51}GDP_{(t-1)} + \phi_{52}UEM_{(t-1)} + \phi_{53}FDI_{(t-1)} + \phi_{54}PCAP_{(t-1)} + e_{5t} \end{aligned}$$

Where:

GDP_t = Gross domestic product at time 't'

UEM_t = Unemployment rate at time 't'

FDI_t = Foreign direct investment at time 't'

$PCAP_t$ = Per capita income at time 't'

Tex_SEZs_t = Tax exemption for Special Economic Zones at time 't'

ϕ_{ij} = coefficients that represent the effect of the predictor variables on the target variable and on themselves (autoregressive terms).

$\beta_1, \beta_2, \beta_3, \beta_4$ and β_5 = intercept terms

$e_{1t}, e_{2t}, e_{3t}, e_{4t}$ and e_{5t} = stochastic error terms.

3. Do Special Economic Zones Granger-cause economic growth in Poland?

Research Objectives

1. To model the relationship between Special Economic Zones and macroeconomic performance in Poland.
2. To statistically evaluate the impact of Special Economic Zones on economic growth, foreign direct investment, employment growth rate and per capita income in Poland.
3. To ascertain if Special Economic Zones Granger-cause economic growth with feedback.
4. To forecast foreign direct investment in Poland based on Special Economic Zones in Poland.

Model Specification

In its simplest form, vector autoregression (VAR) models are used to model multiple time series variables that may be interdependent. The model assumes that each variable is a function of its own lagged values and the lagged values of the other variables in the system. The VAR model can capture short-term relationships between variables even when they are not cointegrated. The functional form of our model is specified as follows:

Definition and Justification of Variables

The variable GDP refers to the annual gross domestic product at market prices in Poland measured in millions of Polish zloty (PLN). Unemployment rate (UEM) is defined here as an estimate of annual national unemployment as a percentage of the total labour force. It refers to the share of the labour force that is without work but available for and seeking employment in Poland. FDI is defined as the

annual sum of direct investment equity capital inflows in Poland, measured in US dollars. Per capita income (PCAP) is Poland's annual gross national income, converted to US dollars using the World Bank Atlas method, divided by the midyear population. It is also known as GNI per capita, measured in US dollars. TEx_SEZs is the total tax exemption value for entrepreneurs and companies managing zones in Poland, measured in thousands of PLN.

Table 1. Data Table

Year	GDP (million PLN)	UEM (%)	FDI (USD)	PCAP (USD)	TEx_SEZs (thousand PLN)
1998	607,103	9.94	6,383,000,000	4360	30,560
1999	674,530	12.29	7,407,000,000	4440	123,469
2000	748,483	16.31	9,335,000,000	4670	241,526
2001	781,548	18.37	5,677,000,000	4710	407,912
2002	812,214	19.89	4,091,000,000	4900	496,954
2003	847,152	19.37	5,371,000,000	5500	611,424
2004	933,091	19.07	13,868,000,000	6260	600,185
2005	990,530	17.75	11,041,000,000	7330	587,816
2006	1,069,431	13.84	21,473,000,000	8420	868,164
2007	1,187,508	9.6	25,031,000,000	9930	1,084,333
2008	1,285,571	7.12	14,574,000,000	11,940	1,089,439
2009	1,372,025	8.17	14,025,000,000	12,490	1,221,559
2010	1,434,368	9.64	18,542,000,000	12,670	1,517,971
2011	1,553,641	9.63	18,212,000,000	12,820	1,829,753
2012	1,612,739	10.09	7,180,000,000	13,090	1,633,383
2013	1,630,126	10.33	1,029,000,000	13,230	2,289,140
2014	1,700,552	8.99	20,455,000,000	13,470	2,551,536
2015	1,798,471	7.5	15,598,000,000	13,250	2,561,422

Year	GDP (million PLN)	UEM (%)	FDI (USD)	PCAP (USD)	TE _x _SEZs (thousand PLN)
2016	1,853,205	6.16	17,750,000,000	12,660	2,728,838
2017	1,982,794	4.89	11,999,000,000	12,690	2,661,240
2018	2126506	3.85	19,204,000,000	14,180	2,775,982
2019	2,288,492	3.28	17,619,000,000	15,330	3,054,179
2020	2,337,672	3.16	19,151,000,000	15,300	2,869,783

Source: Polish Ministry of Development and Technology, World Development Indicators, Eurostat Database

Table 2. Summary Statistics (the summary statistics of the natural data of the variables in the linear model)

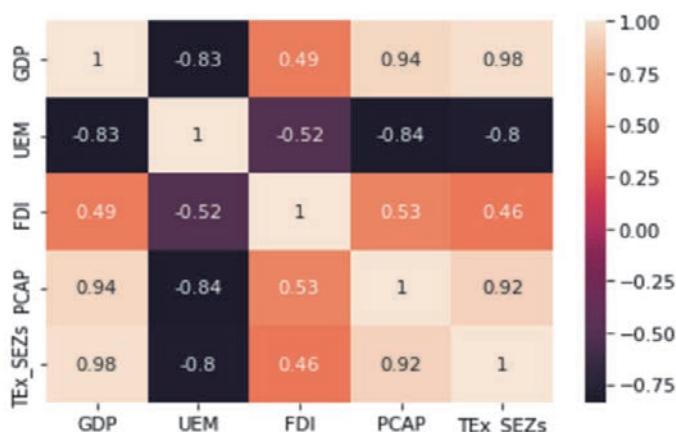
	GDP	UEM	FDI	PCAP	TE _x _SEZs
count	23	23	23	23	23
mean	1,375,120.0	10.8	13,261,520,000	10,158.2	1,471,155
std	533,702.1	5.3	6,471,568,000	3956.1	1,018,627
min	607,103.0	3.1	1,029,000,000	4360.0	30,560
25%	890,121.5	7.3	7,293,500,000	5880.0	594,000
50%	1,372,025.0	9.6	14,025,000,000	12,490.0	1,221,559
75%	1,749,512.0	15.0	18,377,000,000	13,160.0	2,556,479
max	2,337,672.0	19.8	25,031,000,000	15,330.0	3,054,179

Source: See Results Appendix

3. Research results

Following the analysis of data pertaining to the first research question: “What is the nature of the relationship between Special Economic Zones (SEZs) and macroeconomic indicators in Poland?”, the author provides correlation analysis used to test relationships between quantitative variables or categorical variables. A correlation coefficient is a means of assigning a value to the relationship. Correlation coefficients have

a value of between -1 and 1. A figure of 0 means no relationship between the variables at all, while -1 or 1 means a perfect negative or positive correlation. The most common correlation coefficient is the Pearson correlation coefficient, which is used to test for linear relationships between data. For the purpose of this research, the Pearson correlation coefficient will be used to test for relationships between our target vectors (GDP, UEM, FDI and PCAP) and feature (TE_x_SEZs).

Figure 1. Pearson correlation heatmap of the variables in our linear model

Source: own elaboration

Table 3. Correlation between the tax exemption for Special Economic Zones (TEx_SEZs) and selected macroeconomic variables (GDP, UEM, FDI & PCAP) in Poland

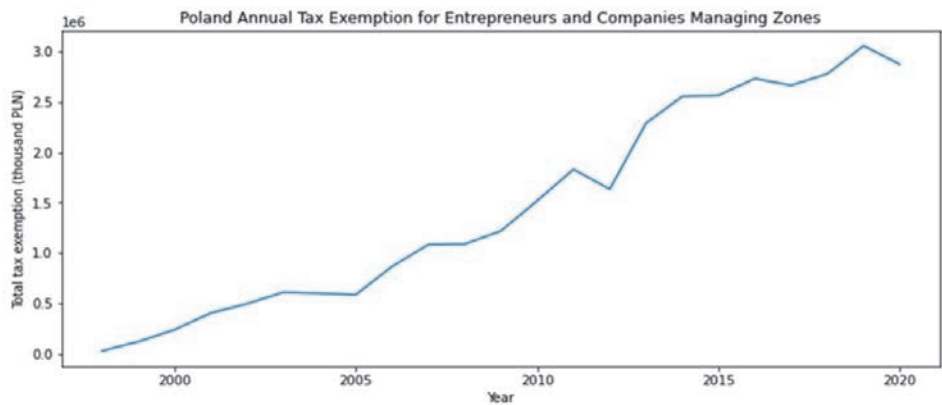
Feature matrix	Target vector	Correlation coefficient	Relationship
TEx_SEZs	GDP	0.98	Strong & Positive
TEx_SEZs	UEM	-0.8	Strong & Negative
TEx_SEZs	FDI	0.46	Moderate & Positive
TEx_SEZs	PCAP	0.92	Strong & Positive

Source: own elaboration

The Pearson correlation test results, as shown in Figure 1 and Table 3, indicate a strong correlation between three target variables (GDP, UEM and PCAP) and the predictor (TEx_SEZs) in the proposed model, while FDI exhibits a moderate correlation with TEx_SEZs. A Pearson correlation coefficient of 0.98 and 0.92 means a very strong and positive relationship

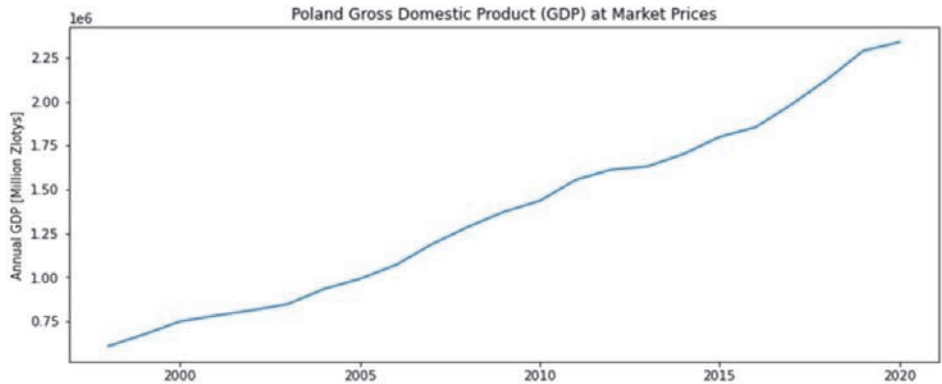
exists between GDP and TEx_SEZs and PCAP and TEx_SEZs, respectively, in Poland. However, a correlation coefficient of 0.46 between FDI and TEx_SEZs indicates a moderately positive relationship between both variables. The positive signs here indicate the nature (direct relationship) of the graph produced by the variables, as shown in Figures 2, 3, 4 and 5.

Figure 2. Annual total tax exemption for special economic zones in Poland



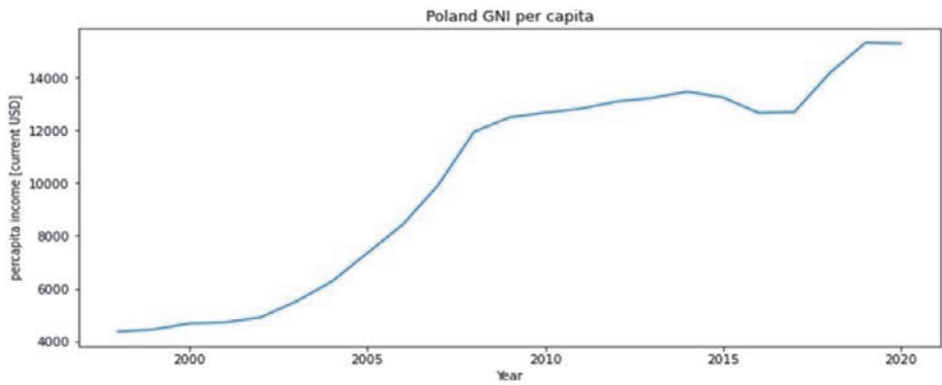
Source: own elaboration based on data obtained from the Polish Ministry of Finance (1998-2020)

Figure 3. Annual GDP at market prices in Poland

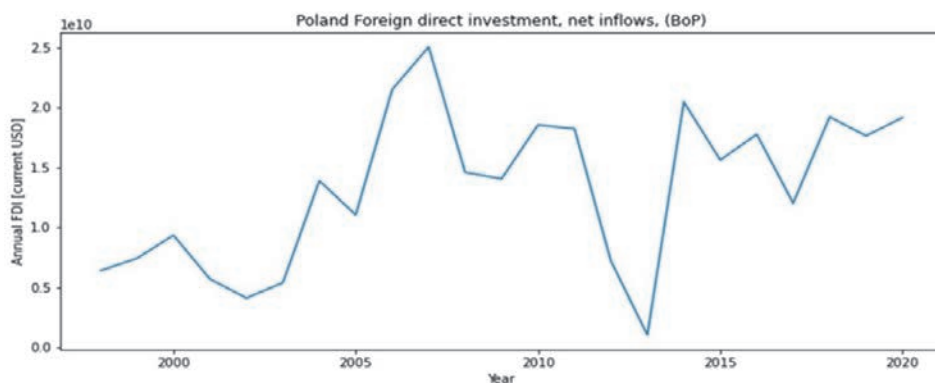


Source: own elaboration based on data obtained from Eurostat (1998-2020)

Figure 4. Annual gross national income per capita in Poland



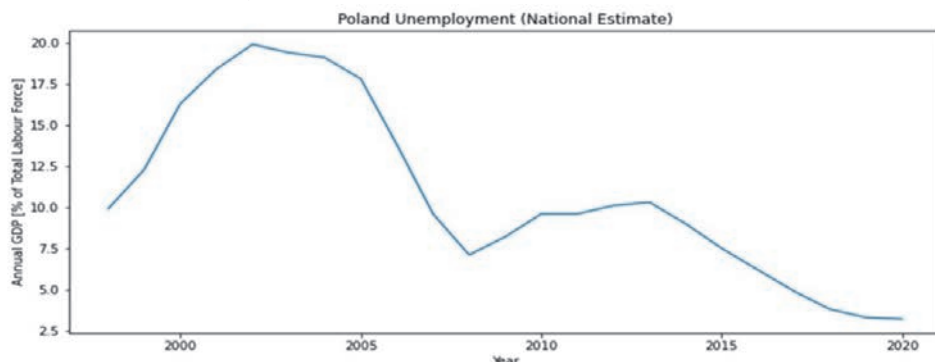
Source: own elaboration based on data obtained from World Development (1998-2020)

Figure 5. Annual foreign direct investment in Poland

Source: own elaboration based on data obtained from World Development (1998-2020)

On the other hand, the Pearson correlation coefficient between TEx_SEZs and UEM is -0.8, implying a strong negative correlation. The negative sign here indicates

the nature (inverse relationship) of the graph produced by both variables, as shown in Figure 6 compared to Figure 2.

Figure 6. Annual unemployment rate in Poland

Source: own elaboration based on data obtained from World Development (1998-2020)

The results of the research based on research question no. 2: “How do special economic zones impact economic growth, foreign direct investment, employment growth rate and per capita income in Poland?” are as follows:

Stationarity (Unit Root) Test

The augmented Dickey-Fuller (ADF) test was used to test for stationarity in the individual variable. The test aligns with the following hypothesis:

Null hypothesis (H0): The variable contains a unit root and is non-stationary.

Alternative hypothesis (H1): The variable is stationary and does not contain a unit root.

Decision Rule: If the calculated ADF test statistic is less than the critical values at the 5% significance level, the study rejects the null hypothesis of non-stationarity and accepts the alternative hypothesis of stationarity and otherwise. The results for the augmented Dickey-Fuller Test for Unit Roots are summarised as follows:

Table 4. Augmented Dickey-Fuller (ADF) Unit Root Test

Variable	Critical Value (5%)	t-statistic	Result
GDP	-3.1271	1.7375	Non-stationary
UEM	-3.1041	-2.0313	Non-stationary
FDI	-3.1271	-3.9025	Stationary
PCAP	-3.1271	-8.4127	Stationary
TE _x SEZs	-3.0054	-0.4930	Non-stationary
TE _x SEZs _{diff_1}	-3.0131	-7.1001	Stationary

Source: own elaboration

Engle-Granger Two-Step Cointegration Test

Two or more variables are said to be cointegrated if they have a long-run or an equilibrium relationship between them (Gujarati, 2022). To test for cointegration among the variables in our model, the author used the Engle-Granger two-step cointegration test on the variables (stationary variables and the first difference of the non-stationary variables in the series). The decision rule for the Engle-Granger two-step cointegration test is based on the p-value. A significance level (5% or 0.05) is typically chosen for the test. The decision rule is as follows:

If the p-value is less than the chosen significance level ($p\text{-value} < 0.05$), we reject the null hypothesis of no cointegration. This means there is evidence of cointegration among the variables.

The test statistic is -6.3848, and the p-value is 0.0000. Comparing these values with the critical values at the 5% significance level, it can be concluded that there is evidence of cointegration among the variables. The p-value is less than 0.05, indicating that the null hypothesis of no cointegration is rejected. Thus, it is concluded that there exists a long-run equilibrium relationship between the lagged values of TE_xSEZs (TE_xSEZs_{diff_1}) and GDP, UEM, FDI, and PCAP in Poland.

Regression Results

Vector autoregression (VAR) models are typically used in econometrics to model the dynamic relationships between multiple time series variables. They are used when:

- The variables are all time series data with interdependencies between them.
- The objective is to capture the relationship between variables and understand how changes in one variable affect the other variables.
- There is no prior theory specifying the direction of causality between the variables.

The decision rule for testing the statistical significance of a regression coefficient is to compare its p-value with a significance level, often set at 0.05. If the p-value is less than the significance level, we reject the null hypothesis that the coefficient is equal to zero and conclude that it is statistically significant. This means that there is strong evidence that the predictor variable has a non-zero effect on the response variable. On the other hand, if the p-value is greater than the significance level, it fails to reject the null hypothesis and concludes that the coefficient is not statistically significant. This means that there is not enough evidence to suggest that the predictor variable has a meaningful effect on the response variable.

**Table 5. Vector Autoregressive (VAR) Estimates with Lag Length 1:
TEx_SEZs_diff_1 Impact**

Dependent Variable	Coefficient	Std. error	t-statistic	Probability
GDP	0.038049	0.28575	1.332	0.183
UEM	-0.000001	0.000001	-0.984	0.325
FDI	11091.58291	4722.82962	2.349	0.019
PCAP	0.000350	0.000548	0.639	0.523

Source: own elaboration

The regression results for the proposed VAR model, shown in Table 7, display the impact of TEx_SEZs on the selected macroeconomic indicators (GDP, UEM, FDI, PCAP) in Poland. Of all the macroeconomic indicators explored in the model, the study can only reject the null hypothesis of statistical insignificance for FDI, given that its p-value (0.019) is less than 0.05 according to the decision rule. Thus, it can be concluded that TEx_SEZs have a statistically significant impact on FDI in Poland. The

regression coefficient (11091.58) indicates a positive relationship between TEx_SEZs and FDI, as can be seen from the sign of its coefficient and confirmed in the correlation analysis. The sign and magnitude of the coefficient of TEx_SEZs imply that, holding all other explanatory variables in the model constant, an increase of 1000 PLN in the total tax exemption for special economic zones (TEx_SEZs) will increase foreign direct investment (FDI) in Poland by US\$11,091.58.

Table 6. (FDI Forecast)

Year	Forecast (USD)
2021	13,271,306,600
2022	17,506,513,100
2023	16,690,797,300
2024	17,060,070,600
2025	17,155,843,600

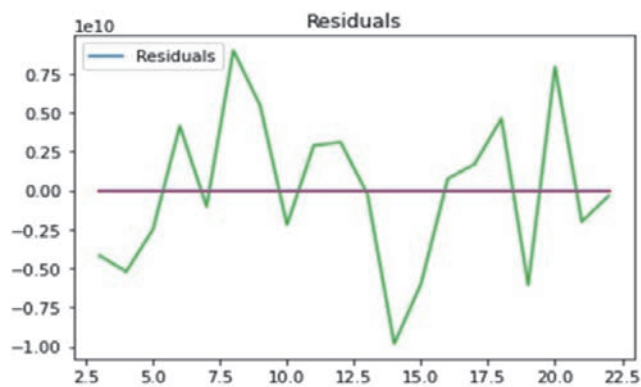
Source: own elaboration

Test for Model Accuracy Mean Residuals

The mean of the residuals should be approximately zero, indicating that the model

is, on average, predicting the correct values. The mean of the residuals can be checked by calculating the mean and comparing it to zero.

Figure 7. Plot of Residuals



Source: own elaboration

Table 7. Table of Mean Residuals

Variable	Mean residual
GDP	-0.000003666111
UEM	0.0000000000074
FDI	-0.01
PCAP	-0.000000000525
TEx_SEZs_diff_1	-0.000000286384

Source: own elaboration

In answering the third research question: “Do SEZs Granger-cause economic growth in Poland?” the Granger causality test was calculated.

Granger causality is a statistical concept used to determine the causal relationship between two time series variables. It is based on the idea that if one time series variable Granger-causes another, then the past values of the first variable provide useful information in predicting the future values of the second variable beyond what is already captured by its past values. The p-value indicates the significance level for the Granger causality between the variables, where a p-value below a chosen significance level (0.05) suggests evidence of Granger causality.

The Granger causality test result between GDP and TEx_SEZs with a p-value of 0.08

suggests weak evidence to reject the null hypothesis of no Granger causality.

In this case, with a p-value of 0.08, larger than the commonly used significance level of 0.05, there is no strong statistical evidence to conclude that TEx_SEZs Granger-causes GDP. This means that the past values of TEx_SEZs may not provide significant information to predict or explain the current or future values of GDP in a causal manner.

4. Discussion

The regression result suggests that the total tax exemption for Special Economic Zones (TEx_SEZs) does not directly contribute to economic growth, employment growth rate and per capita income in Poland. This finding aligns with the findings of Miranda

et al. (2022). The Granger causality test result also suggests weak evidence for the rejection of the the null hypothesis of no Granger causality between TEx_SEZs and GDP. The weak statistical evidence of Granger causality implies that past values of TEx_SEZs may not be reliable predictors of GDP in a causal manner. This implies that the historical performance of TEx_SEZs alone may not provide substantial information for accurately forecasting or explaining GDP changes. The lack of a significant Granger causality relationship indicates that other factors beyond TEx_SEZs might significantly influence GDP in Poland. It suggests that the overall economic performance and growth of the country are influenced by a complex interplay of various factors, including but not limited to special economic zones. The non-causal relationship between TEx_SEZs and GDP suggests that policymakers should not solely rely on tax exemptions for special economic zones as a primary driver of economic growth. While special economic zones may attract foreign investment and promote regional development, other policies and factors must be considered in order to stimulate and sustain overall economic growth. The causality test result highlights the importance of ongoing policy evaluation and monitoring. Policymakers should regularly assess the effectiveness of policies related to special economic zones, including tax incentives, and make adjustments or refinements based on empirical evidence and analysis. This helps ensure that policies align with economic growth and development goals. This finding is in line with the suggestions given by Aggarwal and Kokko (2022).

On the other hand, TEx_SEZs have a statistically significant and positive impact on foreign direct investment (FDI) in Poland. This implies that providing tax incentives, such as tax exemptions on special economic zones, can be an effective policy tool to attract foreign direct investment. This can be beneficial for Poland's economy as it encourages foreign companies to invest in the

country, leading to increased capital inflows, job creation, and potential technology transfer. The positive relationship between TEx_SEZs and FDI implies that by implementing favourable tax policies for special economic zones, Poland can stimulate economic growth. Increased FDI can expand businesses, enhance productivity, and drive overall economic development. The impact of TEx_SEZs on FDI highlights the potential for regional development. By establishing special economic zones in specific regions, Poland can promote economic activities and investments in those areas. This can help to reduce regional disparities and create employment opportunities outside major urban centres. This result aligns with the study conducted in Thailand in that the government must prioritise implementing FDI-friendly policies and trade promotion within the SEZ, as they play a pivotal role in stimulating regional economic growth. Central to this development strategy should be the provision of favourable incentives and privileges to attract foreign direct investment (Romyen et al., 2019).

The result suggests that policymakers should consider the effectiveness of tax incentives, such as the total tax exemption on special economic zones, when designing policies to attract FDI. This information can assist in optimising the design and implementation of tax policies, ensuring they are targeted and tailored to encourage FDI inflows. The findings emphasise the importance of maintaining a competitive business environment to attract foreign investment. By offering tax exemptions on special economic zones, Poland can enhance its competitiveness compared to other countries and potentially position itself as an attractive destination for foreign investors.

Conclusions

Finally, this research sheds light on the complex relationship between tax exemptions for Special Economic Zones

(TE_{Ex}_SEZs) and Poland's economic performance. The Granger causality test results indicate a non-causal relationship between TE_{Ex}_SEZs and GDP, suggesting that historical performance of special economic zones may not be reliable predictors of changes in GDP. This highlights the need for policymakers to recognise that economic growth is influenced by a myriad of factors beyond TE_{Ex}_SEZs. Consequently, it is imperative for policymakers to adopt a holistic approach when designing economic policies, taking into account various factors that contribute to overall economic development.

Conversely, the statistically significant and positive impact of TE_{Ex}_SEZs on foreign direct investment (FDI) indicates the effectiveness of tax incentives in attracting foreign companies to invest in Poland. This finding underscores the importance of crafting targeted and competitive tax policies to stimulate FDI inflows, which can lead to increased capital investment, job creation, and technology transfer, ultimately fostering economic growth.

The contrasting results of the study highlight the complexity of policymaking in the context of Special Economic Zones. Policymakers must strike a balance between leveraging tax incentives to attract FDI while recognising the limitations of TE_{Ex}_SEZs as the sole driver of economic growth. The research emphasises the need for continuous policy evaluation and evidence-based decision-making, allowing policymakers to adapt and refine tax policies to achieve sustainable economic development.

In conclusion, the findings of this study contribute valuable insights to the ongoing discourse surrounding Special Economic Zones and their impact on Poland's economy. By considering both the non-causal relationship between TE_{Ex}_SEZs and GDP and the positive impact on FDI, policymakers can better shape policies that foster balanced economic growth and regional

development. As Poland continues its quest for economic prosperity, understanding the intricate dynamics of Special Economic Zones will be instrumental in charting a resilient and thriving economic future for the nation.

This study has several limitations to consider. Firstly, it relies on secondary data with potential biases and limited depth of analysis. Secondly, its findings may not be easily generalised beyond the Polish context due to variations in economic conditions and policies across countries. Moreover, the statistical analysis used might not capture all causal relationships, overlooking intricate pathways and omitted variables. The study lacks an in-depth exploration of the evolving policies governing TE_{Ex}_SEZs in Poland. Additionally, it does not investigate the potential socio-economic and environmental impacts of these zones. Future research should employ diverse datasets, including case studies and interviews, conduct cross-country comparisons, and explore alternative econometric models to strengthen the findings.

References

- Aggarwal A., (2019). SEZs and Economic Transformation: Towards a Developmental Approach, Transnational Corporations. Investment and Development, 26(2) (Special Issue on Special Economic Zones), 27–47.
- Ambroziak, A. A., Hartwell C. A., (2018). The impact of investments in special economic zones on regional development: the case of Poland, Regional Studies, 52(10), 1322-1331.
- Aggarwal, A., Kokko, A., (2022). SEZs and poverty reduction: evidence from Andhra Pradesh, India, International Journal of Emerging Markets, (17)8, 1793-1814.
- Akhmetshina, E.R., Guzelbaeva, G.T., Rakhmatullina, D.K., (2017). Special Economic Zone as a Local Area of Public-Private Partnership Implementation, European Research Studies Journal, XX(2A), 346-354.

- Blau F.D., Koebe J., Meyerhofer P.A., (2020). Who are the Essential and Frontline Workers? National Bureau of Economic Research, 27791.
- Brezdeń P., Szymtyk R., (2019). Current changes in the location of industry in the suburban zone of a post-socialist city. Case study of Wrocław (Poland), *Tijdschrift voor Economische en Sociale Geografie*, 110(2), 102–122.
- Dargas-Draganik M., Formela J., Mazur-Magier W., Stanke M., Welzant K., (2022). Ustawa o wspieraniu nowych inwestycji: komentarz. CH Beck.
- Dinu, A. M. (2015). Informatic models used in economic analysis of correlation between GDP and FDI. *Polish Journal of Management Studies*, 11(2), 7–16.
- Dorożyński, T., Świerkocki, J., & Dobrowolska, B. (2021). Governance of special economic zones and their performance: Evidence from Poland. *Entrepreneurial Business and Economics Review*, 9(3), 149–167. <https://doi.org/10.15678/EBER.2021.090310>
- Dubinina E., (2023). Impact of Special Economic Zones on domestic market: Evidence from Russia, *Post-Communist Economies*, 35(1), 82–99.
- Durongkaveroj, W., (2023). The economic impact of special economic zones: Evidence from Thailand, *Kasetsart Journal of Social Sciences*, 44(2), 377–386.
- Ficek, W., & Gawlik, R. (2022). A comparative analysis of regional integration potential in the Asia-Pacific Region. *International Entrepreneurship Review*, 8(4), 25–39. <https://doi.org/10.15678/IER.2022.0804.02>
- Gujarati D. N., (2022). Basic econometrics. Prentice Hall.
- Gosek M., Welzant K., (2022). Próby zawężenia katalogu kosztów kwalifikowanych nowej inwestycji w Polskiej Strefie Inwestycji, *Przegląd Podatkowy*, 8.
- Gwartney, J. D., Lawson, R. A., (2006). The impact of tax policy on economic growth, income distribution, and allocation of taxes. *Social Philosophy and Policy*, 23(2), 28–52.
- Hall, R., Jones, C., (1999). Why do some countries produce so much more output per worker than others?, *Quarterly Journal of Economics*, 114(1), 83–116.
- <https://databank.worldbank.org/reports.aspx?dsid=2&series=BX.KLT.DINV.CD.WD>
- https://ec.europa.eu/eurostat/databrowser/view/TIPSAU10__custom_6362291/default/table
- Kanungo, A. K., (2016). Special Economic Zones in China Initiated for Inclusive Growth and Economic Development, *Cambridge Journal of China Studies*. 11(2), 1–23.
- Kryńska E., (2010). Polskie Specjalne Strefy Ekonomiczne, Wydawnictwo Naukowe Scholar, Warszawa, 17–19.
- Lin, J., (2021). New Structural Economics: A Framework of Studying Government and Economics, *Journal of Government and Economics*, 2.
- Lizińska, W., Marks-Bielska, R., (2013). Efekty funkcjonowania specjalnych stref ekonomicznych w Polsce w kontekście realizacji celów ich tworzenia oraz wykorzystywanej pomocy publicznej. *Optimum, Studia Ekonomiczne*, 2(62), 92–105.
- Lipták, František, Klasová, Slávka, Kovac, Viliam, (2015). Special Economic Zone Constitution According to Cluster Analysis, *Proceedings of Economics and Finance*, 27, 186–193.
- Michalek, J. (2023). Incentives and concessions for investors as part of planning investment activities in Special Economic Zones. *Polish Journal of Management Studies*, 27(2), 223–239
- Miranda, M. S., Ferreira, M. A. M., Abrantes, L. A., Macedo, S. V., (2022). Effects of tax exemption on economic growth, *BBR. Brazilian Business Review*, 19, 171–188.
- Mutalimov, V., Kovaleva, I., Mikhaylov, A., & Stepanova, D. (2021). Assessing regional growth of small business in Russia. *Entrepreneurial Business and Economics Review*, 9(3), 119–133. <https://doi.org/10.15678/EBER.2021.090308>
- Myles, G. D., (2000). Taxation and economic growth, *Fiscal Studies*, 21(1), 141–168.

- Nazarczuk, J. M., Cicha-Nazarczuk, M., (2021). What are the key location factors for firms in special economic zones? Evidence from Poland, *European Research Studies Journal*, 1, 147-160.
- Nazmi N., (2015). *Economy Policy and Stabilization in Latin America*, Routledge, New York 2015, 112-116.
- Palit, A., (2010). Growth of Special Economic Zones (SEZs) in India: Issues and perspectives, *Journal of Infrastructure Development*, 1(2), 133-152.
- Pan, Wei-Hwa; Ngo, Xuan-Thang, (2016). Endogenous growth theory and regional performance: The moderating effects of special economic zones, *Communist and Post-Communist Studies*, 49(2), 113-122.
- Pastusiak, R., Bolek, M., Jasiniak, M., Keller, J., (2018). Effectiveness of special economic zones of Poland. [Učinkovitost slobodnih ekonomskih zona Poljske] *Zbornik Radova Ekonomski Fakultet u Rijeka*, 36(1), 261-283.
- Patusiak R., Jasiniak M., Keller J., Krzeczewski, (2016). Wpływ specjalnych stref ekonomicznych na gospodarkę i społeczeństwo, *Ekonomia*, Łódź, 8-15.
- Pastusiak, R., (2011). *Specjalne strefy ekonomiczne jako stymulator rozwoju gospodarczego*. Łódź: Wydawnictwo Uniwersytetu Łódzkiego; Uniwersytet Łódzki.
- Piketty, T., Saez, E., Stantcheva, S., (2014). Optimal taxation of top labor incomes: A tale of three elasticities, *American economic journal: economic policy*, 6(1), 230-271.
- Polish Ministry of Development and Technology: Information on the implementation of the Act on Special Economic Zones. As of December 31, 2021.
- Pujer K., (2016). Zarządzanie przedsiębiorstwem w zmiennym otoczeniu w kontekście zrównoważonego rozwoju, *Exante*, Wrocław, 10-15.
- Romyen A, Liu J, Sriboonchitta S, Cherdchom P, Prommee P., (2019). Assessing Regional Economic Performance in the Southern Thailand Special Economic Zone Using a Vine-COPAR Model, *Economies*, 7(2), 30.
- Shafiq, M. N., Hua, L., Bhatti, M. A., Gillani, S., (2021). Impact of Taxation on Foreign Direct Investment: Empirical Evidence from Pakistan, *Pakistan Journal of Humanities and Social Sciences*, 9(1), 10-18.
- Szczepańska-Woszczyzna, K., Gedvilaitė, D., Nazarko, J., Stasiukynas, A., Rubina, A. (2022). Assessment of economic convergence among countries in the European Union. *Technological and Economic Development of Economy*, 28(5), 1572-1588.
- Śleszyński P., Wiedermann K., (2020). Studium szacunku liczby i struktury pracujących oraz bazy ekonomicznej miast w Polsce, *Studies of the Industrial Geography Commission of the Polish Geographical Society*, 34(4), 184-205.
- Wiedermann, K., Trojak, A., (2009). Specjalne strefy ekonomiczne i strefy przemysłowe w kształtowaniu rozwoju gospodarczego regionów na przykładzie Polski i Czech, *Prace Komisji Geografii Przemysłu Polskiego Towarzystwa Geograficznego*, (12), 133-143.

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E-Commerce and Sustainable Development in the European Union: A Comprehensive Analysis of SDG2, SDG12, and SDG13

ALEKSY KWILINSKI

Abstract

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The rapid expansion of e-commerce has revolutionised global trade and connectivity, bringing forth both opportunities and challenges for sustainable growth in European Union (EU) countries. This study aims to investigate the impact of e-commerce on key sustainable development goals (SDGs) in the EU, specifically focusing on SDG2 (Zero Hunger), SDG12 (Responsible Consumption and Production), and SDG13 (Climate Action). To analyse the influence of e-commerce on the selected SDGs, this study adopts two distinct approaches: the panel-corrected standard error (static estimation) approach and the system generalised method of moments (dynamic estimation) approach. The investigation yields significant insights into the role of e-commerce in shaping the achievement of the aforementioned SDGs. The findings indicate that e-commerce has the potential to enhance food distribution networks, thus improving access to nutritious food in certain regions. However, concerns are raised regarding increased food waste and its impact on food availability for vulnerable populations. Additionally, the study highlights the environmental implications of e-commerce, particularly in terms of excessive packaging waste and carbon emissions from logistics. Based on empirical findings, policymakers, businesses, and stakeholders should develop targeted strategies to capitalise on the positive impacts of e-commerce while addressing the challenges thereof in the context of sustainable development. Recommended measures include optimising delivery routes, promoting sustainable packaging practices, and integrating green technology into e-commerce operations to effectively align e-commerce with the SDGs.

Key words

responsible consumption, responsible production, climate action, no hunger, digitalisation, online shopping.

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Introduction

The rapid growth of e-commerce has indeed brought significant advancements to the global market, offering unparalleled convenience and accessibility to consumers worldwide (Wang and Liu, 2022; Akimov et al., 2021; Titko et al., 2023). However, it has also raised concerns about its environmental and societal impacts, leading to debates over its true contribution to sustainable development (Stępień et al., 2023; Spicka, 2018; Spicka et al., 2019). While proponents argue that e-commerce facilitates resource efficiency and reduces carbon emissions through the optimisation of logistics (Letunovska et al., 2023; Miśkiewicz, 2019), critics question its role in promoting overconsumption (Chen et al., 2021; Arefieva et al., 2021), wasteful packaging (Jacobsen et al., 2022), and the detrimental effects of last-mile deliveries on urban congestion (Muriel et al., 2022; Engesser et al., 2023) and air quality (Zhang et al., 2022).

In the context of the European Union (EU), where e-commerce has witnessed exponential growth in recent years, the balance between economic prosperity and sustainable development has become a critical point of contention (Dementyev et al., 2021; Trushkina et al., 2020; Miśkiewicz et al., 2022; Kwilinski et al., 2022; Jenčová et al., 2023). Considering the official report on the attainment of the Sustainable Development Goals (SDGs), EU countries are weakly positioned in the context of SDG2: Zero Hunger, SDG12: Responsible Consumption and Production, and SDG13: Climate Action. While scholars (Music et al., 2022; Melnyk et al., 2021; Ben Youssef and Dahmani, 2023) argue that e-commerce enhances food accessibility and affordability, others question whether its emphasis on fast delivery and single-use packaging aligns with responsible consumption and production practices (Jia et al., 2022; Morashti et al., 2022; Delina et al., 2023; Lopez-Villalobos

et al., 2022). Thus, it is necessary to identify and empirically justify the character of links between e-commerce and sustainable development. The primary objective of this paper is to investigate the implications of e-commerce on sustainable development within the European Union. This investigation is pursued through the utilisation of existing research and the creation of econometric models, which are tailored to evaluate the specific influence of e-commerce on SDG2, SDG12, and SDG13. The paper fills the scientific gaps (which outline the originality of this study) in attaining SDGs by developing an approach to justify the impact of e-commerce on SDG2, SDG12, and SDG13 based on a combination of the panel-corrected standard error (static estimation) and the system generalised method of moments (dynamic estimation).

The paper is structured as follows. The literature review contains an analysis of the theoretical landscape on linking e-commerce and SDG2, SDG12, and SDG13 to justify the research hypotheses; the materials and methods section explores the variables and sources, explaining the selected approaches to verifying the research hypotheses; the results section describes the empirical results of the study; and the discussion and conclusion section contains a summary of the research findings and a comparative analysis with previous investigations, and outlines the policy implications, limitations and potential directions for further research.

1. Literature review

Past studies (Cordes and Marinova, 2023; Chen et al., 2023; Zhanibek et al., 2022; Di Pierro et al., 2023; Criveanu, 2023) confirm that the share of enterprises with e-commerce sales has a significant impact on achieving the Sustainable Development Goals (SDGs) in various ways. The adoption

and expansion of e-commerce by businesses positively influence several SDGs, particularly those related to economic growth, innovation, and sustainable consumption (Mazhar et al., 2022; Melnychenko, 2019; Karnowski and Miśkiewicz, 2021; von Braun et al., 2023; Oruma et al., 2021). Applying the artificial neural network and cluster analysis, M. Criveanu (2023) confirmed that e-commerce boosts economic growth and sustainable development. Von Braun et al. (2023) have shown that digitalisation impacts a country's food system and reduces hunger. Similar findings are presented in a study by Oruma et al. (2021), which presents the interdependence of food security in Nigeria with Agriculture 4.0 and commercial farming. Based on the findings, they proved that digital technologies in the agri-food supply chain aim to contribute to SDGs 2, 3, and 8 for the benefit of Nigeria and the global community. Hassani et al. (2021) outlined the fact that extending Big Data and e-commerce stimulates the transformation of the food supply chain, improving food security and attaining zero hunger (SDG 2). Studies (Reardon et al., 2021; Carpio et al., 2013; Guo et al., 2021) have shown that e-commerce platforms facilitate direct connections between consumers and local food producers, enabling consumers to support small-scale farmers and local businesses. This contributes to sustainable rural development and poverty reduction, aligning with the objectives of SDG2. Scholars (Musa et al., 2023; Oláh et al., 2018; Chen et al., 2020; Sousa et al., 2021) have shown that e-commerce platforms enable producers and retailers to reach a broader customer base, including consumers who prioritise sustainable and ethically sourced products. This encourages more businesses to adopt sustainable production practices and offer eco-friendly food options, contributing to SDG2's target of ensuring sustainable food production. At the same time, other research (Lin et al., 2021; Apostolopoulos

et al., 2021) has revealed that e-commerce, particularly in the food industry, contributes to food wastage through excessive packaging, short shelf-life products, and inefficient supply chains. It may also prioritise cost and speed over sustainability, leading to an emphasis on processed and non-nutritious foods rather than promoting access to healthy and nutritious options (Letunovska et al., 2022). Additionally, the reliance of e-commerce on long-distance shipping and refrigeration increases the carbon footprint of food transportation, further impacting food security and availability (Lin et al., 2021; Apostolopoulos et al., 2021). Based on this, the following hypothesis is proposed:

Hypothesis 1: The effect of e-commerce on attaining SDG2: Zero Hunger.

Altarturi et al. (2023) outlined that the share of enterprises with e-commerce sales inclines consumer behaviour toward more responsible consumption. E-commerce platforms have the potential to promote sustainable products, provide information on eco-friendly options, and encourage consumers to make conscious choices, reducing the overall environmental impact. Ji et al. (2023) examined China's efforts to achieve the sustainable development goals by reducing carbon emissions and utilising digitalisation. Additionally, the research highlights that digitalisation plays a crucial role in driving sustainable development. Chiu et al. (2020) underlined that by providing consumers with access to sustainable and eco-friendly products, e-commerce influences purchasing decisions and encourages responsible consumption practices that directly relate to SDG 12. Based on the questionnaire from 421 respondents, Nogueira et al. (2021) concluded that demographic characteristics impact the decision to buy green products via e-platforms. At the same time, they outlined that sustainable production and consumption require relevant

digital knowledge (Kwilinski et al., 2020; 2022; Melnychenko, 2021a; 2021b; Kwilinski, 2019; Trzeciak et al., Dzwigol, 2019; 2021; 2022a; 2022b; 2023; Dzwigol et al., 2023), competencies, and infrastructure. Using survey data (among EU and African countries) and applying cluster analyses and ANOVA tests, Kwilinski et al. (2019) showed that e-commerce policy is crucial in extending responsible consumption and production. At the same time, they outlined that EU countries more actively implement relevant policies on the spread of digitalisation than African countries.

Scholars (Xie et al., 2021; Ji et al., 2023) have proven that e-commerce contributes to overconsumption and unnecessary purchases due to easy access to a wide range of products. Such consumer behaviour leads to increased waste generation and resource depletion. Moreover, the use of single-use packaging and inefficient product returns in e-commerce add to the environmental burden. Thus, the second research hypothesis is outlined as follows:

Hypothesis 2: The effect of e-commerce on attaining SDG12: Responsible Consumption and Production.

Based on the results of the literature review, Siikavirta et al. (2002) outline that e-commerce, specifically e-grocery home delivery services, presents an opportunity to reduce greenhouse gas (GHG) emissions in the food production and consumption system by 18% to 87% compared to traditional in-store shopping. However, the current market potential for emission reduction is limited to approximately 0.3% to 1.3% due to low market share. Achieving significant GHG reductions would necessitate system-level innovations and more research to assess the effectiveness of e-commerce and e-grocery in this context. Liang et al. (2021) explored the correlation between e-commerce and carbon dioxide emissions by means of panel data from various Chinese cities spanning

2001-2017. The results indicated that greater trade openness leads to reduced carbon emissions, while increased foreign direct investment (FDI) and market size are associated with higher emissions. Furthermore, the research supports a quadratic-shaped carbon Kuznets curve (CKC) for China, Eastern China, and Western China and a cubic-shaped CKC for Central China, offering significant insights for formulating e-commerce regulations at regional and national levels to mitigate carbon emissions (Liang et al., 2021). Tiwari and Singh (2021) investigated the environmental effects of e-commerce, highlighting the importance of raising awareness about its potential consequences. Although e-commerce has become a lucrative industry with significant revenue generation, its rapid expansion has had both beneficial and detrimental impacts on the environment, underscoring the necessity for agencies and industries involved in its development to prioritise sustainability measures. Using panel data from Chinese cities between 2006 and 2016 and the staggered difference-in-differences method, Wang et al. (2023) examined the impact of e-commerce pilot policies on carbon emissions. The results indicate that an e-commerce pilot policy leads to a significant reduction in carbon emissions, especially in non-old industrial and non-resource-based cities, achieved through the optimisation of resource allocation, a reduction in energy consumption, and industrial structure upgrades. Furthermore, the e-commerce pilot policy demonstrates positive synergies with other carbon reduction measures, providing empirical evidence for reducing carbon emissions and implications for fostering sustainable urban development. However, scholars (Khrais, 2020; Jiménez-Rodríguez et al., 2022; Pérez-Martínez et al., 2023) have proven that the impact of e-commerce on SDGs is not always uniformly positive. In regions with limited internet access and digital literacy, certain communities and

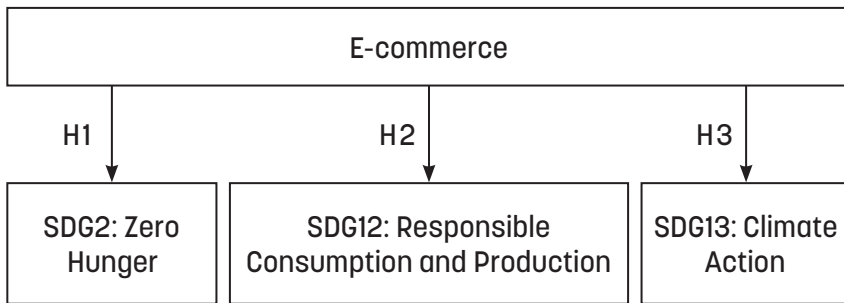
populations are left behind, exacerbating existing inequalities. While e-commerce promotes responsible consumption, it also leads to increased packaging waste and energy consumption due to transportation and logistics. In addition, e-commerce growth could raise concerns about labour practices and working conditions, particularly in the

gig economy, where workers face precarious employment. The third research hypothesis is as follows:

Hypothesis 3: The effect of e-commerce on attaining SDG13: Climate Action.

The research framework of this study is shown in Figure 1.

Figure 1. Theoretical framework of the investigation



Source: own elaboration

2. Materials and methods

This paper aims to explore the impact of e-commerce on sustainable development in the European Union. To achieve this,

$$SDG2_{it} = b_1 Ecommerce_{it} + \delta_j X_{jt} + \varepsilon_{it} \quad (1)$$

where $SDG2_{it}$ – the SDG2 Index Score of country i at time t ; $Ecommerce_{it}$ – the level of e-commerce of country i at time t ; X_{jt} – the set of control variables for country i at time t ; b_1 – the estimator associated with the e-commerce variable; δ_j – the estimator associated with the control variables; and ε_{it} – the residual term representing the error in the model.

SDG2 primarily deals with food security and sustainable agriculture. It aims to ensure that everyone has access to sufficient,

the study leveraged existing research and devised econometric models focused on assessing the influence of e-commerce on SDG2, SDG12, and SDG13:

safe, and nutritious food while also promoting sustainable farming practices. The link between SDG2 and e-commerce may not be direct, as e-commerce sales are more related to trade and business practices. However, in the context of agriculture and food supply chains, e-commerce platforms play a role in facilitating the distribution and sales of agricultural products, especially for smallholder farmers. E-commerce gives them access to larger markets and fair prices, ultimately contributing to food security.

$$SDG12_{it} = b_2 Ecommerce_{it} + \delta_j X_{jt} + \varepsilon_{it} \quad (2)$$

where $SDG12_{it}$ – the SDG12 Index Score of country i at time t ; b_2 – the estimator associated with the e-commerce variable.

SDG12 focuses on sustainable consumption and production patterns. It aims to ensure that economic growth is

decoupled from resource use, environmental degradation, and negative ecosystem impacts. E-commerce could be a tool by means of which to promote sustainable consumption by enabling businesses to adopt more efficient and eco-friendly production

processes. It also facilitates the development of sharing economies and the circular economy, reducing waste and promoting the reuse of products. By encouraging e-commerce that prioritises sustainable practices, SDG12 objectives could be advanced.

$$SDG13_{it} = b_3 Ecommerce_{it} + \delta_j X_{jt} + \varepsilon_{it} \quad (3)$$

where $SDG13_{it}$ – the SDG13 Index Score of country i at time t ; b_3 – the estimator associated with the e-commerce variable

SDG13 is centred around climate action to combat the impacts of climate change. It involves efforts to reduce greenhouse gas emissions, build resilience to climate-related hazards, and promote sustainable practices. E-commerce can contribute to SDG13 by reducing the carbon footprint associated with traditional retail. Online shopping can be more energy-efficient, as it eliminates the need for physical stores and can optimise transportation routes for deliveries.

In equations (1) to (3), the dependent variables SDG2, SDG12, and SDG13 are measured on a scale ranging from 0 (indicating worst performance) to 100 (indicating best performance) (Sachs et al., 2022). Consistent with previous studies (Zhu et al., 2023; Dharmawansa et al., 2023), the explanatory variable used to describe the level of e-commerce in these models is the percentage of enterprises with e-commerce sales accounting for at least 1% of their turnover.

The following control variables were included in the models to account for other factors that may influence the relationship between e-commerce and the SDGs:

- Trade openness (TO), which measures the degree of a country's integration into the global economy, can influence both the adoption of e-commerce and the attainment of SDGs (Hussain et al., 2021; Szczepańska-Woszczyzna et al., 2022; Kharazishvili and Kwilinski, 2022; Karnowski and Rzońca, 2023). Countries with a higher level of trade openness

might have greater exposure to international markets, affecting the supply of and demand for e-commerce. Moreover, trade openness can impact a country's ability to achieve certain SDGs, particularly SDG12 (Responsible Consumption and Production) and SDG13 (Climate Action).

- Government expenditure on environmental protection (GovEnv) reflects a country's commitment to addressing environmental challenges and mitigating climate change (Hu et al., 2022; Bashir et al., 2022; Fremstad & Paul, 2022). It captures the level of support and investment in sustainable practices, which can influence both e-commerce strategies and progress toward climate-related SDGs.
- Government efficiency (WGI) reflects how effectively and transparently a country's government operates. Countries with more efficient governments might be better at implementing policies that support e-commerce adoption and achieving SDGs. Including this control variable helps account for the institutional and governance context that may influence the relationships under investigation (Kryshtanovych et al., 2022; Ahi et al., 2023). The assessment of WGI serves as an aggregate average indicator encompassing six overarching dimensions of governance: voice and accountability; political stability and absence of violence/terrorism; government effectiveness; regulatory quality; rule of law; and control of corruption. The assessment scale ranges from -2.5 (indicating poor governance performance) to 2.5 (reflecting strong governance performance).

The research employed a panel data approach to empirically estimate the regression model using annual data from EU countries gathered between 2009 and 2021, sourced from Eurostat and the World Bank. However, e-commerce data for Belgium, Bulgaria, Greece, and Malta were unavailable for the

chosen period. As a result, the number of cross-sectional units (N) exceeded the time period (T). Specifically, N was 23, and T was 13. All variables in the models were expressed in logarithmic form. Table 1 shows the variables utilised in the study, accompanied by their associated descriptive statistics.

Table 1. Descriptive statistics of the variables

Variable	Units	Source	Mean	CV	Min	Max
SDG2	Index Score	Sachs et al. (2022)	68.120	0.071	57.816	77.571
SDG12	Index Score	Sachs et al. (2022)	67.728	0.141	46.705	85.595
SDG13	Index Score	Sachs et al. (2022)	63.422	0.187	33.333	87.866
Ecommerce	Percentage of enterprises	Eurostat (2023)	16.205	0.537	1.100	47.200
TO	% of GDP	World Bank (2023)	123.259	0.504	45.419	388.120
GovEnv	% of GDP	Eurostat (2023)	0.705	0.424	0.100	1.700
WGI	Index Score	World Bank (2023)	1.082	0.431	0.087	1.873

Notes: CV – Coefficient of variation; Min – minimum value; Max – maximum value; Mean – average value.

Source: own elaboration

Given the nature of the dataset, which exhibits an imbalanced panel structure with more cross-sectional units than time periods, two distinct estimation approaches were applied to address its specific characteristics.

The panel-corrected standard error (PCSE) approach (static estimation) was chosen to address heteroscedasticity and within-group correlation in the panel data (Rodríguez-Pose and Ketterer, 2012; Jiang and Zheng, 2023). While well-suited to static estimation in balanced panels, this method may not be the best choice for handling the imbalanced panel structure present in this study. However, the PCSE approach was still employed to compare its performance with the dynamic estimation approach.

To effectively account for the challenges posed by the imbalanced panel structure and to address potential endogeneity issues arising from unobserved heterogeneity, the System GMM estimator was employed

(Wawro, 2002; Agan and Balcilar, 2023; Saha, 2023). This dynamic estimation approach is specifically designed to handle datasets with more cross-sectional units than time periods. By utilising instrumental variables, the system GMM estimator provided a robust framework for analysing the dynamics of the variables in the panel data. The validity of the instruments utilised in GMM estimation was assessed by employing Hansen and Arellano-Bond's AR(2) tests for autocorrelation (Saidi and Hammami, 2017; Omri and Kahouli, 2014; Hansen, 1982; Arellano and Bond, 1991; Roodman, 2006).

Before using the panel-corrected standard error (PCSE) approach for static estimation and the system GMM estimator, the following tests were utilised to assess assumptions and address potential issues in the data and model:

- Modified Wald and Breusch-Pagan/Cook-Weisberg heteroscedasticity test (Baptista et al., 2013; Roy and Rayhan,

2011): These tests were used to check for heteroscedasticity, which occurs when the variance of the error terms is not constant across observations. Heteroskedasticity can lead to inefficient and biased parameter estimates. If these tests detect heteroscedasticity, it indicates that the traditional standard errors might not be appropriate, and the PCSE approach can be utilised to correct for heteroscedasticity and obtain consistent estimates;

- Wooldridge test for autocorrelation (Wooldridge, 1990): This test was employed to detect the presence of autocorrelation in the error terms, which implies that the error terms are correlated across time periods. Autocorrelation violates the assumption of independently and identically distributed errors, leading to biased and inefficient estimators. If autocorrelation is detected, the System GMM estimator, which can handle dynamic panel data with autocorrelated errors, might be more suitable;
- VIF test for multicollinearity (Lin et al., 2011; Curto and Pinto, 2011): The variance inflation factor (VIF) test was used to assess multicollinearity, which occurs when independent variables are highly

correlated. Multicollinearity can lead to unstable and unreliable coefficient estimates. If significant multicollinearity is detected, it is essential to address it to obtain accurate coefficient estimates;

- Cross-sectional dependence test by Pesaran: The cross-sectional dependence test developed by Pesaran (2007) and Baltagi and Pesaran (2007) was used to assess whether a cross-sectional correlation exists in the data. The PCSE approach is more appropriate when cross-sectional dependence exists, as it provides consistent standard errors that account for cross-sectional correlation.

3. Results

The outcomes shown in Table 2 unveil notable diminutions in correlation coefficients observed among the variables, with the most elevated coefficient being documented at 0.527. As delineated by studies (Kwilinski et al., 2023), a robust correlation becomes evident when the coefficient exceeds the threshold of 0.80. Employing this criterion established by Kennedy, it is possible to deduce that the present study remains unburdened by concerns pertaining to multicollinearity.

Table 2. Correlation matrix

Variable		Ecommerce	TO	GovEnv	WGI
Ecommerce	const	1.000			
	p value				
TO	const	0.133	1.000		
	p value	0.021			
GovEnv	const	0.040	0.063	1.000	
	p value	0.496	0.281		
WGI	const	0.527	0.222	0.247	1.000
	p value	0.000	0.000	0.000	

Source: own elaboration

Furthermore, the variance inflation factor (VIF) falls below 10, suggesting the non-existence of multicollinearity among the

independent variables, as noted by Lin et al. (2011) and Curto and Pinto (2011). The empirical results of VIF are shown in Table 3.

Table 3. The empirical results of the multicollinearity test (VIF)

Variable	Ecommerce	TO	GovEnv	WGI
SDG2	1.45	1.07	1.13	1.61
SDG12	1.45	1.07	1.13	1.61
SDG13	1.45	1.07	1.13	1.61

Source: own elaboration

The results of the diagnostic tests (Table 4) suggest the presence of heteroskedasticity, autocorrelation, and cross-sectional dependence in the model. For the dependent variable SDG2, the modified Wald statistic is highly significant at 0.000, indicating the presence of heteroskedasticity. The Breusch-Pagan/Cook-Weisberg test also shows significance at a level of 0.037, further confirming the presence of heteroskedasticity. Similarly, the Wooldridge test highlights autocorrelation with a significant statistic of 2.309 and a p value of 0.011. The Pesaran test for cross-sectional dependence yields a statistic of 2.802 and a p value of 0.005, indicating the presence of cross-sectional dependence for SDG2.

For the variable SDG12, the modified Wald statistic is highly significant at 0.000, indicating heteroscedasticity. The

Breusch-Pagan/Cook-Weisberg test confirms this with a significant statistic of 4.55 and a p value of 0.032. The Wooldridge test suggests the presence of autocorrelation, with a statistic of 3.961 and a p value of 0.000. Additionally, the Pesaran test indicates cross-sectional dependence, with a statistic of 19.969 and a p value of 0.000 for SDG12.

For the variable SDG13, the modified Wald statistic is highly significant at 0.000, indicating heteroscedasticity. The Breusch-Pagan/Cook-Weisberg test supports this with a significant statistic of 8.11 and a p value of 0.004. The Wooldridge test suggests autocorrelation with a statistic of 3.756 and a p value of 0.000. Similarly, the Pesaran test indicates cross-sectional dependence, with a statistic of 11.986 and a p value of 0.000 for SDG13.

Table 4. Heteroskedasticity, autocorrelation and cross-sectional dependence diagnostic tests

Variable	Modified Wald		Breusch-Pagan/ Cook-Weisberg		Wooldridge		Pesaran	
	Statistic	p value	Statistic	p value	Statistic	p value	Statistic	p value
SDG2	4389.79	0.000	4.33	0.037	2.309	0.011	2.802	0.005
SDG12	1176.75	0.000	4.55	0.032	3.961	0.000	19.969	0.000
SDG13	3534.35	0.000	8.11	0.004	3.756	0.000	11.986	0.000

Source: own elaboration

To ensure the robustness of the regression results, the method of sequentially introducing control variables for regression analysis in models (1)-(3) was employed. It may be

observed from Table 5 that irrespective of the number of control variables added, the coefficient of SDG remained consistent and significant.

Table 5. Benchmark regression results

Variable	SDG2							
	Coef.	p value	Coef.	p value	Coef.	p value	Coef.	p value
Ecommerce	1.518	0.000	1.275	0.000	1.004	0.000	0.878	0.000
TO	–	–	0.005	0.000	0.004	0.000	0.003	0.000
GovEnv	–	–	–	–	1.380	0.000	1.468	0.000
WGI	–	–	–	–	–	–	0.298	0.036
R-Squared	0.935		0.943		0.955		0.955	
Adj R-squared	0.935		0.942		0.954		0.954	
SDG12								
Ecommerce	1.506	0.000	1.274	0.000	0.981	0.000	0.931	0.000
TO	–	–	0.005	0.000	0.003	0.000	0.003	0.001
GovEnv	–	–	–	–	1.488	0.000	1.523	0.000
WGI	–	–	–	–	–	–	0.119	0.443
R-Squared	0.926		0.932		0.946		0.946	
Adj R-squared	0.925		0.931		0.945		0.945	
SDG13								
Ecommerce	1.480	0.000	1.280	0.000	0.980	0.000	0.969	0.000
TO	–	–	0.004	0.000	0.002	0.006	0.002	0.008
GovEnv	–	–	–	–	1.525	0.000	1.533	0.000
WGI	–	–	–	–	–	–	0.027	0.863
R-Squared	0.925		0.930		0.945		0.945	
Adj R-squared	0.924		0.929		0.944		0.944	

Source: own elaboration

The empirical outcomes derived from PCSE (Table 6) show the associations of

e-commerce with SDG2, SDG12, and SDG13.

Table 6. The empirical results of PCSE (static estimation)

Variable	SDG2		SDG12		SDG13	
	Coef.	p value	Coef.	p value	Coef.	p value
Ecommerce	0.490	0.000	0.477	0.000	0.540	0.000
TO	0.006	0.000	0.007	0.000	0.006	0.000
GovEnv	0.835	0.000	0.770	0.000	0.869	0.000
WGI	1.149	0.000	1.130	0.000	0.958	0.000
R-Squared	0.914		0.894		0.897	
Observation	299		299		299	

Source: own elaboration

In the context of SDG2, the coefficient of 0.490 with a p value of 0.000 reveals a statistically significant and positive correlation between e-commerce and advancements in hunger reduction. This suggests that e-commerce practices potentially contribute to the enhancement of food distribution networks, facilitating access to nourishing sustenance. At the same time, concerning SDG12, the coefficient of 0.477 with a p value of 0.000 reveals a substantial and positive link between e-commerce and responsible consumption and production. This implies that while e-commerce may offer convenience and accessibility, it could concurrently foster sustainable consumption behaviours. Likewise, for SDG13, the coefficient of 0.540 with a p value of 0.000 establishes a noteworthy and positive connection between e-commerce and climate action. This hints at the potential influence of e-commerce strategies on initiatives aimed at mitigating carbon emissions and advancing environmental sustainability. The positive coefficients exhibited by TO, GovEnv, and WGI across all three SDGs, coupled with their low p values, underline their constructive associations with

progress toward the respective SDGs. This implies that increased trade openness, robust governance and environmental regulations, and favourable governance indicators collectively contribute to the advancement of these sustainability objectives. The substantial R-squared values (0.914, 0.894, and 0.897) confirm that a significant proportion of the variability in the dependent variables (SDG2, SDG12, and SDG13) could be elucidated by the independent variables featured in the model.

The results of Table 7 indicate that in the context of the European Union, the variables of e-commerce, trade openness, government expenditure on environmental protection, and government efficiency are positively associated with the achievement of SDG2 (Zero Hunger), SDG12 (Responsible Consumption and Production), and SDG13 (Climate Action). The lagged value of each SDG is also important in explaining its current value. Additionally, the Arellano-Bond tests for autocorrelation and the Hansen test for overidentification suggest that the assumptions of the model and the instruments are valid.

Table 7. Results of system GMM (Dynamic Estimation)

Variable	SDG2		SDG12		SDG13	
	Coef.	p value	Coef.	p value	Coef.	p value
L1.SDG	0.169	0.062	0.915	0.000	0.865	0.000
Ecommerce	0.012	0.000	0.002	0.000	0.001	0.022
TO	0.027	0.000	0.009	0.000	0.025	0.000
GovEnv	0.017	0.000	0.003	0.000	0.007	0.001
WGI	0.011	0.000	0.016	0.000	0.022	0.007
Arellano–Bond test for AR(1)	-1.91	0.056	-1.82	0.069	-2.45	0.014
Arellano–Bond test for AR(2)	1.25	0.212	1.06	0.290	1.62	0.105
Hansen test of overid restrictions	11.82	0.223	10.38	0.407	17.15	0.104
Group	23		23		23	
Instruments	15		16		17	

Source: own elaboration

The results for SDG2 demonstrate that e-commerce, trade openness, government expenditure on environmental protection, and government efficiency all exhibit positive and statistically significant coefficients (p value = 0.000), indicating a significant positive relationship with the SDG2 index score. This implies that an increase in e-commerce activity, greater trade openness, more government investment in environmental protection, and more efficient governance are associated with improved performance in terms of food security and sustainable agriculture. Additionally, the lagged value of SDG2 has a positive effect on its current value, although with a marginally significant statistical level (p value = 0.062), suggesting that past achievements in SDG2 might influence its current attainment. The emphasis placed by the EU on fostering e-commerce and trade openness, along with policies promoting environmental protection and efficient governance, can contribute to improving access to nutritious food and sustainable farming practices within the region.

In the context of SDG12 (responsible consumption and production), the notable positive coefficients associated with

e-commerce, trade openness, government expenditure on environmental protection, and government efficiency underscore their potential to serve as driving forces behind the promotion of responsible consumption and production patterns within the European Union. The statistical significance of these coefficients (p value = 0.000) strengthens the credibility of this relationship. The positive coefficient for the lagged value of SDG12 further indicates the lasting impact of past achievements on current outcomes. These findings hold particular significance for EU development policies. First, the positive link between e-commerce and SDG12 implies that the EU's efforts to foster sustainable e-commerce practices, such as encouraging online platforms that prioritise eco-friendly products and packaging, can lead to more responsible consumer choices and reduced environmental impact. Second, the positive association with trade openness suggests that EU trade policies which emphasise sustainability considerations can encourage responsible production practices both domestically and abroad. This alignment with trade openness can facilitate the exchange of sustainable goods and

services, contributing to the goals of SDG12. Moreover, the positive relationship between government expenditure on environmental protection and SDG12 highlights the pivotal role of governmental support in advancing responsible consumption and production practices. The EU commitment to investing in initiatives that promote sustainable production methods, encourage recycling and waste reduction, and facilitate the circular economy aligns directly with the objectives of SDG12. Additionally, the positive coefficient for government efficiency underscores the importance of effective governance in driving responsible consumption and production. Policies that streamline regulatory processes, promote transparency, and ensure efficient resource allocation can facilitate the adoption of sustainable practices by businesses and consumers alike. Furthermore, the highly significant positive effect of the lagged value of SDG12 emphasises the lasting impact of previous achievements in promoting responsible consumption and production within the EU. This suggests that the EU's historical dedication to sustainable practices has laid the foundation for ongoing progress in this area.

Within the framework of SDG13 (Climate Action), the positive coefficients observed for e-commerce, trade openness, government expenditure on environmental protection, and government efficiency, all of which are statistically significant at p value = 0.000, underscore their crucial roles in advancing climate mitigation and resilience objectives within the European Union. These findings align seamlessly with the essence of SDG13, which seeks to combat the adverse impacts of climate change. The results substantiate the instrumental role played by the EU in curbing the far-reaching effects of climate change through strategic policies that effectively balance economic growth with environmental stewardship. By prioritising sustainable e-commerce practices, fostering eco-friendly trade policies,

investing significantly in environmental protection initiatives, and ensuring efficient governance, the EU can effectively contribute to the reduction of greenhouse gas emissions, enhance the resilience of its communities and ecosystems, and pave the way for a more sustainable future.

4. Discussion

The empirical results confirm the research hypotheses regarding the effect of e-commerce on attaining SDG2: Zero Hunger (Hypothesis 1), SDG12: Responsible Consumption and Production (Hypothesis 2), and SDG13: Climate Action (Hypothesis 3).

The results reveal a robust link between e-commerce, trade openness, government environmental spending, and governance efficiency, all contributing to improved food security and sustainable agriculture. The highly significant coefficients (p value = 0.000) underscore their crucial roles in achieving SDG2, which is also confirmed in the research (Reardon et al., 2021; Carpio et al., 2013; Guo et al., 2021). This highlights the potential of the EU in terms of utilising e-commerce and trade openness to enhance food distribution networks, facilitating access to nutritious food and sustainable farming practices (Reardon et al., 2021; Carpio et al., 2013; Guo et al., 2021). The positive connection between e-commerce and SDG12 indicates that encouraging sustainable online platforms and eco-friendly packaging steer environmentally conscious consumer behaviour. The link between trade openness and SDG12 supports the hypothesis that EU trade policies stimulate responsible production both domestically and internationally (Dau et al., 2021; Jakob, 2021). The positive relationship with government environmental spending underscores the role of governmental support in promoting responsible practices, while the governance efficiency coefficient highlights the role of effective governance. The notable effect of the lagged

value of SDG12 further underscores the EU's historical dedication to responsible consumption and production, fostering continued progress. As in past studies (Zhang et al., 2022; Rao et al., 2023), our empirical findings also show positive coefficients for e-commerce, trade openness, government environmental spending, and governance efficiency for SDG13. These outcomes resonate with the essence of SDG13, affirming the EU's commitment to balancing economic growth and environmental stewardship. By prioritising sustainable e-commerce, advocating eco-friendly trade policies, investing in environmental protection, and ensuring efficient governance, the EU could significantly contribute to reducing greenhouse gas emissions, bolstering community and ecosystem resilience, and shaping a sustainable future.

Conclusions

The paper investigated the intricate relationship between e-commerce and sustainable development within the European Union. The study utilised a novel approach, blending existing research insights and the construction of tailored econometric models to comprehensively assess the specific influence of e-commerce on SDG2, SDG12, and SDG13 by adopting a combined methodology of the panel-corrected standard error and the system generalised method of moments. By investigating the potential positive and negative consequences of e-commerce, the study contributes to a nuanced understanding of how this dynamic sector either aligns with or deviates from the objectives of sustainable development. Furthermore, the adoption of advanced econometric models bolsters the robustness of the findings, enhancing the credibility of our conclusions. Considering the empirical results, the following policy implications can be outlined:

It may be worth encouraging international trade agreements that integrate sustainable e-commerce practices, thus fostering

cross-border collaborations that not only facilitate economic growth but also prioritise responsible production, consumption, and delivery methods. By aligning these practices with SDG12, which emphasises responsible consumption and production, such agreements create a global framework for e-commerce operations that are mindful of their environmental impact. This approach would not only bolster economic activity but also propel the sustainable development agenda forward by ensuring that the benefits of e-commerce are harnessed without compromising the well-being of the planet (Letunovska et al., 2022; Kwilinski et al., 2022; Oláh et al., 2023).

The implementation of stringent environmental standards for packaging and shipping methods within the e-commerce sector constitutes a crucial step toward achieving sustainable development. By mandating the use of eco-friendly materials and energy-efficient delivery practices, these regulations demonstrate a commitment to both SDG12 and SDG13. Such standards not only minimise the environmental footprint of e-commerce operations but also foster a culture of sustainability within the industry. This comprehensive approach ensures that the convenience of online shopping is harmonised with the broader goals of environmental preservation and the responsible utilisation of resources, paving the way for a more sustainable future (Miśkiewicz et al., 2022; Kwilinski et al., 2023; Melnyk et al., 2021; 2022).

Developing comprehensive regulations that hold e-commerce platforms accountable for the entire lifecycle of products is an essential stride toward embracing the principles of a circular economy. By extending their responsibilities to encompass post-consumer waste management, these regulations powerfully address SDG12. By advocating for sustainable practices that prioritise not just the initial sale but also the entire lifecycle of products, these measures not only contribute to environmental conservation but also

ensure that the e-commerce sector aligns with the broader SDGs. This approach not only enhances transparency but also encourages innovation in product design, resource utilisation, and waste reduction, ultimately fostering a more resilient and sustainable economic ecosystem.

Rolling out comprehensive digital literacy programmes represents a pivotal strategy in educating and empowering consumers to navigate the intricate landscape of online shopping with an environmental lens (Kwilinski et al., 2020; Trzeciak et al., 2022; Dzwigol, 2022a; 2022b; 2023). By imparting knowledge about the profound environmental repercussions of their choices, these programmes equip consumers with the tools to make informed decisions that are harmoniously aligned with responsible consumption and production. Empowered with this awareness, consumers proactively opt for eco-friendly products, evaluate the sustainability credentials of e-commerce platforms, and ultimately steer the industry toward practices that prioritise environmental integrity. This virtuous cycle of education and action not only elevates individual consumer agency but also lays the groundwork for collective efforts to drive the e-commerce sector toward a more sustainable trajectory.

To advance SDGs within the European Union, it is imperative to foster strategic partnerships among e-commerce platforms, governmental bodies, and environmental organisations. Such collaborations stand as catalysts for innovation and knowledge sharing, enabling the exchange of best practices that endorse sustainable operations. By collectively developing voluntary industry standards for e-commerce that are environmentally conscious, these partnerships are poised to drive positive change and positive impact SDG2, SDG12, and SDG13.

Establishing uniform regulations and standards across EU member states is crucial to cultivating a unified and conducive environment in which sustainable

e-commerce practices could flourish. This initiative, aimed at mitigating fragmentation caused by varying regulations, paves the way for a consistent framework that incentivises conscientious operations throughout the industry. Consequently, this endeavour fortifies the advancement of SDG2, SDG12, and SDG13, benefiting from a harmonious regulatory milieu that nurtures sustainability while concurrently enhancing economic growth and environmental conservation.

While this study offers valuable insights into the intricate relationship between e-commerce and SDGs within EU countries, it is important to acknowledge certain limitations that warrant consideration. First, the scope of this research primarily focuses on three specific SDGs, namely, SDG2: Zero Hunger, SDG12: Responsible Consumption and Production, and SDG13: Climate Action. While these goals are undoubtedly significant, the exclusion of other relevant SDGs might limit the comprehensive assessment of the broader impact of e-commerce on sustainable development in the EU. The study does not delve into the perspectives and experiences of key stakeholders such as consumers, businesses, and policymakers, which could provide nuanced insights into the challenges and opportunities encountered in the real-world implementation of e-commerce strategies. Furthermore, variations in socioeconomic factors, regulatory environments, and cultural dynamics across different EU regions might influence the transferability of findings to other global contexts, thus limiting the generalisability of the study's conclusions beyond the EU.

References

- Agan, B., Balcilar, M. (2023), Unraveling the Green Growth Matrix: Exploring the Impact of Green Technology, Climate Change Adaptation, and Macroeconomic Factors on Sustainable Development, *Sustainability*, 15, 8530. <https://doi.org/10.3390/su15118530>.

- Ahi, A.A., Sinkovics, N., Sinkovics, R.R. (2023), E-commerce policy and the global economy: A path to more inclusive development?, *Management International Review*, 63(1), 27-56.
- Akimov, O., Karpa, M., Parkhomenko-Kutsevil, O., Kupriichuk, V., Omarov, A. (2021), Entrepreneurship education of the formation of the e-commerce managers professional qualities, *International Journal of Entrepreneurship*, 25(7), 1-8.
- Altarturi, H.H., Nor, A.R. M., Jaafar, N.I., Anuar, N.B. (2023), A bibliometric and content analysis of technological advancement applications in agricultural e-commerce, *Electronic Commerce Research*, 1-44. <https://doi.org/10.1007/s10660-023-09670-z>.
- Apostolopoulos, N., Ratten, V., Petropoulos, D., Liargovas, P., Anastasopoulou, E. (2021), Agri-food sector and entrepreneurship during the COVID-19 crisis: A systematic literature review and research agenda, *Strategic Change*, 30(2), 159-167.
- Arefieva, O., Polous, O., Arefiev, S., Tytykalo, V., Kwilinski, A. (2021), Managing sustainable development by human capital reproduction in the system of company's organizational behavior, *IOP Conference Series: Earth and Environmental Science*, 628(1), 012039. <https://doi.org/10.1088/1755-1315/628/1/012039>.
- Arellano, M., Bond, O. (1991), Some tests of specification for panel data. Monte Carlo evidence and an application to employment equations, *Review of Economic Studies*, 58, 277-97.
- Baltagi, B.H., Pesaran, M. (2007), Heterogeneity and cross-section dependence in panel data models: theory and applications introduction, *Journal of Applied Econometrics*, 22(2), 229-232.
- Baptista, C., Matias, F., do Valle, P.O. (2013), The moderating role of strategy and environment on the relationship between corporate liquidity and investment: evidence from panel data, *Tourism & Management Studies*, 9(1), 85-91.
- Bashir, M.F., Benjiang, M.A., Hussain, H.I., Shahbaz, M., Koca, K., Shahzadi, I. (2022), Evaluating environmental commitments to COP21 and the role of economic complexity, renewable energy, financial development, urbanization, and energy innovation: empirical evidence from the RCEP countries, *Renewable Energy*, 184, 541-550.
- Ben Youssef, A., Dahmani, M. (2023), Examining the Drivers of E-Commerce Adoption by Moroccan Firms: A Multi-Model Analysis, *Information*, 14(7), 378.
- Carpio, C.E., Isengildina-Massa, O., Lamie, R.D., Zapata, S.D. (2013), Does e-commerce help agricultural markets? The case of MarketMaker, *Choices*, 28(4), 1-7.
- Chen, Y., Kwilinski, A., Chygryn, O., Lyulyov, O., Pimonenko, T. (2021), The Green Competitiveness of Enterprises: Justifying the Quality Criteria of Digital Marketing Communication Channels, *Sustainability*, 13, 13679. <https://doi.org/10.3390/su132413679>.
- Chen, Y., Lyulyov, O., Pimonenko, T., Kwilinski, A. (2023), Green development of the country: Role of macroeconomic stability, *Energy & Environment*, 0(0). <https://doi.org/10.1177/0958305x231151679>.
- Chen, Z., Cao, H., Xu, F., Cheng, M., Wang, T., Li, Y. (2020), Understanding the role of intermediaries in online social e-commerce: an exploratory study of beidian, *Proceedings of the ACM on Human-Computer Interaction*, 4(CSCW2), 1-24.
- Chiu, A.S., Aviso, K.B., Baquillas, J., Tan, R.R. (2020), Can disruptive events trigger transitions toward sustainable consumption?, *Cleaner and Responsible Consumption*, 1, 100001. <https://doi.org/10.1016/j.clrc.2020.100001>.
- Cordes, D.L., Marinova, D. (2023), Systematic literature review of the role of e-commerce in providing pathways to sustainability for poverty alleviation in Sub-Saharan Africa, *Discover Sustainability*, 4(1), 7. <https://doi.org/10.1007/s43621-022-00109-3>.
- Criveanu, M.M. (2023), Investigating Digital Intensity and E-Commerce as Drivers for Sustainability and Economic Growth in the EU Countries, *Electronics*, 12(10), 2318. <https://doi.org/10.3390/electronics12102318>.

- Curto, J.D., Pinto, J.C. (2011), The corrected vif (cvif), *Journal of Applied Statistics*, 38(7), 1499-1507.
- Dau, L., Moore, E., Doh, J., Soto, M. (2021), Does global integration stimulate corporate citizenship? The effect of international trade agreements and regulatory quality on state and private firm adoption of CSR standards, *Journal of International Business Policy*, 5(3), 328-352.
- Delina, L. L., Perez, O. A., Afable, S. B., Steuer, B. (2023), Do global public health crises change people's behaviors toward sustainability? Evidence of the COVID-19 and sustainability nexus from Hong Kong, *Cleaner and Responsible Consumption*, 100132.
- Dementyev, V., Dalevska, N., Kwilinski, A. (2021), Innovation and Information Aspects of the Structural Organization of the World Political and Economic Space, *Virtual Economics*, 4, 54-76. [https://doi.org/10.34021/ve.2021.04.01\(3\)](https://doi.org/10.34021/ve.2021.04.01(3)).
- Dharmawansa, A. D., Balasooriya, B., Madhuwanthi, R. (2023), Evaluating the use of e-commerce for the performance of the SME sector, *International Journal of Information, Business and Management*, 15(2), 1-14.
- Di Pierro, R., Frasnetti, E., Bianchi, L., Bisagni, M., Capri, E., Lamastra, L. (2023), Setting the sustainable development targets for restaurants and Italian HoReCa sector, *Science of The Total Environment*, 855, 158908. <https://doi.org/10.1016/j.scitotenv.2022.158908>.
- Dzwigol, H. (2019), Research Methods and Techniques in New Management Trends: Research Results, *Virtual Economics*, 2019, 2(1), 31-48. [https://doi.org/10.34021/ve.2019.02.01\(2\)](https://doi.org/10.34021/ve.2019.02.01(2)).
- Dzwigol, H. (2021), The Uncertainty Factor in the Market Economic System: The Microeconomic Aspect of Sustainable Development, *Virtual Economics*, 4(1), 98-117. [https://doi.org/10.34021/ve.2021.04.01\(5\)](https://doi.org/10.34021/ve.2021.04.01(5)).
- Dzwigol, H. (2022a), Comparing Idiographic and Nomothetic Approaches in Management Sciences Research, *Virtual Economics*, 5(4), 27-49. [https://doi.org/10.34021/ve.2022.05.04\(2\)](https://doi.org/10.34021/ve.2022.05.04(2)).
- Dzwigol, H. (2022b), Research Methodology in Management Science: Triangulation, *Virtual Economics*, 5, 78-93. [https://doi.org/10.34021/ve.2022.05.01\(5\)](https://doi.org/10.34021/ve.2022.05.01(5)).
- Dzwigol, H. (2023). The Quality Determinants of the Research Process in Management Sciences, *Virtual Economics*, 6(2), 35-54. [https://doi.org/10.34021/ve.2023.06.02\(3\)](https://doi.org/10.34021/ve.2023.06.02(3)).
- Dzwigol, H., Kwilinski, A., Lyulyov, O., Pimonenko, T. (2023), Renewable Energy, Knowledge Spillover and Innovation: Capacity of Environmental Regulation, *Energies*, 16(3), 1117. <https://doi.org/10.3390/en16031117>.
- Engesser, V., Rombaut, E., Vanhaverbeke, L., Lebeau, P. (2023), Autonomous Delivery Solutions for Last-Mile Logistics Operations: A Literature Review and Research Agenda, *Sustainability*, 15(3), 2774. <https://doi.org/10.3390/su15032774>.
- Eurostat (2023), retrieved from: <https://ec.europa.eu/eurostat> (accessed on 11 April 2023).
- Fremstad, A., Paul, M. (2022), Neoliberalism and climate change: How the free-market myth has prevented climate action, *Ecological Economics*, 197, 107353.
- Guo, H., Liu, Y., Shi, X., Chen, K.Z. (2021), The role of e-commerce in the urban food system under COVID-19: Lessons from China, *China Agricultural Economic Review*, 13(2), 436-455.
- Hansen, L.P. (1982), Large sample properties of generalized method of moments estimators, *Econometrica*, 50, 1029-54.
- Hassani, H., Huang, X., MacFeely, S., Entezarian, M. R. (2021), Big data and the united nations sustainable development goals (UN SDGs) at a glance, *Big Data and Cognitive Computing*, 5(3), 28. [HTTPS://DOI.ORG/10.3390/bdcc5030028](https://doi.org/10.3390/bdcc5030028)
- Hu, K., Sinha, A., Tan, Z., Shah, M. I., Abbas, S. (2022), Achieving energy transition in OECD economies: Discovering the moderating roles of environmental governance, *Renewable and Sustainable Energy Reviews*, 168, 112808. <https://doi.org/10.1016/j.rser.2022.112808>.

- Hussain, H.I., Haseeb, M., Kamarudin, F., Dacko-Pikiewicz, Z., Szczepańska-Woszczyna, K. (2021), The role of globalization, economic growth and natural resources on the ecological footprint in Thailand: Evidence from nonlinear causal estimations, *Processes*, 9, 1103. <https://doi.org/10.3390/pr9071103>.
- Jacobsen, L.F., Pedersen, S., Thøgersen, J. (2022), Drivers of and barriers to consumers' plastic packaging waste avoidance and recycling—A systematic literature review, *Waste Management*, 141, 63-78.
- Jakob, M. (2021), Climate policy and international trade—A critical appraisal of the literature, *Energy Policy*, 156, 112399. <https://doi.org/10.1016/j.enpol.2021.112399>.
- Jenčová, S., Vašaničová, P., Miškuřová, M. (2023), Multidimensional Evaluation of EU and Slovakia in the Context of Digital Transformation, *Central European Business Review*, 12(1), 65-95. <https://doi.org/10.18267/j.cebr.313>.
- Ji, X., Xu, J., Zhang, H. (2023), Environmental effects of rural e-commerce: A case study of chemical fertilizer reduction in China, *Journal of Environmental Management*, 326, 116713. <https://doi.org/10.1016/j.jenvman.2022.116713>.
- Ji, Z., Gao, T., Li, W., Niu, D., Wu, G., Peng, L., Zhu, Y. T. (2023), The critical role of digital technology in sustainable development goals: A two-stage analysis of the spatial spillover effect of carbon intensity, *Journal of Renewable and Sustainable Energy*, 15(3), 035903.
- Jia, S. S., Gibson, A. A., Ding, D., Allman-Farinelli, M., Phongsavan, P., Redfern, J., Partridge, S. R. (2022), Perspective: are online food delivery services emerging as another obstacle to achieving the 2030 United Nations sustainable development Goals?, *Frontiers in Nutrition*, 9, 295.
- Jiang, H., Zheng, C. (2023), Will the Structure of Food Imports Improve China's Water-Intensive Food Cultivation Structure? A Spatial Econometric Analysis, *Water*, 15(15), 2800.
- Jiménez-Rodríguez, E., Vázquez-Cano, E., Cebrián-Hernández, Á., López-Meneses, E. (2022), Influence of Computer Knowledge and Level of Education on Spanish Citizens' Propensity to Use E-Commerce, *Social Science Computer Review*, 40(6), 1376-1392.
- Karnowski, J., Miśkiewicz, R. (2021), Climate Challenges and Financial Institutions: An Overview of the Polish Banking Sector's Practices, *European Research Studies Journal*, XXIV (3), 120-139. <https://doi.org/10.35808/ersj/2344>.
- Karnowski, J., Rzońca, A. (2023), Should Poland join the euro area? The challenge of the boom-bust cycle, *Argumenta Oeconomica*, 1(50), 227-262. <https://doi.org/10.15611/aoe.2023.1.11>.
- Kharazishvili, Y., Kwilinski, A. (2022), Methodology for Determining the Limit Values of National Security Indicators Using Artificial Intelligence Methods, *Virtual Economics*, 5, 7-26. [https://doi.org/10.34021/ve.2022.05.04\(1\)](https://doi.org/10.34021/ve.2022.05.04(1)).
- Khrais, L. T. (2020), Role of artificial intelligence in shaping consumer demand in E-commerce, *Future Internet*, 12(12), 226.
- Kryshtanovych, M., Akimova, L., Shamrayeva, V., Karpa, M., Akimov, O. (2022), Problems of European integration in the construction of EU security policy in the context of counterterrorism, *International Journal of Safety and Security Engineering*, 12(4), 501-506.
- Kwilinski, A. (2019), Implementation of Blockchain Technology in Accounting Sphere, *Academy of Accounting and Financial Studies Journal*, 23(SI2), 1-6.
- Kwilinski, A., Volynets, R., Berdnik, I., Holovko, M., Berzin, P. (2019), E-Commerce: Concept and Legal Regulation in Modern Economic Conditions, *Journal of Legal, Ethical and Regulatory Issues*, 2019, 22(Special Issue 2), 1-6.
- Kwilinski, A., Lyulyov, O., Pimonenko, T. (2023), Environmental Sustainability within Attaining Sustainable Development Goals: The Role of Digitalization and the Transport Sector, *Sustainability*, 15, 11282. <https://doi.org/10.3390/su151411282>.
- Kwilinski, A., Lyulyov, O., Pimonenko, T., Dzwigol, H., Abazov, R., Pudryk, D. (2022), International Migration Drivers: Economic, Environmental, Social, and Political Effects, *Sustainability*, 14(11), 6413. <https://doi.org/10.3390/su14116413>.

- Kwilinski, A., Slatvitskaya, I., Dugar, T., Khodakivska, L., Derevyanko, B. (2020), Main Effects of Mergers and Acquisitions in International Enterprise Activities, *International Journal of Entrepreneurship*, 24, 1-8.
- Letunovska, N., Abazov, R., Chen, Y. (2022), Framing a Regional Spatial Development Perspective: The Relation between Health and Regional Performance, *Virtual Economics*, 5, 87-99. [https://doi.org/10.34021/ve.2022.05.04\(5\)](https://doi.org/10.34021/ve.2022.05.04(5)).
- Letunovska, N., Offei, F. A., Junior, P. A., Lyulyov, O., Pimonenko, T., Kwilinski, A. (2023), Green Supply Chain Management: The Effect of Procurement Sustainability on Reverse Logistics, *Logistics*, 7, 47. <https://doi.org/10.3390/logistics7030047>.
- Liang, C., Liu, Z., Geng, Z. (2021), Assessing e-commerce impacts on China's CO2 emissions: Testing the CKC hypothesis, *Environmental Science and Pollution Research*, 28(40), 56966-56983.
- Lin, D., Foster, D. P., Ungar, L. H. (2011), VIF regression: a fast regression algorithm for large data. *Journal of the American Statistical Association*, 106(493), 232-247.
- Lin, H., Li, R., Hou, S., Li, W. (2021), Influencing factors and empowering mechanism of participation in e-commerce: An empirical analysis on poor households from Inner Mongolia, China, *Alexandria Engineering Journal*, 60(1), 95-105.
- Lopez-Villalobos, A., Bunsha, D., Austin, D., Caddy, L., Douglas, J., Hill, A., Kubeck, K., Lewis, P., Stormes, B., Sugiyama, R. (2022), Aligning to the UN Sustainable Development Goals: Assessing Contributions of UBC Botanical Garden, *Sustainability*, 14, 6275. <https://doi.org/10.3390/su14106275>.
- Mazhar, S., Sher, A., Abbas, A., Ghafoor, A., Lin, G. (2022), Empowering Shepreneurs to achieve the sustainable development goals: Exploring the impact of interest-free start-up credit, skill development and ICTs use on entrepreneurial drive, *Sustainable Development*, 30(5), 1235-1251.
- Melnychenko, O. (2019), Application of artificial intelligence in control systems of economic activity. *Virtual Economics*, 2, 30-40. [https://doi.org/10.34021/ve.2019.02.03\(3\)](https://doi.org/10.34021/ve.2019.02.03(3)).
- Melnychenko, O. (2021a). The Prospects of Retail Payment Developments in the Metaverse. *Virtual Economics*, 4(4), 52-60. [https://doi.org/10.34021/ve.2021.04.04\(4\)](https://doi.org/10.34021/ve.2021.04.04(4))
- Melnychenko, O. (2021b), Energy Losses Due to Imperfect Payment Infrastructure and Payment Instruments, *Energies*, 14(24), 8213. <https://doi.org/10.3390/en14248213>.
- Melnyk, L., Kubatko, O., Piven, V., Klymenko, K., Rybina, L. (2022), Digital and Economic Transformations for Sustainable Development Promotion: A Case of OECD Countries, *Environ. Econ.*, 12, 140-148.
- Melnyk, L., Matsenko, O., Kubatko, O., Balatskyi, Y., Serdyukov, K. (2021), Transformation of the human capital reproduction in line with Industries 4.0 and 5.0, *Problems and Perspectives in Management*, 19(2), 480-494.
- Miśkiewicz, R. (2019), Challenges facing management practice in the light of Industry 4.0: The example of Poland, *Virtual Economics*, 2, 37-47. [https://doi.org/10.34021/ve.2019.02.02\(2\)](https://doi.org/10.34021/ve.2019.02.02(2)).
- Miśkiewicz, R., Matan, K., Karnowski, J. (2022), The Role of Crypto Trading in the Economy, Renewable Energy Consumption and Ecological Degradation, *Energies*, 15, 3805. <https://doi.org/10.3390/en15103805>.
- Morashti, J. A., An, Y., Jang, H. (2022), A systematic literature review of sustainable packaging in supply chain management, *Sustainability*, 14(9), 4921.
- Muriel, J. E., Zhang, L., Fransoo, J. C., Perez-Franco, R. (2022), Assessing the impacts of last mile delivery strategies on delivery vehicles and traffic network performance, *Transportation Research Part C: Emerging Technologies*, 144, 103915.
- Musa, S. F. P. D., Haji Besar, M. H. A., Anshari, M. (2023), COVID-19, local food system and digitalization of the agri-food sector, *Journal of Indian Business Research*, 15(1), 125-140.
- Music, J., Charlebois, S., Toole, V., Large, C. (2022), Telecommuting and food E-commerce: Socially sustainable practices during the COVID-19 pandemic in Canada, *Transportation Research Interdisciplinary Perspectives*, 13, 100513.

- Nogueira, G. P. M., de Assis Rangel, J. J., Shimoda, E. (2021), Sustainable last-mile distribution in B2C e-commerce: Do consumers truly care?, *Cleaner and Responsible Consumption*, 3, 100021.
- Oláh, J., Kitukutha, N., Haddad, H., Pakurár, M., Máté, D., Popp, J. (2018), Achieving sustainable e-commerce in environmental, social and economic dimensions by taking possible trade-offs, *Sustainability*, 11(1), 89.
- Omri, A., Kahouli, B. (2014), Causal relationships between energy consumption, foreign direct investment and economic growth: Fresh evidence from dynamic simultaneous-equations models, *Energy Policy*, 67, 913–922.
- Oruma, S. O., Misra, S., Fernandez-Sanz, L. (2021), Agriculture 4.0: an implementation framework for food security attainment in Nigeria's post-Covid-19 era, *IEEE Access* 2021, 9, 83592–83627.
- Pérez-Martínez, J., Hernandez-Gil, F., San Miguel, G., Ruiz, D., Arredondo, M. T. (2023), Analyzing associations between digitalization and the accomplishment of the Sustainable Development Goals, *Science of The Total Environment*, 857, 159700.
- Pesaran, M. H. (2007), A simple panel unit root test in the presence of cross-section dependence, *Journal of applied econometrics*, 22(2), 265–312.
- Rao, A., Talan, A., Abbas, S., Dev, D., Taghizadeh-Hesary, F. (2023), The role of natural resources in the management of environmental sustainability: Machine learning approach, *Resources Policy*, 82, 103548.
- Reardon, T., Heiman, A., Lu, L., Nuthalapati, C. S., Vos, R., Zilberman, D. (2021), “Pivoting” by food industry firms to cope with COVID-19 in developing regions: E-commerce and “copivoting” delivery intermediaries, *Agricultural Economics*, 52(3), 459–475.
- Rodríguez-Pose, A., Ketterer, T. D. (2012), Do local amenities affect the appeal of regions in Europe for migrants?, *Journal of Regional Science*, 52(4), 535–561.
- Roodman, D. (2006), How to do xtabond2: An introduction to “Difference” and “System” GMM in Stata”, Center for Global Development Working Paper, 103. <https://doi.org/10.2139/ssrn.982943>.
- Roy, M., Rayhan, M. I. (2011), Trade flows of Bangladesh: A gravity model approach, *Economics Bulletin*, 31(1), 950–959.
- Sachs, J., Lafortune, G., Kroll, C., Fuller, G., Woelm, F. (2022), From Crisis to Sustainable Development: the SDGs as Roadmap to 2030 and Beyond, *Sustainable Development Report*, Cambridge: Cambridge University Press.
- Saha, S. K. (2023), Does the Impact of the Foreign Direct Investment on Labor Productivity Change Depending on Productive Capacity?, *Journal of the Knowledge Economy*, 1–33.
- Saidi, S., Hammami, S. (2017), Modeling the causal linkages between transport, economic growth and environmental degradation for 75 countries, *Transportation Research Part D: Transport and Environment*, 53, 415–427.
- Siikavirta, H., Punakivi, M., Kärkkäinen, M., Linnanen, L. (2002), Effects of e-commerce on greenhouse gas emissions: a case study of grocery home delivery in Finland, *Journal of Industrial Ecology*, 6(2), 83–97.
- Sousa, P. R. D., Barbosa, M. W., Oliveira, L. K. D., Resende, P. T. V. D., Rodrigues, R. R., Moura, M. T., Matoso, D. (2021), Challenges, Opportunities, and lessons learned: Sustainability in Brazilian omnichannel retail, *Sustainability*, 13(2), 666.
- Spicka, J. (2018), How Do Agricultural Biogas Investments Affect Czech Farms?, *Central European Business Review*, 7(4), 34–60. <https://doi.org/10.18267/j.cebr.205>.
- Spicka, J., Hlavsa, T., Soukupova, K., Stolbova, M. (2019), Approaches to estimation the farm-level economic viability and sustainability in agriculture: A literature review, *Agricultural Economics*, 65(6), 289–297. <https://doi.org/10.17221/269/2018-AGRICECON>.
- Stępień, S., Smędzik-Ambroży, K., Polcyn, J., Kwiliński, A., Maican, I. (2023), Are small farms sustainable and technologically smart? Evidence from Poland, Romania, and Lithuania, *Central European Economic Journal*, 10(57), 116–132. <https://doi.org/10.2478/ceej-2023-0007>.

- Szczepańska-Woszczyzna, K., Gedvilaitė, D., Nazarko, J., Stasiukynas, A., Rubina, A. (2022), Assessment of Economic Convergence among Countries in the European Union, *Technological and Economic Development of Economy*, 28, 1572-1588. <https://doi.org/10.3846/tede.2022.17518>.
- Titko, J., Tambovceva, T., Atstāja, D., Lapinskaitė, I., Solesvik, M. Z., Svirina, A., Uzule, K. (2023), Attitudes Toward Sustainable Entrepreneurship among Students: A Pilot Study in Latvia and Lithuania, *TalTech Journal of European Studies*, 13(1), 107-132.
- Tiwari, S., Singh, P. (2011), E-commerce: prospect or threat for environment, *International Journal of Environmental Science and Development*, 2(3), 211.
- Trushkina, N., Abazov, R., Rynkevych, N., Bakhautdinova, G. (2020), Digital Transformation of Organizational Culture under Conditions of the Information Economy, *Virtual Economics*, 3, 7-38. [https://doi.org/10.34021/ve.2020.03.01\(1\)](https://doi.org/10.34021/ve.2020.03.01(1)).
- Trzeciak, M., Kopec, T.P., Kwilinski, A. (2022), Constructs of Project Programme Management Supporting Open Innovation at the Strategic Level of the Organization, *Journal of Open Innovation: Technology, Market, and Complexity*, 8, 58. <https://doi.org/10.3390/joitmc8010058>.
- von Braun, J., Afsana, K., Fresco, L. O., Hassan, M. H. A. (2023), Science for transformation of food systems: opportunities for the UN Food Systems Summit, *Science and Innovations for Food Systems Transformation*, 921.
- Wang, H., Li, Y., Lin, W., Wei, W. (2023), How does digital technology promote carbon emission reduction? Empirical evidence based on e-commerce pilot city policy in China, *Journal of Environmental Management*, 325, 116524.
- Wang, H., Liu, B. (2022), A role of production on e-commerce and foreign policy influencing One Belt One Road: Mediating effects of international relations and international trade, *Frontiers in Psychology*, 12, 793383.
- Wawro, G. (2002), Estimating dynamic panel data models in political science, *Political Analysis*, 10(1), 25-48.
- Wooldridge, J. M. (1990), A unified approach to robust, regression-based specification tests, *Econometric Theory*, 6, 17-43.
- World Data Bank (2023), retrieved from: <https://data.worldbank.org> (accessed on 11 April 2023).
- Xie, G., Huang, L., Apostolidis, C., Huang, Z., Cai, W., Li, G. (2021), Assessing consumer preference for overpackaging solutions in e-commerce, *International Journal of Environmental Research and Public Health*, 18(15), 7951.
- Zhang, C., Khan, I., Dagar, V., Saeed, A., Zafar, M. W. (2022), Environmental impact of information and communication technology: Unveiling the of education in developing countries, *Technological Forecasting and Social Change*, 178, 121570.
- Zhang, Z., Sun, Z., Lu, H. (2022), Does the e-commerce city pilot reduce environmental pollution? Evidence from 265 cities in China, *Frontiers in Environmental Science*, 10, 813347.
- Zhanibek, A., Abazov, R., Khazbulatov, A. (2022), Digital Transformation of a Country's Image: The Case of the Astana International Finance Centre in Kazakhstan, *Virtual Economics*, 5, 71-94. [https://doi.org/10.34021/ve.2022.05.02\(4\)](https://doi.org/10.34021/ve.2022.05.02(4)).
- Zhu, F., Shi, Q., Balezentis, T., Zhang, C. (2023), The impact of e-commerce and R&D on firm-level production in China: Evidence from manufacturing sector, *Structural Change and Economic Dynamics*, 65, 101-110.

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An Investigation of Changes in Returns on Peer-to-Peer Lending in Lithuania and Sweden During the COVID-19 Pandemic: Evidence from Wavelet Coherence Analysis

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Abstract

FinTech has revolutionised financial services, making them more accessible and efficient. However, the COVID-19 pandemic impacted the FinTech industry, including peer-to-peer lending, in Lithuania and Sweden. This article explores the relationship between the pandemic and changes in peer-to-peer lending returns in both countries. By analysing existing literature, statistical data, and using wavelet coherence analysis, the study aims to understand the influence of COVID-19 on lending in Lithuania and Sweden. The results indicate that the pandemic had a limited impact on Lithuanian peer-to-peer lending, with average interest rates declining over time. Negative correlations between infection cases and lending returns were observed in specific quarters but were only significant in the short term. In contrast, the influence on Swedish peer-to-peer lending was more pronounced. Interest rates initially decreased, but a significant increase occurred in the first quarter of 2022, coinciding with a surge in COVID-19 infections and foreign policies. The negative correlation between cases of infection and lending returns persisted across the short, medium, and long terms alike in Sweden. These findings suggest that the Swedish peer-to-peer lending market was more affected by the economic and policy factors related to the pandemic than that of Lithuania.

Key words

COVID-19; FinTech; Financial technology; Peer-to-peer; Returns; Wavelet coherence analysis.

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Introduction

Nowadays, financial technology (FinTech) is essential when it comes to delivering advances to the financial sector. It helps to improve financial services by boosting their capabilities to make things easier and faster. This innovation in the finance sector is being propelled in part by the Industry 4.0 era. Due to the widespread use of mobile devices and the Internet in modern society, there is a massive global market for digital financial services (Le, 2021). FinTech offers easier access to these services. These innovations have led to the emergence of new markets, where people can invest, send, store, or receive money from each other. Nowadays, people are able to select from a great many offers from various participants in the financial sector, who would happily hold their money for them. However, customers generally seek the most convenient option for their everyday life, which will help them to control, monitor and spend their money. FinTech has made their lives easier, as it has connected FinTech products and services with their desire to have everything in one place – most commonly on their mobile phones. FinTech adapts to the evolution of the financial world, attempting to provide as many financial services as possible in order to attract more customers. Nowadays, the world is faced with the spectre of COVID-19. First discovered in Wuhan, China, it caused a pandemic that spread throughout the world. Most cases were initially found in China, but the virus eventually spread to Europe, the Americas, and ultimately Africa (Roy, 2020). COVID-19 has negatively affected economies and unbalanced human capital processes. An international health crisis that has been declared a threat to global health leads society to worry not only about health, but also about possible economic decline. The measures which were used to combat the pandemic had a negative impact on society, including reduced household consumption, reduced demand,

exports, increased unemployment, supply chain disruptions, shrinking stock markets and numerous other economic issues. Additionally, when the government banned domestic and international transportation and logistics routes to limit the spread of the coronavirus, the global supply chain was disrupted (Barua, 2020). Countries faced not only an unstable external environment, but also an unpredictable internal environment. Political decisions were made promptly, in response to the situation and without coordination with the governments of other countries. To stabilise the situation, control the spread of COVID-19 and to avoid greater negative effects on the economy, countries used a variety of tools to fight the pandemic. People and businesses in different countries faced differing quarantine restrictions. Lithuania is one of the countries that applied strict quarantine restrictions aimed at limiting movement and economic activity. This not only caused economic stagnation due to the quarantine period, but also public dissatisfaction with possible human rights violations. Meanwhile Sweden took the opposite step and opted for advisory restrictive measures, which were voluntarily observed in that nation. The object of this research is Lithuanian and Swedish peer-to-peer lending during the COVID-19 pandemic. The aim of the articles is to assess how COVID-19 brought about changes in returns on peer-to-peer lending in Sweden and Lithuania. To properly achieve the goal of the research, the following objectives were set: to analyse the works of other authors on the impact of COVID-19 on FinTech; to describe the use of wavelet coherence analysis to assess the impact of COVID-19 on peer-to-peer lending returns; and to analyse the impact of COVID-19 on the average interest rates for both Lithuanian and Swedish peer-to-peer lending. In this article, scientific literature was analysed to discern the global impact of

COVID-19 on FinTech; statistical data analysis was used to determine the respective changes in COVID-19 infections and interest rates; and wavelet coherence analysis was used by means of MATLAB to determine the correlation between COVID-19 and changes in peer-to-peer lending returns in various periods.

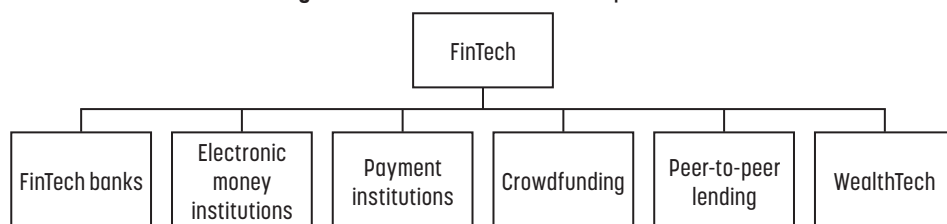
1. Literature review

1.1. The FinTech ecosystem during COVID-19

Financial innovation, enabled by technology, has the potential to lead to new business models, applications, workflows, or end products that significantly impact financial markets, institutions, and the delivery of financial services (Soloviev, 2018). The emergence of FinTech became particularly important after the 2008 financial crisis, which eroded consumer trust and confidence in traditional service providers. This crisis,

coupled with high-profile financial scandals, has fuelled a growing demand in the market for alternative finance. Additionally, the development of new financial products and services that offer greater convenience, efficiency, and inclusiveness at a lower cost has reduced reliance on conventional businesses. The convergence of various technological advancements, such as accessible and affordable infrastructure, maturing technological applications, and streamlined corporate operations, among others, is a significant driving force behind the growth of FinTech (Gelís, 2016). The expanding FinTech market includes licensed companies that offer a wide range of financial services on a global scale. These companies act as financial market participants and provide convenient access to various services such as banking, transactions and payment processing, business lending, personal loans, and virtual brokerage (see Figure 1).

Figure 1. Licensed FinTech companies



Source: He et al., 2017

FinTech market participants with FinTech bank licenses are generally more user-friendly than traditional banks and typically operate through mobile applications without physical branches. These FinTech banks offer people payment and financial services, including credits, deposits, money transfers, and investments. Upon their establishment, FinTech banks have the same requirements as traditional banks to ensure consumer protection (Zveryakov et al., 2019).

Electronic money institutions facilitate easy access to digital wallets, allowing individuals to store money and make

transactions at their convenience (He et al., 2017). Payment institutions assist people in conducting day-to-day payment services such as payment transactions, direct debits, credit transfers, cash deposits, cash withdrawals, and payment initiation services (Degerli, 2019).

Crowdfunding connects companies in need of funding with individuals who wish to contribute to their growth and development while seeking potential profits. It facilitates the discovery of companies in need of funds for the implementation of new technologies and serves as an investment

diversification instrument for individuals (Navaretti et al., 2017).

Peer-to-peer lending primarily operates on online platforms and is easily accessible via mobile phones. It connects borrowers in need of personal loans with private individuals seeking to diversify their investment portfolios and generate profits. Peer-to-peer lending regulations enable borrowers to analyse their investments and calculate risks before making any commitments (Bachmann and Funk, 2011).

WealthTech assists individuals in finding user-friendly investment experiences, providing access to stock markets, bond markets, and other financial instruments, including cryptocurrencies. It enables people to find more cost-effective ways to invest in the financial markets (Li, Lu and Hasan, 2020).

1.2. The impact of COVID-19 on the FinTech sector

During the challenging period of the COVID-19 pandemic, many individuals had to carry out their everyday activities from home using the Internet, laptops, and smartphones. The restrictions imposed during 2020 and 2021 resulted in an economic downturn in several nations, particularly in developing countries. However, this period also witnessed a significant rise in digital entrepreneurship activities (Bacq et al., 2020). FinTech, known for providing 24/7 access to efficient and flexible financial services, has been proven to contribute to cost savings, time savings, and economic growth. It is a convenient option that can be accessed from anywhere. While the FinTech sector, like many others, has been impacted by the COVID-19 outbreak, numerous companies are striving to find innovative solutions to sustain their operations. FinTech encompasses more than just financial innovation; it represents inventive ways to improve budget administration through emerging technological trends, such as

monetary innovation and mobile financial applications (Nair et al., 2021).

Several studies, including those by Yan et al. (2021), Minhas (2022), Faeni et al. (2021), Mohannad et al. (2021), Naz et al. (2022), Al nawayseh (2020), Tripalupi and Anggahegari (2020), and Tut (2023), have employed quantitative research methods, including structured questionnaire surveys, structural equation modelling (SEM), descriptive analysis and content analysis. These methods were utilised to gather data, examine relationships between variables, conduct in-depth analysis, and derive meaningful insights from the collected data to investigate the impact of COVID-19 on the FinTech sector in their respective countries. For example, in Bangladesh, Yan et al. (2021) identified the variables that influence users' intentions to utilise mobile financial services (MFS) platforms. Their findings indicated that COVID-19 had a significant impact on the growth of MFS usage in Bangladesh. Similarly, Minhas (2022) found that in India, a considerable percentage of respondents reported increased usage of digital payments during the pandemic, with a significant proportion solely relying on digital payments instead of cash. Faeni et al. (2021) observed that social distancing guidelines and the adoption of technology in Indonesia had a positive impact on the economy by slowing the spread of the pandemic and increasing organisational productivity. The COVID-19 pandemic also accelerated the adoption of FinTech platforms for payments in Indonesia, with a rise in mobile banking transactions, mobile agents, and mobile banking accounts. Furthermore, Mohannad et al. (2021) found that people believe that switching to electronic and contactless payment methods can help reduce the spread of COVID-19 by avoiding direct physical contact with cash.

In the Middle East and North Africa (MENA) region, Naz et al. (2022) highlighted the need for technological advancements

to foster an advanced economy and bridge the gap between individuals and digital platforms. To facilitate the growth of the FinTech industry in the region, regulators must prioritise cybersecurity and digital infrastructure. Cross-sector and cross-border collaborations are also essential to the thriving FinTech ecosystem. Notably, the UAE's blockchain innovations have been the predominant presence in the MENA region, accounting for 50% of all transactions with the federal government. The Kuwait International Bank (KIB) has also introduced additional FinTech products, such as an Interactive Voice Response (IVR) portal, opening up more avenues for economic prosperity. In Jordan, Al nawayseh (2020) found that customers' intention to use FinTech applications is influenced by their awareness of the benefits, social impact, and level of trust associated with these services. However, during the COVID-19 pandemic, customers' perceptions of risks had a greater impact on their trust in the service than did their intention to use FinTech applications. Tripalupi and Anggahegari (2020) examined the effects of the pandemic on Indonesia's FinTech sector, revealing a decline in productivity due to altered operational patterns, increased market risk, decreased consumer demand, and increased operational risk. However, certain segments, such as online shopping platforms and FinTech loans and payments, experienced growth during this period.

Tut (2023) analysed the adoption of FinTech during the COVID-19 pandemic in Kenya, finding that favourable regulatory actions by the government, particularly in mobile banking, aided the growth of FinTech usage for payments and digital services while mitigating the adverse economic effects of the pandemic. This research suggests that investments in FinTech can act as a buffer against extreme events such as the COVID-19 pandemic, with implications for developing and emerging markets, including African nations. Fu and

Mishra (2022) conducted a qualitative research study on the impact of COVID-19 on worldwide FinTech app downloads, discovering a significant increase in financial app downloads during the pandemic influenced by factors such as the spread of COVID-19, government measures to control the spread thereof, and economic shocks experienced during the crisis. Vasenska et al. (2021) used a mixed research method involving questionnaires and the programming language Python to examine the impact of COVID-19 on Bulgaria's FinTech sector. Their findings indicated that while many respondents were not aware of FinTech to any significant extent before the pandemic, some individuals began using FinTech services during the outbreak. However, a significant proportion of respondents still had no plans to adopt FinTech services due to a lack of information.

Based on the findings from these studies conducted in various countries, the decision was made to evaluate the impact of COVID-19 on the FinTech sectors of Lithuania and Sweden using wavelet coherence analysis. Lithuania was chosen as it is the authors' native country, while Sweden's softer restrictions during the pandemic make it an interesting case to examine. Wavelet coherence analysis was chosen as the methodology for this study due to its ability to examine the impact of COVID-19 infections on peer-to-peer lending by analysing the frequency structure over time. This analysis allows us to understand the relationship between infection cases and lending returns in both countries in a comprehensive manner.

2. Methodology

In this article, Lithuania and Sweden, both of which are in northern Europe, have been chosen as the objects of analysis. At the beginning of the COVID-19 pandemic, the Swedish government introduced relatively lenient control measures to fight the spread

of the virus. Conversely, the Lithuanian government implemented strict control measures. This stark difference in approach is the main reason behind the choice of both countries for analysis. The decision was made to focus on peer-to-peer lending returns as they are easier to track compared to other FinTech service providers due to the global interchange of their services and financial products. Additionally, Lithuania and Sweden differ significantly in terms of population size. To understand the general trend of infections and how it relates to the population, the chosen measure was the percentage of infected residents in relation to the total population of each country.

In this article, wavelet coherence analysis is used to examine how COVID-19 affected peer-to-peer lending in Lithuania and Sweden. This method was selected as it enables a greater understanding of the impact of COVID-19 infections on peer-to-peer lending through analysing the frequency structure over time. This analysis will help us determine how COVID-19 infections affect peer-to-peer lending in both countries. The wavelet coherence analysis method is more suitable for this topic than other authors' methods mentioned above because wavelet coherence analysis is particularly suitable for studying time-series data, which is relevant when examining changes in returns over time. It allows for the identification of relationships and co-movements between variables across different time periods and frequency bands. This is especially important when studying the impact of COVID-19, as the effects may vary over time. Wavelet coherence analysis enables the detection of frequency-specific

relationships between variables. This means it can capture relationships that exist at specific frequencies or time scales, which may be missed by other methods. In the context of peer-to-peer lending returns, this can provide insights into how different frequencies or time periods are affected by the pandemic and related control measures. Wavelet coherence analysis allows for the dynamic analysis of relationships between variables, as it can capture changes in relationships over time. This is valuable when investigating the impact of COVID-19 on peer-to-peer lending returns, as the effects may evolve and fluctuate throughout the pandemic. This led to the hypothesis that the impact of COVID-19 on peer-to-peer lending returns differs between Lithuania and Sweden.

In order to perform wavelet coherence analysis and assess the impact of COVID-19 on peer-to-peer lending returns in Lithuania and Sweden, data on COVID-19 infection cases in both countries, as well as the interest rates of peer-to-peer lending platforms, was collected. Our investigation draws on data published on the websites of the World Health Organization (WHO), Statistics Sweden, the Bank of Lithuania, and the Official Statistics Portal. The data used in the study spans from 1 April 2020 to 31 December 2022. Although the COVID-19 outbreak in Lithuania and Sweden began in March 2020, some data were inaccurate or unavailable until the end of October. Therefore, this period was chosen to ensure the optimal calculations for studying the impact of COVID-19 on peer-to-peer lending returns in both countries. Our research was conducted in four steps (see Figure 2).

Figure 2. Four-step research



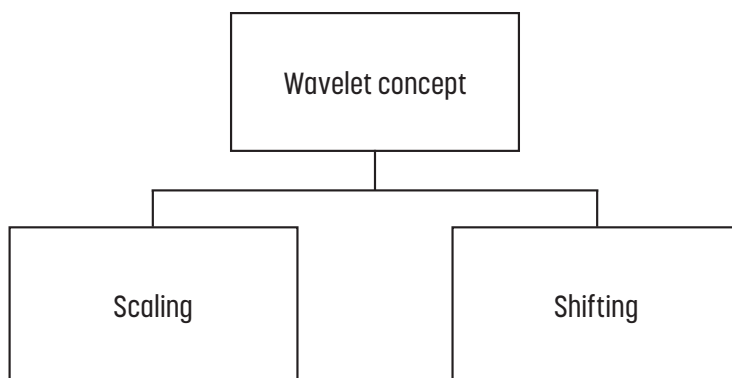
Source: compiled by the authors

As mentioned earlier, data on COVID-19 infections was collected from the World Health Organization (WHO) website. In the second step, calculations were performed using the MATLAB programme. The third step involved evaluating the results obtained, followed by drawing conclusions in the final step.

To examine the impact of COVID-19 on peer-to-peer lending in the respective

countries, the research employed wavelet coherence analysis. This allows for the examination of signals in terms of both time and frequency. It involves transforming the signals into images using wavelets, which exhibit fluctuations and zero values and come in various sizes and shapes. Wavelets are characterised by their limited duration (Kristoufek, 2015) (see Figure 3).

Figure 3. Wavelet concept



Source: Addison, 2017

Wavelet scaling, which allows one to describe the process of signal stretching

or compression in time, is expressed by the following formula (Addison, 2017):

$$\psi\left(\frac{t}{s}\right) s > 0 \quad (1)$$

where: ψ – original wavelet; s – is the scaling factor of the wave; t – period of time.

The scaling factor of the wave is positive and indicates the extent to which the wave

scaling of the signal changes over time. Wave scaling is inversely proportional to frequency (see Table 1).

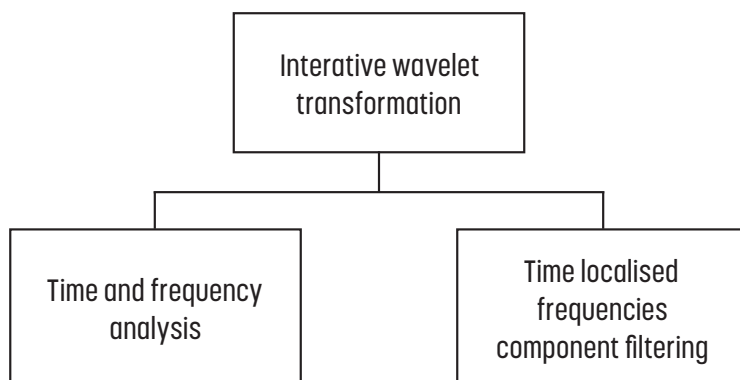
Table 1. Wave scaling features

Type	Feature
Low wavelet scaling and high frequency	$S > 1$
High wavelet scaling and low frequency	$0 < S < 1$

Source: Addison, 2017

Wavelet shifting refers to the movement or stagnation of wavelets from their initial position within a signal. The wave motion should align with the characteristics of the

signal (Addison, 2017). To assess the impact, we will employ an iterative wavelet transform method (see Figure 4).

Figure 4. Iterative wavelet transformation features

Source: Addison, 2017

This method makes it possible to determine the time and frequency characteristics of the signal. The wavelet transformation enables one to examine the dependence of the signal on wave scaling over time. By utilising wavelet scaling, this transformation reveals the instantaneous frequency, which

assists in generating a frequency-time image of the signal (Sadowsky, 1996). When initiating the analysis, attention should be paid to the initial wavelet, also known as the mother wavelet, or analysing wave. The initial wavelet is represented by the following formula:

$$\psi(t) = (1 - t^2)e^{-t^2/2} \quad (2)$$

From this wavelet, dilated and translated wavelets may be derived for use in the transformation. To explore the wave power spectrum, which indicates the strength of the impact of the COVID-19 pandemic on

peer-to-peer lending in the respective countries, a recurrent wavelet transformation function was employed as expressed by the following formulas (Si & Zeleke, 2005):

$$W_x(t, s) = \int_{-\infty}^{\infty} x(t)\psi_{t,s}^*(t)dt \quad (3)$$

where: W_x – wavelet transformation function; ψ^* – complex version of the original wavelet.

The time series of $x(t)$ is discrete, so t is assigned as 1. The recurrent wavelet transform is expressed by the following formula:

$$W_x(t, s) = \sum_{t=1}^N x(t)\psi_{t,s}^*(t) \quad (4)$$

An iterative time series helps to transform the original residual series $x(t)$ into another representation by separating time t and frequency s . From these formulas, the wavelet power spectrum formula, which measures the variance of the time series each time the wavelet scale changes, is derived. All

measurements will be made according to the initial wavelet. The place where the wavelet power spectrum is formed is called a scalogram (Phillips and Gorse, 2018). The wavelet power spectrum for time and frequency is expressed by the following formula:

$$WPS(t, s) = |W_x(t, s)|^2 \quad (5)$$

where: WPS – wavelet power spectrum.

A power spectrum measures the dispersion at each period and frequency relative to the wavelet. To find the average dispersion in frequency corresponding to the

$$E(s) = \frac{1}{N} \sum_{t=1}^N |W_x(t, s)|^2 \quad (6)$$

where: $E(s)$ – average dispersion.

$E(s)$ highlights the dominant frequency in the $x(t)$ time series. To analyse the simple cause-and-effect relationships in the time series, we will use the wavelet transform

$$R^2(t, s) = \frac{|S(s^{-1}W_{xy}(t, s))|^2}{S(s^{-1}|W_x(t, s)|^2)S(s^{-1}|W_y(t, s)|^2)} \quad (7)$$

where: R^2 – wavelet transform coherence.

The wavelet transform coherence will reveal the connection between signals in the x and y time and frequency domains. The average correlation over time and at

$$AC(s) = \frac{1}{N} \sum_{T=1}^N R^2(t, s) \quad (8)$$

where: $AC(s)$ – average correlation.

To study the connection, we will use a more complex initial wavelet, which is

$$\psi(t) = e^{-\frac{1}{4}t} e^{i\omega_0 t} e^{-\frac{t^2}{2}} \quad (9)$$

This initial wavelet will provide a good balance between time and frequency when searching for a connection.

The coherence ranges from 0 to 1, and it is classified as low, medium, or high based on the coherence coefficient falling within the ranges $0 \leq x \leq 0.3$, $0.3 < x \leq 0.7$, and $0.7 < x \leq 1$. By utilising the previously mentioned formulas, the MATLAB programme generates a scalogram, visually presenting the relationship between selected variables during specific periods. In the generated image, the arrows demonstrate the interdependence of the investigated variables, with right- or left-pointing arrows indicating in-phase or anti-phase time series and positive or negative correlations. Upward-pointing arrows indicate that the X variable leads the Y variable, while downward-pointing arrows indicate that the Y variable leads the X variable. The dashed white bar indicates

scaling, we will use the average dispersion, which is expressed by the following formula (Addison, 2017):

coherence, which is expressed by the following formula ($E(s)$ represents the average dispersion from wavelet coherence analysis) (Si & Zeleke, 2005):

each frequency is expressed in the following formula (R^2 represents the coherence from wavelet coherence analysis) (Goodell & Goutte, 2020):

expressed in the following formula (Goodell & Goutte, 2020):

potential inaccuracies in the results. The X -axis represents the volume of the analysed study (from the second quarter of 2020 to the fourth quarter of 2022) in the figures, while the Y -axis represents the periods covering the entire duration of the study. R^2 and $AC(s)$ play a crucial role in the images, where R^2 demonstrates the correlation between variables, and $AC(s)$ shows the correlation between signals in time and frequency. $AC(s)$ highlights the area where coherence exists between x and y .

3. Research results and discussion

3.1. The Impact of COVID-19 on Peer-to-Peer Lending Returns: A Comparative Analysis of Lithuania and Sweden

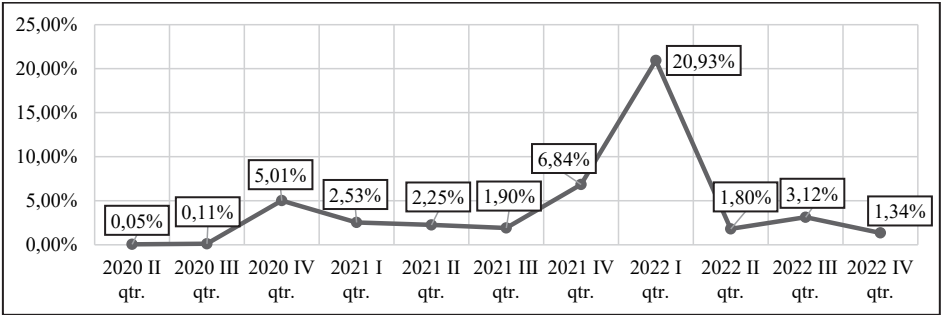
The COVID-19 pandemic has had far-reaching effects on various sectors of

the economy, including the financial industry. As people adapted to the challenges posed by the pandemic, there has been an increased adoption of digital financial services and innovative solutions, such as peer-to-peer lending. This chapter explores the relationship between COVID-19 infection cases and the returns of peer-to-peer lending platforms in Lithuania and Sweden. By analysing the fluctuations in infection rates and average interest rates over a specific period, we aim to uncover any potential correlations between these factors. Additionally, we compare the strength and duration of the correlations in both countries. The findings shed light on the impact of the pandemic on the peer-to-peer lending sector and contribute to our understanding of the interplay between outbreaks of infectious disease and the financial markets.

The infection rate in Lithuania was relatively low in the second quarter of 2020, at 0.05%. It increased significantly in the third quarter of 2020, reaching 0.11%, and subsequently surged in the fourth quarter of 2020, reaching 5.01%, which was the highest

observed during that year. In the first quarter of 2021, the infection rate decreased slightly to 2.53%. The second and third quarters of 2021 saw a further decline in the infection rate, with values of 2.25% and 1.90% respectively. The infection rate then increased significantly in the fourth quarter of 2021, reaching 6.84%, the highest value since the fourth quarter of 2020. The first quarter of 2022 witnessed a dramatic rise in infection cases, with a rate of 20.93%, which was the highest recorded in the analysed period. The infection rate dropped significantly in the second quarter of 2022, with a value of 1.80%. The third and fourth quarters of 2022 saw a moderate increase in the infection rate, reaching 3.12% and 1.34% respectively. In conclusion, the number of cases of infection in Lithuania exhibited significant fluctuations over the period in question. The highest infection rate observed was 20.93% in the first quarter of 2022, while the lowest was 0.05% in the second quarter of 2020. The average infection rate across all the reported quarters was approximately 4.23% (see Figure 5).

Figure 5. COVID-19 cases in Lithuania as a percentage of the total population



Source: WHO & Official Statistics Portal, 2023

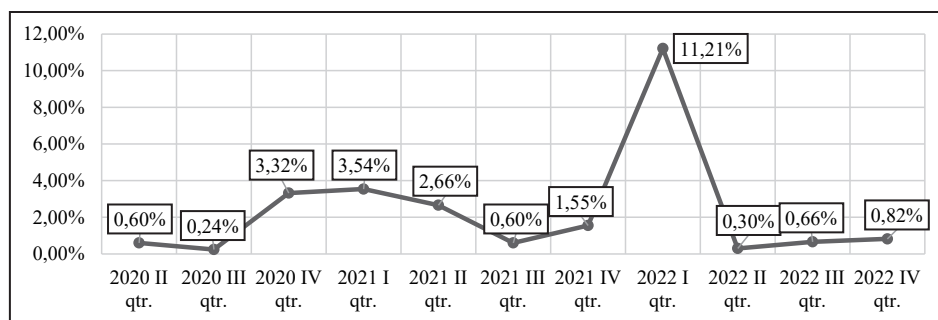
The infection rate in Sweden was relatively low in the second quarter of 2020, at 0.60%. It decreased further in the third quarter of 2020, reaching 0.24%. The infection rate increased significantly in the fourth quarter of 2020, with a value of 3.32%.

In the first quarter of 2021, the infection rate remained high at 3.54%. The second quarter of 2021 saw a slight decline in the infection rate to 2.66%, while the third quarter of 2021 saw a significant decrease to 0.60%. The infection rate then increased again in the

fourth quarter of 2021, reaching 1.55%. The first quarter of 2022 witnessed a substantial rise in infection cases, with a rate of 11.21%, which was the highest recorded in the analysed period. The infection rate dropped significantly in the second quarter of 2022, with a value of 0.30%, before increasing slightly to 0.66% in the third quarter of 2022. The fourth quarter of 2022 saw a further

increase in the infection rate to 0.82%. In conclusion, the number of COVID-19 cases in Sweden fluctuated over the course of the research period. The highest infection rate observed was 11.21% in the first quarter of 2022, while the lowest was 0.24% in the third quarter of 2020. The average infection rate across all the reported quarters was approximately 2.15% (see Figure 6).

Figure 6. COVID-19 cases in Sweden as a percentage of the total population

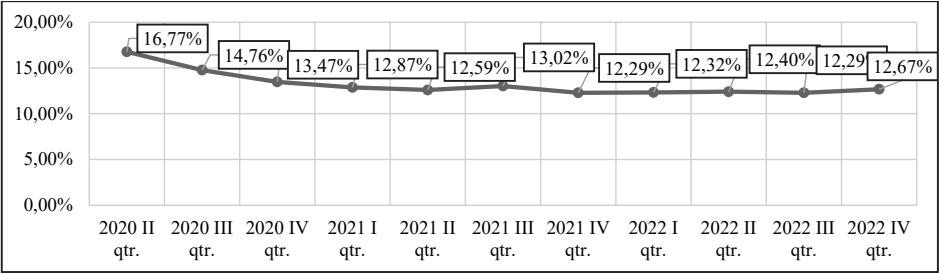


Source: WHO & Statistics Sweden, 2023

The average interest rate in Lithuania in the second quarter of 2020 was 16.77%. It decreased in the third and fourth quarters of 2020, reaching 14.76% and 13.47% respectively, and continued to decline in the first and second quarters of 2021, with values of 12.87% and 12.59% respectively. The third quarter of 2021 saw a slight increase in the average interest rate to 13.02%, while in the fourth quarter of 2021, the average interest rate decreased to 12.29%. The average interest rates in the first and second quarters of 2022 remained relatively stable at 12.32% and 12.40% respectively. The average interest rate in the third quarter

of 2022 matched the rate observed in the fourth quarter of 2021, standing at 12.29%. The final quarter of 2022 saw a slight increase in the average interest rate to 12.67%. In conclusion, the average interest rates of peer-to-peer lending in Lithuania showed some fluctuations over the analysed period. The highest average interest rate observed was 16.77% in the second quarter of 2020, while the lowest was 12.29%, recorded in both the fourth quarter of 2021 and the third quarter of 2022. The overall average interest rate across all the reported quarters was approximately 13.01% (see Figure 7).

Figure 7. Average interest rates of peer-to-peer lending in Lithuania

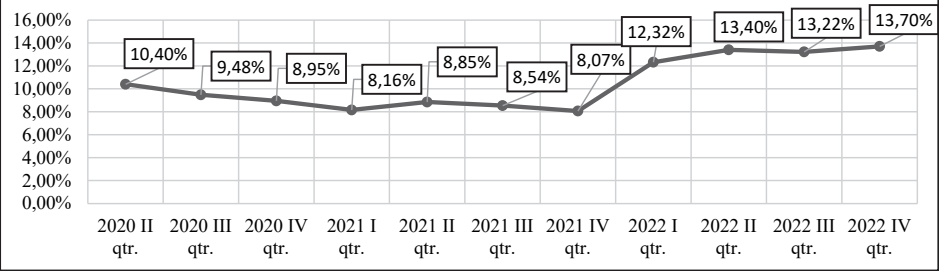


Source: Bank of Lithuania, 2023

The average interest rate in Sweden in the second quarter of 2020 was 10.40%. It decreased in the third and fourth quarters of 2020, reaching 9.48% and 8.95% respectively, and continued to decline in the first quarter of 2021, with a value of 8.16%. In the second and third quarters of 2021, there was a slight increase in the average interest rate to 8.85% and 8.54% respectively. The average interest rate further decreased in the fourth quarter of 2021, reaching 8.07%. The first quarter of 2022 witnessed a significant rise in the average interest rate to 12.32%, and the second

and third quarters of 2022 saw further increases in the average interest rate, reaching 13.40% and 13.22% respectively. The average interest rate in the fourth quarter of 2022 reached its highest point at 13.70%. In summary, the average interest rates of peer-to-peer lending in Sweden exhibited fluctuations over the analysed period. The highest average interest rate observed was 13.70% in the fourth quarter of 2022, while the lowest was 8.07% in the fourth quarter of 2021. The overall average interest rate across all the reported quarters was approximately 10.69% (see Figure 8).

Figure 8. Average interest rates of peer-to-peer lending in Sweden



Source: Statistics Sweden, 2023

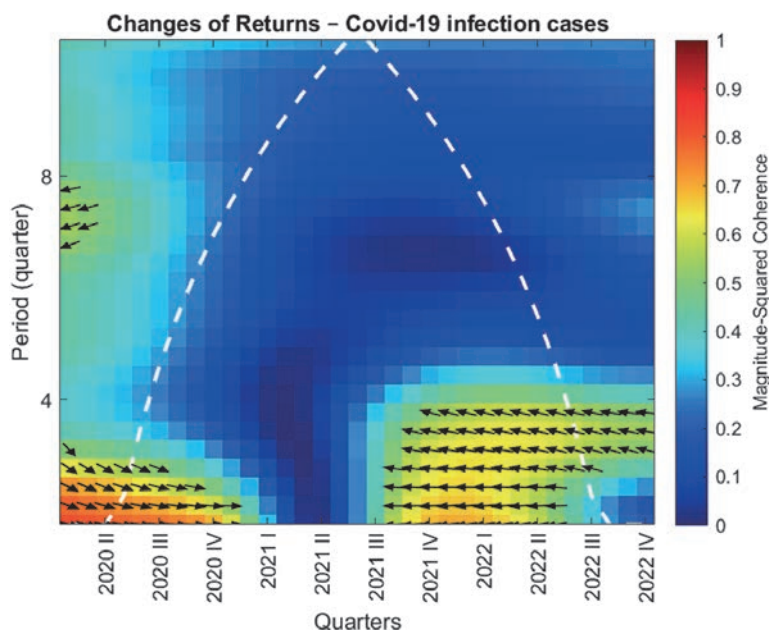
The average interest rates of peer-to-peer lending in Sweden displayed notable fluctuations between 2020 and 2022. In the second quarter of 2020, the average interest rate stood at a relatively high 10.4%, which then saw a gradual decline in subsequent

quarters. By the first quarter of 2021, it had decreased to 8.16%. However, the trend took a different direction from early 2022 onwards, with interest rates steadily rising. In the first quarter of 2022, there was a noticeable spike, jumping to 12.32%,

followed by further increases in the second, third, and fourth quarters of 2022, reaching a peak of 13.7%. This significant uptick in interest rates suggests a shift in the P2P

lending landscape in Sweden towards higher borrowing costs for borrowers during this period (see Figure 9).

Figure 9. Connection between changes in return on peer-to-peer lending and COVID-19 cases in Lithuania

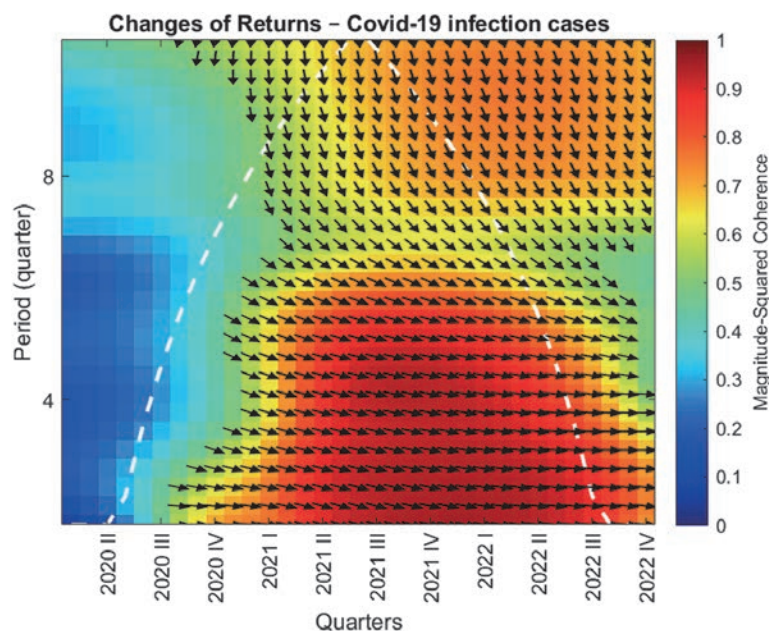


Source: own elaboration

During the period in question, in the long term (between eight and 12 quarters) a strong correlation between Swedish COVID-19 cases and changes in returns on peer-to-peer lending was visible from the fourth quarter of 2020 to the fourth quarter of 2022. The correlation from the fourth quarter of 2020 to the second quarter of 2021 reached a value of -0.5, and from the third quarter of 2021 to the fourth quarter of 2022 it became stronger, reaching a ratio of -0.7 points. There is clear evidence for the existence of correlation in both periods. In the medium term (between four and eight quarters) a strong connection was visible from the first quarter of 2021 to the third quarter of 2022, at a level of -0.9 points. In the short term (from one to four quarters),

it is possible to note that a connection can be seen in the fourth quarter of 2020 lasting until the fourth quarter of 2022. The strength of the connection as of the fourth quarter of 2020 was measured at -0.7 before strengthening to 0.8 in the first and second quarters of 2021. From the third quarter of 2021 to the fourth quarter of 2022 the connection was stronger still, reaching a ratio of -1, enabling us to state that correlation between changes in returns and the number of COVID cases was extremely high in the short term. According to the indicators, it can be said that during all three periods, the incidence of infection had an influence on changes in returns, with especially high correlation during the short and medium term (see Figure 10).

Figure 10. Connection between changes in return on peer-to-peer lending and COVID-19 cases in Sweden



Source: compiled by the authors

The correlation between COVID-19 cases and the changes in returns on peer-to-peer lending is visible for both Lithuania and Sweden. However, the correlation between COVID-19 and Lithuanian peer-to-peer lending is visible only in the short term, while such correlation is visible in all three periods in the Swedish context. In conclusion, Lithuanian peer-to-peer lending was less influenced by COVID-19 than Swedish peer-to-peer lending, where we can see that correlation is visible in all three periods.

Other authors conducted analyses providing an overview of the impact of COVID-19 on the FinTech sector, drawing on studies conducted in various countries. This highlights the accelerated adoption of FinTech services during the pandemic and the positive effects on economic growth. The studies discussed in the text showcase the increased usage of digital payments and mobile financial applications, as well as the role of FinTech in providing cost savings, time savings, and convenience. The

findings suggest that the COVID-19 outbreak has acted as a catalyst for the growth of the FinTech sector, with people embracing innovative financial solutions in response to the limitations imposed by the pandemic. This article focuses specifically on the impact of COVID-19 on peer-to-peer lending returns in Lithuania and Sweden. It employs wavelet coherence analysis to examine the relationship between COVID-19 infection cases and lending returns over a specific period. The analysis reveals a correlation between the two variables in both countries, although the strength and duration of the correlation differ. In Lithuania, the correlation is primarily observed in the short term, while in Sweden, it persists across all three analysed periods.

Conclusions

In conclusion, theoretical analysis and studies conducted in various countries have revealed that the COVID-19 pandemic has

had a significant impact on the FinTech sectors. Countries such as Bangladesh, India, Indonesia, the Middle East and North Africa region, Jordan, Kenya, and Bulgaria have experienced the accelerated adoption of digital financial services because of the pandemic. The need for remote and contactless transactions during lockdowns and social distancing measures has driven the increased usage of mobile banking and digital payments.

The findings also indicate that the impact of COVID-19 on the FinTech sector varies across countries. While some countries experienced the increased usage and adoption of FinTech services, others faced challenges related to altered operational patterns, decreased consumer demand, and increased market and operational risks. Factors such as government regulations, cybersecurity, digital infrastructure, trust, awareness, and perception of risks play a crucial role in shaping the FinTech landscape during the pandemic.

In conclusion, using wavelet coherence analysis was an effective method of evaluating the impact of COVID-19 on peer-to-peer lending returns in Lithuania and Sweden. This method has advantages over other approaches, as it can identify frequency-specific relationships and capture changes in relationships over time. By applying wavelet coherence analysis, the researchers were able to visually demonstrate the interdependence and correlations between cases of infection and lending returns during specific periods. Overall, this analysis provides a deeper understanding of how the pandemic affected the peer-to-peer lending sector in these two countries.

In Lithuania, the average interest rates of peer-to-peer lending exhibited a decreasing trend throughout the analysed period. However, the correlation between COVID-19 cases and lending returns was only significant in the short term, with a high negative correlation observed during

specific quarters of 2020, 2021, and 2022. Overall, the influence of COVID-19 on Lithuanian peer-to-peer lending was relatively limited. On the other hand, in Sweden, the average interest rates of peer-to-peer lending initially showed a decreasing trend but experienced a significant increase in the first quarter of 2022. This spike in interest rates can be attributed to a surge in COVID-19 infections and countries' foreign policies during that period. The correlation between COVID-19 infections and lending returns in Sweden was evident in all three periods analysed (the short, medium, and long term). In particular, the correlation was strong and negative, indicating a higher influence of COVID-19 on Swedish peer-to-peer lending compared to Lithuania. Therefore, it can be concluded that Swedish peer-to-peer lending was more strongly impacted by COVID-19 than Lithuanian peer-to-peer lending, as evidenced by the longer duration and stronger correlation between infection cases and lending returns in Sweden. These findings suggest that economic and policy factors related to the pandemic had a more pronounced effect on the Swedish peer-to-peer lending market.

In conclusion, the impact of COVID-19 on peer-to-peer lending returns differs between Lithuania and Sweden. In Lithuania, the correlation between infection cases and lending returns is primarily observed in the short term, while in Sweden, the correlation persists across all three analysed periods (the short, medium, and long term). This suggests that peer-to-peer lending was more influenced by the COVID-19 pandemic in Sweden than in Lithuania.

References

- Addison, P. S. (2017). *The Illustrated Wavelet Transform Handbook. Introductory Theory and Applications in Science, Engineering, Medicine, and Finance*. Boca Raton: CRC Press. <https://doi.org/10.1201/9781315372556>

- Al nawayseh, Mohammad K. (2020). FinTech in COVID-19 and Beyond: What Factors Are Affecting Customers' Choice of FinTech Applications?. *Journal of Open Innovation: Technology, Market, and Complexity* 6, no. 4: 153. <https://doi.org/10.3390/joitmc6040153>
- Bacq, S., Geoghegan, W., Josefy, M., Stevenson, R., & Williams, T. A. (2020). The COVID-19 Virtual Idea Blitz: Marshaling social entrepreneurship to rapidly respond to urgent grand challenges. *Business Horizons*, 63(6), 705–723. <https://doi.org/10.1016/j.bushor.2020.05.002>
- Barua, S. (2020). Understanding Coronanomics: The economic implications of the coronavirus (COVID-19) pandemic. <https://dx.doi.org/10.2139/ssrn.3566477>
- Degerli, K. (2019). Regulatory Challenges and Solutions for Fintech in Turkey. *Procedia Computer Science*, 158, 929–937. <https://doi.org/10.1016/j.procs.2019.09.133>
- Faeni, D. P., Faeni, R. P., Hidayat, R. S., Oktaviani, R. F., & Meidiyustiani, R. (2021). Analisis Pengaruh Social Distancing, Work from Home dan Aplikasi Video Call terhadap Produktivitas Organisasi: Studi Kasus pada Permukiman di DKI Jakarta. *Studi Ilmu Manajemen Dan Organisasi*, 2(1), 11–18. <https://doi.org/10.35912/simo.v2i1.92>
- Fu, J., Mishra, M. (2022). Fintech in the time of COVID–19: Technological adoption during crises. <https://doi.org/10.1016/j.jfi.2021.100945>
- Goodell, J., Goutte, S. (2020). Co-movement of COVID-19 and Bitcoin: Evidence from Wavelet Coherence Analysis. Akron: University of Akron. <https://doi.org/10.1016/j.frl.2020.101625>
- He, D., Leckow, R. B., Haksar, V., Griffoli, T. M., Jenkinson, N., Kashima, M., Khiaonarong, T., Rochon, C., Tourpe, H. (2017). Fintech and Financial Services: Initial Considerations. Volume 2017: Issue 005. <https://doi.org/10.5089/9781484322383.006>
- Kristoufek, L. (2015). What Are the Main Drivers of the Bitcoin Price? Evidence from Wavelet Coherence Analysis. *PLoS ONE* 10(4): e0123923. <https://doi.org/10.1371/journal.pone.0123923>
- Le, M. T. H. (2021). Examining factors that boost intention and loyalty to use Fintech post-COVID-19 lockdown as a new normal behavior. <https://doi.org/10.1016/j.heliyon.2021.e07821>
- Li, X., Lu, H., & Hasan, I. (2020). The Promises and Pitfalls of WealthTech: Evidence from Online Marketplace Lending 1 The Promises and Pitfalls of WealthTech: Evidence from Online Marketplace Lending. <http://dx.doi.org/10.2139/ssrn.3575260>
- Minhas, A. (2022). Impact of the coronavirus (COVID-19) on digital payment usage in India as of April 2020. <https://www.statista.com/statistics/1111082/india-coronavirus-impact-on-digital-payment-usage/>
- Mohannad, A. D., Milan, C., Samer, A., Ahmad, D. (2021). The role of Fintech in predicting the spread of COVID-19. [http://dx.doi.org/10.21511/bbs.16\(1\).2021.01](http://dx.doi.org/10.21511/bbs.16(1).2021.01)
- Nair, D., Veeragandham, M., Pamnani, P., Prasad, S., & Guruprasad, M. (2021). Impact of COVID-19 On Fintech Industry. *International Journal of Research in Engineering, Science, and Management*, 4(2), 27–34. https://www.researchgate.net/publication/350920575_Impact_of_COVID-19_On_Fintech_Industry
- Navaretti, G. B., Calzolari, G., Mansilla-Fernandez, J. M., Pozzolo, A. F. (2017). FinTech and Banks: Friends or Foes? <https://dx.doi.org/10.2139/ssrn.3099337>
- Naz, F., Karim, S., Houcine, A., Naeem, M. A. (2022). Fintech Growth during COVID-19 in MENA Region: Current Challenges and Future prospects. *Electron Commer Res.* <https://doi.org/10.1007/s10660-022-09583-3>
- Official Statistics Portal Lithuania's population. <https://osp.stat.gov.lt/en/pagrindiniai-salies-rodikliai>
- Phillips, R. C., Gorse D. (2018) Cryptocurrency price drivers: Wavelet coherence analysis revisited. *PLoS ONE* 13(4): e0195200. <https://doi.org/10.1371/journal.pone.0195200>
- Roy, S. (2020). Economic impact of COVID-19 pandemic. https://www.researchgate.net/publication/343222400_ECONOMIC_IMPACT_OF_COVID-19_PANDEMIC

- Sadowsky, J. (1996). Investigation of Signal Characteristics Using the Continuous Wavelet Transform. *John Hopkins APL Technical Digest*, 17, p. 258 – 269. <https://www.jhuapl.edu/Content/techdigest/pdf/V15-N04/15-04-Sadowsky.pdf>
- Schmidbauer, H., Roesch, A., Uluceviz, E., Erkol, N., (2016). Are American and European equity markets in phase? — Frequency aspects of return and volatility spillovers. <https://ideas.repec.org/p/ekd/009007/9559.html>
- Si, B. C., Zeleke, T. B. (2005). Wavelet coherency analysis to relate saturated hydraulic properties to soil physical properties. *Water Resources Research*, 41, p. 1 – 9. <https://doi.org/10.1029/2005WR004118>
- Soloviev, V. I. (2018). Fintech ecosystem and landscape in Russia. *Journal of Reviews on Global Economics* 7: 377–90. <https://doi.org/10.6000/1929-7092.2018.07.32>
- Statistics Sweden statistics of the Swedish peer-to-peer lending interest rates. <https://www.scb.se/en/finding-statistics/statistics-by-subject-area/financial-markets/financial-market-statistics/financial-market-statistics/>
- Statistics Sweden Sweden's population. <https://www.scb.se/en/finding-statistics/statistics-by-subject-area/population/population-composition/population-statistics/pong/tables-and-graphs/population-statistics---month-quarter-half-year/population-statistics-2019-2022-month-and-1998-2021-year/>
- The Bank of Lithuania statistics of the Lithuanian peer-to-peer lending interest rates. <https://www.lb.lt/en/operators-of-a-peer-to-peer-lending-platform-1>
- Tripalupi, R. I., Anggahegari, P. (2020). The Impact of Covid-19 Pandemic: Challenges and Opportunities of Syariah Financial Technology. *International Journal of Nusantara Islam* 8(1):119-128. <https://doi.org/10.15575/ijni.v8i1.10207>
- Tut, D. (2023). FinTech and the COVID-19 pandemic: Evidence from electronic payment systems. *Emerging Markets Review: Volume 54*. <https://doi.org/10.1016/j.ememar.2023.100999>
- Vasenska, I., Dimitrov, P., Koyundzhyska-Davidkova, B., Krastev, V., Durana, P., Poulaki, I. (2021). Financial Transactions Using FINTECH during the Covid-19 Crisis in Bulgaria. *Risks*, 2021; 9(3):48. <https://doi.org/10.3390/risks9030048>
- WHO statistics of the Lithuanian Covid-19 pandemic. <https://covid19.who.int/region/euro/country/lt>
- WHO statistics of the Swedish Covid-19 pandemic. <https://covid19.who.int/region/euro/country/se>
- Yan, C., Siddik, A. B., Akter, N., & Dong, Q. (2021). Factors influencing the adoption intention of using mobile financial service during the COVID-19 pandemic: the role of Fintech. *Environmental Science and Pollution Research*, 0123456789. <https://doi.org/10.1007/s11356-021-17437-y>
- Zveryakov, M., Kovalenko, V., Sheludko, S., & Sharah, E. (2019). FinTech sector and banking business: Competition or symbiosis? *Economic Annals-XXI*, 175(1–2), 53–57. <https://doi.org/10.21003/ea.V175-09>

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The Development of Employees' Green Competencies Through Sustainable Business Practices

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Abstract

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Green competencies (GCs) are recognised in the business management literature as those related to all the dimensions of the concept of sustainable development (SD). However, the relationship between GCs and sustainable business practices (SBPs) is not well defined; GCs are often presented in the context of selected organisational activities or the sector of the economy. This paper aims to present the influence of SBPs on employees' GCs in the transport and logistics sector. To achieve this goal, the combination of the methods was employed. First, a classical and semi-bibliometric literature review was undertaken to explore the connection between GCs and SBPs in the literature. Subsequently, the collection of good sustainable practices gathered by the Polish business ethics organisation *Forum Odpowiedzialnego Biznesu* [Responsible Business Forum] (FOB) was re-analysed qualitatively and quantitatively as a source of SBPs in subjective and objective focus. The analysis of the secondary data collected in FOB indicated those SBPs which influence employees' GCs in the transport and logistics sector. As a result of this study, the combined orientation of the SBPs and their influence on GCs is conditional for the creation of green jobs (GJs). In this paper, future research avenues are also proposed for studying employees' competencies in the narrow context of both subjective and objective perspectives and for research into "golden" GJs, the conditions of the sustainable green labour market and green self-employment development.

Key words

green competencies, green economy, green jobs, green labour market, green transition, sustainable development.

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Introduction

Sustainable business practices (SBPs) are the result of the theoretical assumptions of sustainable development (SD) put into practice. SBPs can be also defined as the

economic processes which change under the influence of the SD concept (Alsmadi and Alzoubi, 2022; Pu et al., 2021). Therefore, researchers usually emphasise that SBPs constitute a gradual transition (Papademetriou et al., 2023; Piowar-Sulej, 2022a) from a so-called brown, high-carbon economy and based on non-renewable energy sources, to a green economy (Aceleanu et al., 2015; Sulich, 2018), and ultimately a zero-emission economy based on renewable energy sources (Ferguson, 2015; Sulich and Zema, 2018). Thus, there is a defined process of greening the economy (Kasztelan, 2021; Kozar, 2019) or undertaking a green transition (Čavoški, 2022; Kozar et al., 2022), and activities identified as SBPs (Brown and McGranahan, 2016; Knuth, 2018). In the literature, there is also an increasing number of references focused on the analysis of SBPs (Martínez-Ferrero and Frías-Aceituno, 2015; Sołoducho-Pelc and Sulich, 2022), which are also called green or environmental practices (Afum et al., 2021; Asghar and Hussain, 2009). In scientific publications, research on SBPs is usually focused on at least one of the three dimensions of the SD concept (Khoshnava et al., 2020; Leal Filho et al., 2019). In addition, the studies cited quite often deal with the issue of greening various types of organisations operating on the market, and their activities lead to the development of a sustainable and green labour market (Gull and Idrees, 2022; Kozar and Sulich, 2023a).

The process of greening an organisation through SBPs can occur in various areas of its operation (Gull and Idrees, 2022; Nowak and Kasztelan, 2022). It is impossible to indicate a universal indicator that would allow one to assess when a given entity can be considered sustainable or green (Solešvik et al., 2022). For example, it is possible to state that some researchers consider employees' environmental awareness (Tabuenca et al., 2023) or their green competencies (GCs) to be a determinant of organisational

sustainability, the issue of zero emissions (Ahmad, 2015; Baas, 2007), or the climate neutrality of a given entity (Wolf et al., 2021; Wu et al., 2022). Nevertheless, with the development of science and technology along with the change in the level of environmental awareness in society as a whole, the challenges pertaining to sustainability continue to be redefined (Fuso Nerini et al., 2019; Leal Filho et al., 2019; Tsalis et al., 2020). Hence, as the authors of this article acknowledge, there is a space for setting new and more ambitious sustainability-oriented goals (Hofbauer and Limanskis, 2022; Sołoducho-Pelc and Sulich, 2020). This aspect can be seen in various types of organisations in which there is a constant evolution in the approach to the directions and areas of implementation of the SD concept in their daily operations. Such changes can be observed, for example, in the field of organisational solutions related to the subjective and objective areas of work, where it is increasingly common to encounter the creation and shaping of GCs (Kozar and Sulich, 2023a; Sulich and Zema, 2018). The subject- and object-oriented SBPs define GCs in two dimensions (Macke and Genari, 2019). The first, subjective focus relates to whom SBPs are dedicated to and how they develop employees' GCs (Ahmad, 2015; Ludwikowska, 2021; Piowar-Sulej and Podsiadły, 2022); this is the personal dimension of SBPs. The second objective relates to those aspects that SBPs directly focus on (Kozar, 2017; Tymbaliuk et al., 2023); this represents the non-personal dimension of SBPs.

One of the economic sectors in which researchers observe an ongoing process of green transition and an increasing number of SBPs is the transport and logistics sector (Gruchmann et al., 2018; Oberhofer and Dieplinger, 2014). This sector plays an important or even strategic role in socioeconomic development (Bogusz and Sulich, 2019; Shestakova and Shestakov, 2023). At the same time, as indicated by the

assumptions of the European Union SD policy, this sector will undergo a significant transition in the coming years (Faizan et al., 2019; Kijewska et al., 2019). In the opinion of the authors of this article, there will be significant change in the transport and logistics sector, not only in terms of the existing working conditions of individual employees, but also in terms of new environmental GCs or those mentioned above.

This paper aims to present the influence of SBPs on employees' GCs in the transport and logistics sector. The SBPs were divided into two groups, namely those oriented towards the subject and those focused on the object of employee duties in the transport and logistics sector. The subject- and object-oriented SBPs define GCs in two dimensions. The first is a personal and subjective focus pertaining to whom SBPs are dedicated to and how they develop employees' GCs. The second dimension is objective and non-personal, and is related to those aspects on which SBPs are focused. Therefore, objective orientation corresponds to whom the SBPs are aimed at, while the objective orientation addresses how SBPs are targeted. To achieve such complex goals, a collection of complementary methods was used in this paper. First, a classical and semi-automated bibliometric literature review was undertaken based on resources drawn from the Scopus and Web of Science databases. In effect, the 48 publications were used to develop the theoretical construct of the GCs. After this critical analysis of publications, a definition of GCs was proposed. SBPs were researched in terms of their subject and object orientation, and especially to show whether they are already aimed at developing employees' GCs. Additionally, the data collected by the Polish Responsible Business Forum (Polish: *Forum Odpowiedzialnego Biznesu*, FOB) were reused and analysed to achieve the goal of this research (Forum Odpowiedzialnego Biznesu, 2023). In the opinion of the authors of the article, such

a goal is important, because it makes it possible for those responsible for managing employees in organisations to observe the most frequently chosen directions of development of employee competencies.

The article consists of six sections, which are interrelated and focused on achieving the goal of the research. The first section, the introduction, presents the general location of the chosen research problem in the literature and indicates the purpose of the research. In turn, the second section presents what the GCs of employees are and highlights the issues related to their formation and development. The third section contains a description of the research methodology aimed at analysing selected examples of SBPs related to the field of work in the transport and logistics sector. The fourth section describes the results of the analysis. The penultimate section of the article is devoted to a discussion within the scope of which reference is made to the results of other research. The article ends with conclusions. Within the scope of this section, potential directions of future research on the issue of GCs of employees are indicated. As authors, we have also drawn attention in this section to the perceived barriers facing researchers in the field of the issue discussed herein.

1. Literature review

1.1. Bibliometric literature review

Two databases were selected for a qualitative review of the literature in terms of GC issues, namely Scopus and Web of Science. These databases, due to the procedures associated with the indexing of individual publications therein, are considered by many researchers to be a reliable source of information (Zema and Sulich, 2022), resulting in numerous literature reviews performed precisely on the basis of these databases in the context of the problems of SD and SBPs (Dzhengiz and Niesten, 2020; Murillo-Ramos et al., 2023;

Papademetriou et al., 2023). In addition, the review of research drawn from the Scopus and Web of Science (WoS) databases is explored by means of bibliometric queries constructed by the authors (Konys, 2020; Sulich and Sołoducho-Pelc, 2022). Hence, the authors constructed one query each to the databases indicated (Table 1). These queries were characterised by the same analysis area of the searched keywords (in two forms of English) in scientific studies indexed in the Scopus database (Q1 in Table 1) (Scopus, 2023a) and the Web of Science

database (Q2 in Table 1). The search fields were the titles, abstracts and keywords of the publications (Scopus, 2023b). The databases were explored on 11 February 2023 and the results of each query are presented in Table 1. Considering good practice in this type of analysis (Kozar and Sulich, 2023b; Pu et al., 2021), publications from 2023 were not included, which will enable future researchers exploring the indicated topic to draw comparisons with the quantitative results obtained from the presented queries (Elsevier, 2022).

Table 1. Search Query syntax details

Symbol	Database	Query syntax	No. Results
Q1	Scopus	TITLE-ABS-KEY(„green competencies” OR „green competences”) AND (EXCLUDE(PUBYEAR, 2023))	45
Q2	Web of Science	„green competencies” (Topic) OR „green competences” (Topic) AND 2012-2022 (Year Published)	26

Source: own elaboration

The oldest publications obtained in both queries were published in 2012. Moreover, it was observed that 23 publications from the WoS database were also part of the result of the query obtained from the Scopus database. There was an overlay among the results in Table 1. Hence, only 48 different scientific papers were used for further substantive analysis in exploring the issue of employee GC development through SBPs.

1.2. Development of green competencies

The critical analysis of the scientific literature proved that there is no single, universally valid definition of GCs (Cabral and Dhar, 2021); rather, they are discussed by researchers in different important contexts. They are usually addressed in the context of the green transformation of various types of organisations (Mirčetić et al., 2022), the issue of green human resource management (Bombiak, 2019; Cabral and Lochan Dhar, 2019), the formulation of various types of green strategies by organisations (Ling,

2019; Yahya et al., 2021), or the importance of this type of competence in the process of creating green innovations (Yahya et al., 2022). In addition, there is a noticeable amount of research aimed at identifying GCs from the perspective of selected sectors of the economy (Farooq et al., 2022; Gull and Idrees, 2022).

The context in which the GCs are discussed impinges on the direction of the definitions of this issue created by individual researchers (Garrouste and Courtial, 2016; Misnevs et al., 2021). At this point, it is worth citing selected exemplary definitions of GCs. Thus, GCs are defined by Subramanian et al. as “the requisite ecological knowledge, skills and other socioeconomic behaviour an individual has to help him/her behave and act rightly and responsibly toward the overall well-being of his/her immediate environment” (Subramanian et al., 2016). Kozar, on the other hand, emphasises that the GCs “of employees are the result of their knowledge and skills in

applying pro-environmental solutions in the company” (Kozar, 2017). Even based on the example of these two definitions of GCs, it can be seen that they emphasise a strictly defined environmental objective dimension of SBPs. A qualitative analysis of the articles selected for literature analysis made it possible to identify the following areas of GCs: green knowledge (Maksimov et al., 2022), green skills (Mirčetić et al., 2022), green behaviour (Cabral and Dhar, 2021), green attitudes, also known as environmentally-friendly attitudes (Bombiak, 2019), green abilities (Yafi et al., 2021) and green awareness (Farooq et al., 2022). These six areas are key to the construction of GCs and are also recognised by other researchers (Cabral and Lochan Dhar, 2019). Those key areas can be known by slightly different albeit synonymous terms, e.g. instead of “green” they may be “environmental” (Farooq et al., 2022).

The separation of the GC areas presented above is important, in the opinion of the authors of this article, not only from a theoretical point of view but also from a practical one. It allows one, first of all, to indicate the issues which managers of employees in an organisation should pay attention to, so as to shape GCs among employees which are desired in the organisation, including their appropriate quality (Hameed et al., 2020). Previous research carried out in Polish companies by Kozar indicates that the formation of GCs can take place through training, the assessment of employees' attitudes and behaviour, as well as engaging employees in pro-environmental enterprise initiatives (Kozar, 2017, 2019). In this research, attention is paid to SBPs in the transport and logistics sector which develop employees' GCs.

2. Methodology

2.1. Description of the methodology

This paper aims to present the influence of SBPs on employees' GCs in the transport and logistics sector. Therefore, the first

step of the research procedure was to analyse selected practices from the transport and logistics sector related to sustainability in the area of employees' duties in terms of their subject and object orientation, and especially to show whether they are already aimed at shaping the GCs of employees. A qualitative analysis of the practices selected for the study was used to prepare a set of SBPs based on the FOB (Polish: *Forum Odpowiedzialnego Biznesu*) database (Forum Odpowiedzialnego Biznesu, 2023). The qualitative analysis was additionally supported by quantitative analysis in terms of demonstrating the frequency of occurrence of the elements in the research sample.

Due to the purposeful selection of the sample for this study, the analysed data are not presented in terms of quantitative changes year-on-year and there is no substantive or static justification for this type of analysis. The programme ATLAS.ti was used for qualitative analyses, while quantitative analyses were carried out in the programme PS IMAGO PRO. The research was conducted from January to March 2023.

2.2. Selection of sustainable business practices for research

The selection of SBPs in the workplace for the study was preceded by a definition selected by the authors and literature defining what such practices should be characterised by. This definition was accompanied by the adoption of a baseline period for the planned quantitative and qualitative analyses.

Thus, for the purposes of this study, SBPs in the workplace were understood as all solutions implemented by employers that do not result directly from the current legislation, and at the same time are aimed at creating:

1. an employee-friendly workplace (implementing additional measures aimed at integrating new employees into the operation of the entity, supporting the development of employees' interests based on

- their hobbies, striving for gender equality, and emphasising the appropriate environment in which an employee spends his or her time during breaks at work),
2. a healthy workplace (supporting activities aimed at work-life balance, health, and developing and introducing additional non-legislative solutions aimed at increasing the level of employee safety in the workplace),
 3. opportunities to develop existing and acquire new competencies (including GCs in their various dimensions),
 4. career opportunities (inside and outside a particular business entity).

It was assumed that the SBPs chosen for analysis should be characterised by the same source or database. This was to ensure a similar qualitative description of individual SBPs. In turn, the authors of this article chose 2016 as the starting point. The choice of that year was not accidental, as it was the first full year after the adoption of Agenda 2030 and the related Sustainable Development Goals. As a result of a review of research on the issue of SD in Poland, the authors assumed that the most comprehensive database for the purposes of the research would be the database of SBPs created by FOB, an organisation which is a forum for responsible business in Poland (Forum Odpowiedzialnego Biznesu, 2023).

The aforementioned database collects practices in the field of SD from organisations operating in various sectors of the economy in Poland. It is important for the fulfilment of the research objective that this database contains descriptions of SBPs from the transport and logistics sector. A review of the FOB database in January 2023 allowed the researchers to identify 243 SBPs in the transport and logistics sector. As a result of further analysis undertaken based on the SBPs from the workplace area defined above, 94 descriptions of various practices that were implemented in 2016-2021 were

selected for further qualitative and quantitative analysis (the criterion of data availability at the time of the survey).

2.3. Criteria for analysing sustainable business practices

In order to achieve the stated goals of the study, the authors formulated criteria for the analysis of SBPs from the workplace. The criteria for subject analysis and the formation of GCs were distinguished.

In terms of subjectivity, attention was paid to whether a given solution implemented in the studied entity was targeted to all employees or to a portion of them. In cases where the SBPs from the workplace area applied only to some of the employees in a given entity, the identification of the factor or factors that influenced the availability of the implemented solution was carried out.

In the subject dimension, in turn, each sustainable business practice from the workplace area was analysed through the perspective of the following research questions:

1. Is there a reference to the issue of integration and/or the creation of a friendly workplace in the given sustainable business practice from the workplace area?
2. In the given sustainable business practice from the workplace area, were activities aimed at the development of existing competencies and/or the acquisition of new competencies by employees indicated? If so, what types of activities were undertaken?
3. In the SBPs in the workplace area, is there reference to the implementation of additional solutions aimed at improving the health and safety of employees at work? Do such solutions apply only to the work environment?

In the case of the last aspect, attention was focused on the identification and classification of activities that contribute to the formation of GCs. Hence, it was verified each time whether the scope of the analysed SBPs from the field of workplace refers

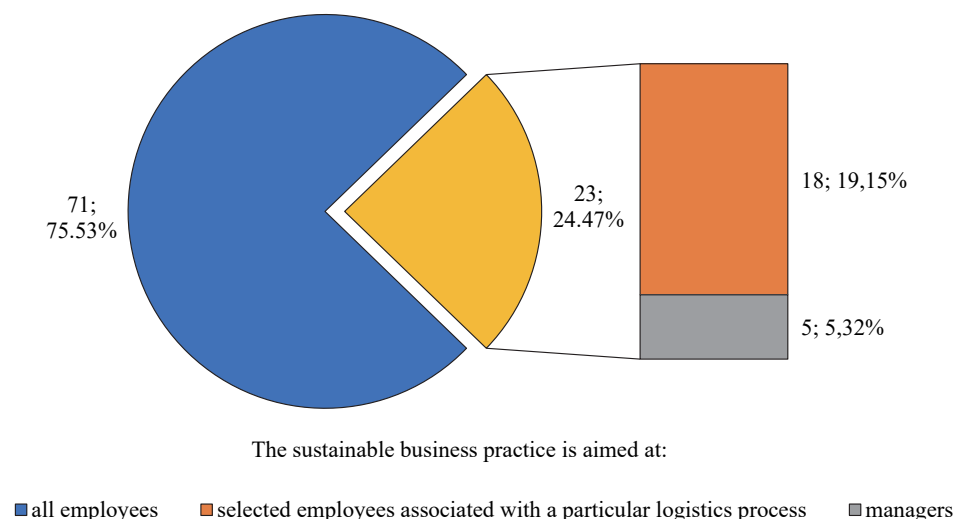
to activities aimed at developing existing and acquiring new GCs in at least one of the six dimensions selected during the review of the literature on the subject, namely green knowledge, green skills, green behaviour, green attitudes, green abilities and green awareness.

3. Research results

Based on an analysis of the literature and the FOB database, it was found that the vast majority of the sustainability-oriented solutions implemented were targeted at employees in general (Figure 1). However,

approximately 24.7% of the analysed SBPs from the workplace area were found to be targeted only at those employed in a strictly defined job position or responsible for a strictly defined logistical process. Such action was aimed primarily at offering specialised solutions aimed at developing existing competencies and acquiring new ones, as well as improving working conditions for selected groups of employees. It should be noted at the same time that in around one-fifth of such cases these solutions were available only to managers in organisations where this type of SBPs in the workplace had been implemented.

Figure 1. Analysis of SBPs among groups of employees



Source: Own elaboration based on Forum Odpowiedzialnego Biznesu (2023)

In light of the analysed SBPs from the workplace area (Forum Odpowiedzialnego Biznesu, 2023), it should be noted that creating a welcoming and inclusive workplace was the primary goal of a significant number of the implemented solutions. References to integration could be seen in approximately 42.6% of the analysed SBPs (Table 2). Integration activities took various forms and had different goals (e.g. social, environmental, or educational). Nevertheless, based

on the direction of the integration process taking place, they can be divided into:

1. internal (the initiatives taken with regard to a particular practice were aimed at integrating employees exclusively around workplace issues, e.g. improving working conditions),
2. external (the initiatives undertaken for a given practice were aimed at integrating employees exclusively around issues external to the organisation, e.g. supporting

the group involvement of employees in various social actions),

3. mixed (both internal and external initiatives were undertaken within the scope of a given practice).

Some of the analysed SBPs assumed that the activities undertaken as part thereof were reported by employees themselves. Subsequently, by the decision of superiors or on the basis of a transparent competition, they were evaluated and, if the requirements were met (focusing good practices on aspects related to SD), implemented in organisational practice. The

special value of this type of integrative activities should be emphasised here (employees involved in the indicated practice identified with it very strongly, which later translated into the results obtained). Unfortunately, as Table 2 shows, activities aimed at integrating employees based on their own ideas were used sporadically. For the purpose of integration activities, managers also provided opportunities for employees to engage in various types of volunteer activities (these were initiatives taken in the form of one-time actions or on an ongoing basis).

Table 2. Friendly and inclusive workplaces in the analysed practices

Targeted action identified in practice:	Total practices [n=94] from the workplace area that were focused on sustainability	
	number	%
integration (in general)	40	42.6
integration (internal)	16	17.0
integration (external)	11	11.7
integration (mixed)	13	13.8
the opportunity to independently propose an integration activity	7	7.4
proposals for integration activities are subject to a competition procedure	3	3.2
volunteerism	7	7.4
onboarding	3	3.2
hobbies	5	5.3
improving the conditions for spending breaks during work time	2	2.1
equality at work	4	4.3

Source: Own elaboration based on Forum Odpowiedzialnego Biznesu (2023)

In addition to integration measures, some of the practices aimed at creating friendly working conditions referred to the issue of supporting employees' interests (hobbies) or improving conditions for taking breaks during work time. Initiatives aimed at labour equality were found in only four SBPs. They were mainly focused on gender equality, and related activities most

often addressed the issue of improving the skills of female employees. Activities to support new employees in the scope of their functioning in the organisation (onboarding) were also observed in the results of the analysis (Table 2).

An important element of SBPs in the workplace area was the issue of employee health and safety in the workplace. One can

see numerous initiatives addressed in this aspect, which is also, in the opinion of the authors, mainly due to the specifics of the transport and logistics sector. In approximately 40.4% of the analysed practices there was a reference to the issue of safety in the workplace (Table 3). Through the prism of the analysed practices, it can be seen that in addition to restrictive organisational policies on safety, individual entities implement various additional initiatives. These are aimed not only at the acquisition of new knowledge of workplace safety by employees, but are primarily aimed at consolidating the good practices already taking place in these

organisations. As part of the organisational solutions implemented, it was observed that some entities offer employees additional non-wage benefits in the form of psychological support, free medical services, or opportunities for various types of stress management therapy (Forum Odpowiedzialnego Biznesu, 2023). Fully anonymous access was offered to some of the aforementioned benefits. It should be pointed out here that during part of the period from which the analysed practices are drawn (2020-2021), the COVID-19 pandemic had a significant impact on the type of sustainable workplace practices initiated in organisations of this type.

Table 3. The aspect of health and safety in the analysed practices

Targeted action identified in practice:	Total practices [n=94] from the workplace area that were focused on sustainability	
	number	%
safety in the workplace	38	40.4
implementation of additional technical solutions to reduce the risk of accidents at work	6	6.4
offering free medical services	5	5.3
psychological support	8	8.5
stress management	7	7.4
promotion of healthy lifestyles	19	20.2
activation through sport	18	19.1
promotion of healthy eating	8	8.5

Source: Own elaboration based on Forum Odpowiedzialnego Biznesu (2023)

In the SBPs surveyed, initiatives aimed at promoting healthy lifestyles are discernible; as Table 3 shows, this type of initiative is part of approximately one-fifth of sustainability-oriented initiatives surveyed. It can be seen that managers of organisations that implement this type of activity notice a direct link between the quality of work and employee health. Thus, an active lifestyle around numerous sports is promoted. Ensuring physical fitness plays an important

role in the field of work in the transport and logistics sector, despite the numerous technical solutions that are still being implemented to relieve the physical strain on employees. In 8.5% of practices, attention was also paid to the issue of healthy eating, which directly affects the psychophysical predispositions of employees.

Another measure observed in the analysed practices, in line with the goals of Agenda 2030, was additional initiatives

aimed at improving employee competencies. 36.2% of the analysed practices referred to this issue. It should be noted that the pandemic contributed in many cases to a change in the form in which employees received additional voluntary training/courses from on-site to remote learning. As a result, a much larger number of people were able to participate in them. Participation in courses in remote form also contributed to the fact that the managers of the entities in question paid attention to the issue of digital exclusion.

Hence, the training topics varied in nature. On the one hand, more generalised training was available in various fields (including those aimed at digital inclusion of employees). On the other hand, very narrow and highly specialised training related to strictly defined logistical processes (additional professional training) was organised.

Issues related to GCs were the object of analysis of the last criterion. In the indicated research area (Table 4) an intensification of activities aimed at GCs was diagnosed.

Table 4. Intensification of activities aimed at the development of GCs in the analysed practices

In a given practice, one can find the following number of activities aimed at the development of GCs:	Total practices [n=94] from the workplace area that were focused on sustainability	
	number	%
one	9	9.6
two	6	6.4
three	2	2.1

Source: Own elaboration based on Forum Odpowiedzialnego Biznesu (2023)

Activities aimed at the development of employees' GCs were identified in as many as 18.1% of the analysed SBPs (Table 4). According to the analysed practices, managers made rather narrow use of training to develop GCs (this was observed in only 35.3% of practices targeting GCs). They were primarily used to impart rather narrow and specialised pro-environmental knowledge. More common was an attempt to green the existing competencies of employees using voluntary integration activities around the indicated issues (in approximately 58.8% of cases) and the promotion of healthy lifestyles (in approximately 52.9% of cases). Activities aimed at the development of GCs of employees were primarily undertaken in the area of:

1. commuting (shared transportation, use of environmentally friendly means of transportation, the creation of conditions in the organisation to encourage bicycle

- usage, e.g. a healthy/ecological meal provided by the employer),
2. to promote the idea of the sharing economy (the creation of various types of exchange points in the workplace),
3. meals consumed at the workplace (the possibility for employees to propose vegan and vegetarian meals, which were then offered for a trial period in the employees' cafeteria),
4. eco-driving (additional courses in sustainable driving combined with awareness-raising activities about the emissions performance of various types of vehicles),
5. waste management (the correct segregation of waste at different workplaces).

In the context of the analysed SBPs, it should be noted that attempts were made to universalise GCs in a certain way, which consisted in indicating to employees that they are not only important in the context

of the workplace, but should be part of everyday life. Hence, in creating GCs which are desirable from the point of view of the goals of a given organisation, reference was often made to attitudes and behaviours that affect the health of a given employee and his or her loved ones, as well as the economic effects they may bring. In order to create appropriate pro-environmental patterns, so-called "open days" were also organised, during which employees could come to work with their children and participate in various types of integrative activities related to environmental issues, which were aimed at creating GCs in all six dimensions of this type of competence diagnosed during the literature review.

4. Discussion

The low number of publications (48 publications both in Scopus and WoS) identified in the semi-automated survey of the literature indexed in the database, with coverage since 2012, indicates that the topic of GCs is relatively new to management science. On the other hand, the general picture presented in this study covers all six of the most important dimensions of GCs constructs also proposed by other authors (Tabuenca et al., 2023).

Tabuenca et al. pointed that there is development of GCs along with the development of the technical infrastructure in business organisations, especially if they teach and promote employees' environmental awareness by means of learning processes which can be extended (Tabuenca et al., 2023). Increased environmental awareness and green principles were also the subject of research by Büyüközkan and Ifi (2012), which also indicated environmental competencies or GCs of the suppliers of green supply chains. These researchers surprisingly turned their attention to transport and logistics sector organisations ('Feature 2: Imtech launches Green Competence

Centre', 2012) which also develop GCs, and listed the SBPs nurturing the same competencies as the Polish FOB organisation (Forum Odpowiedzialnego Biznesu, 2023). Nurturing employees' GCs through sustainable business processes was also confirmed in research on training at universities (Murga-Menoyo, 2014). "These competencies must embrace their formative role not only with regard to future graduates who will be employed in GJs per se, but also with regard to those alumni who will work in all the other productive sectors, in addition to all citizens directly and indirectly involved in the wider economy as consumers, producers and (direct or indirect) recipients of its effects" (Murga-Menoyo, 2014). Training in the general competencies of sustainability is necessary within the ambit of the subjects taught at universities, but equally to those are part of SBPs in companies (Subramanian et al., 2016). Therefore, environmentally protective actions with adequate ecological knowledge and socio-economic behaviour and skills are referred to in this paper as GCs. Contrary to the research of Subramanian et al. (2016), in this research the authors proposed a bespoke model based on the organisational set of GCs. Therefore, this paper empirically examines the influence of individual GCs on organisations' green practices or SBPs and performance objectives and list the areas where GJs are created.

In the opinion of the authors of this article, the greening of modern economies cannot be achieved without measures aimed at workers acquiring GCs. On the other hand, shaping or nurturing the competences related to SD is essential to the creation of high-quality GJs, the so-called "golden" GJs, which are necessary workplaces for each SD-oriented organisation. SBPs make workplaces and employees' positions more integrative. It can be assumed that this theme will also be visible in the practices carried out in the future.

Conclusions

This paper aimed to present the influence of SBPs on employees' GCs in the transport and logistics sector. The results indicate that acquired GCs are more positively associated with individuals' GCs and green behaviour. The study empirically demonstrates that verifying acquired GC attributes such as environmental knowledge, green purchase attitude and intention during employee selection would certainly be helpful for firms in order to identify individual green performance potential and GJ creation.

The transition to a green economy is based on technical change and the development of selected sectors of the economy, one of which is the transport and logistics sector. Apart from technological changes, there are also changes in employees' competences, which also become green. This research aimed to present the best SBPs from the transport and logistics sector which develop employees' GCs.

In light of the research carried out, it seems that the level of involvement of economic actors in the process of creating GCs is still quite low. It is good practice to attempt to integrate employees around these issues through their voluntary involvement (Piwowar-Sulej, 2022b). The use of integration and health-oriented instruments is a much better solution than hours of theoretical training. Nevertheless, some of the necessary knowledge should still be imparted in courses (especially specialised in the field). In the authors' opinion, organisational managers should, however, aim to link these courses to practice and other incentives (i.e. non-salary motivators). Such activities would not only contribute to a better assimilation of new green knowledge, but would result in the consolidation of green attitudes and green behaviour. The attempt to universalise green competences is a good move in this respect.

The authors recognise that the formation of GCs in organisations should be

permanent. Such an observation is due to the fact that such specific competences are devalued relatively quickly due to the dynamic development of technology or knowledge itself in terms of pro-environmental solutions. Hence, practices undertaken on a one-off basis, or from time to time, will not have the desired effect (Afum *et al.*, 2021).

Future research directions may focus on: the evolution of GCs in organisations, green onboarding for organisations that ascribe to sustainability; a benchmark in the context of the quality of GJs, and research aimed at determining whether the different dimensions of GCs influence each other (e.g., whether people with a high level of green knowledge are also characterised by a high level of green attitudes). This suggests that researchers in the fields of economics and management should collaborate with psychologists, an interdisciplinary and challenging endeavour. The next area of possible research may be green self-employment developed in the context of GCs. However, the authors recognise the difficulty of reaching green sole traderships.

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References

- Aceleanu, M.I., Serban, A.C. and Burghilea, C. (2015), “Greening” the youth employment-A chance for sustainable development’, *Sustainability (Switzerland)*, Vol. 7 No. 3, pp. 2623–2643.
- Afum, E., Zhang, R., Agyabeng-Mensah, Y. and Sun, Z. (2021), ‘Sustainability excellence: the interactions of lean production, internal green practices and green product innovation’, *International Journal of Lean Six Sigma*, Emerald Group Holdings Ltd., Vol. 12 No. 6, pp. 1089–1114.
- Ahmad, S. (2015), ‘Green Human Resource Management: Policies and practices’, edited by Nisar, T. *Cogent Business and Management*, Cogent, 31 December.
- Alsmadi, A.A. and Alzoubi, M. (2022), ‘Green Economy: Bibliometric Analysis Approach’, *International Journal of Energy Economics and Policy*, Econjournals, Vol. 12 No. 2, pp. 282–289.
- Asghar, S. and Hussain, T. (2009), ‘Business Intelligence dimensions: Issues and practices’, *International Conference on Enterprise Information Systems and Web Technologies 2009, EISWT 2009*, pp. 9–18.
- Baas, L. (2007), ‘To make zero emissions technologies and strategies become a reality, the lessons learned of cleaner production dissemination have to be known’, *Journal of Cleaner Production*, Elsevier, Vol. 15 No. 13–14, pp. 1205–1216.
- Bogusz, K. and Sulich, A. (2019), ‘The Sustainable Development Strategies in Mining Industry’, in Soliman, K.S. (Ed.), *Education Excellence and Innovation Management through Vision 2020*, International Business Information Management Association (IBIMA), pp. 6893–6911.
- Bombiak, E. (2019), ‘Green human resource management – the latest trend or strategic necessity?’, *Entrepreneurship and Sustainability Issues*, Entrepreneurship and Sustainability Center, Vol. 6 No. 4, pp. 1647–1662.
- Brown, D. and McGranahan, G. (2016), ‘The urban informal economy, local inclusion and achieving a global green transformation’, *Habitat International*, Pergamon, Vol. 53, pp. 97–105.
- Büyüközkan, G. and Ifi, G. (2012), ‘A novel hybrid MCDM approach based on fuzzy DEMATEL, fuzzy ANP and fuzzy TOPSIS to evaluate green suppliers’, *Expert Systems with Applications*, Vol. 39 No. 3, pp. 3000–3011.
- Cabral, C. and Dhar, R.L. (2021), ‘Green competencies: insights and recommendations from a systematic literature review’, *Benchmarking: An International Journal*, Emerald Group Holdings Ltd., Vol. 28 No. 1, pp. 66–105.
- Cabral, C. and Lochan Dhar, R. (2019), ‘Green competencies: Construct development and measurement validation’, *Journal of Cleaner Production*, Elsevier Ltd, Vol. 235, pp. 887–900.
- Čavoški, A. (2022), ‘The European Green Deal and technological determinism’, *Environmental Law Review*, SAGE Publications Ltd, Vol. 24 No. 3, pp. 201–213.
- Dzhengiz, T. and Niesten, E. (2020), ‘Competences for Environmental Sustainability: A Systematic Review on the Impact of Absorptive Capacity and Capabilities’, *Journal of Business Ethics*, Vol. 162 No. 4, pp. 881–906.
- Elsevier. (2022), ‘Tutorial text: How to expand your search - Scopus: Access and use Support Center’, Service, available at: https://service.elsevier.com/app/answers/detail/a_id/35976/supporthub/scopus/ (accessed 6 April 2023).
- Faizan, R., Ul Haque, A., Cockrill, A. and Aston, J. (2019), ‘Females at strategic level affecting logistics firms’ competitiveness: Qualitative comparative analysis of contrasting gender in Pakistan and Canada’, *Forum Scientiae Oeconomia*, Vol. 7 No. 1, pp. 57–71.
- Farooq, K., Yusliza, M.Y., Muhammad, Z. and Mat, N.H.N. (2022), ‘Make it their Decisions, not your Directives: Exploring Required Green Competencies for Employee Ecological Behaviour’, *Organizacija*, Sciendo, Vol. 55 No. 2, pp. 128–141.
- ‘Feature 2: Imtech launches Green Competence Centre’. (2012), *Naval Architect*, No. NOV, pp. 49–50.

- Ferguson, P. (2015), 'The green economy agenda: business as usual or transformational discourse?', *Environmental Politics*, Vol. 24 No. 1, pp. 17–37.
- Forum Odpowiedzialnego Biznesu. (2023), 'Good practices [Dobre praktyki]', available at: <https://odpowiedzialnybiznes.pl/dobre-praktyki/> (accessed 10 May 2023).
- Fuso Nerini, F., Sovacool, B., Hughes, N., Cozzi, L., Cosgrave, E., Howells, M., Tavoni, M., *et al.* (2019), 'Connecting climate action with other Sustainable Development Goals', *Nature Sustainability*, Nature Publishing Group, 15 July.
- Garrouste, C.L. and Courtial, E. (2016), 'Towards a strategic anticipation of "green competencies": The CIPEGE tool; [Pour une anticipation stratégique des besoins en «compétences vertes»: l'outil CIPEGE]; [Strategische Ermittlung des Bedarfs an „ökologischen Kompetenzen“: das Instrument „Cipege“, *Formation Emploi*, No. 135, pp. 155–177.
- Gruchmann, T., Melkonyan, A. and Krumme, K. (2018), 'Logistics Business Transformation for Sustainability: Assessing the Role of the Lead Sustainability Service Provider (6PL)', *Logistics*, Multidisciplinary Digital Publishing Institute, Vol. 2 No. 4, p. 25.
- Gull, S. and Idrees, H. (2022), 'Green training and organizational efficiency: mediating role of green competencies', *European Journal of Training and Development*, Emerald Group Holdings Ltd., Vol. 46 No. 1/2, pp. 105–119.
- Hameed, Z., Khan, I.U., Islam, T., Sheikh, Z. and Naeem, R.M. (2020), 'Do green HRM practices influence employees' environmental performance?', *International Journal of Manpower*, Vol. 41 No. 7, pp. 1061–1079.
- Hofbauer, G. and Limanskis, A. (2022), 'An assessment of the level of sustainability of Foreign Direct Investments (FDI) of German companies in Latvia', *Forum Scientiae Oeconomica*, WSB University, Vol. 10 No. 1, pp. 97–116.
- Kasztelan, A. (2021), 'On the road to a green economy: How do european union countries "do their homework"?', *Energies*, Vol. 14 No. 18, available at: <https://doi.org/10.3390/en14185941>.
- Khoshnava, S.M., Rostami, R., Zin, R.M., Kamyab, H., Abd Majid, M.Z., Yousefpour, A. and Mardani, A. (2020), 'Green efforts to link the economy and infrastructure strategies in the context of sustainable development', *Energy*, Elsevier Ltd, Vol. 193, available at: <https://doi.org/10.1016/j.energy.2019.116759>.
- Kijewska, K., Iwan, S. and Małeck, K. (2019), 'Applying multi-criteria analysis of electrically powered vehicles implementation in urban freight transport', in Rudas I.J. Janos C., T.C.B.J.H.R.J.J.L.C. (Ed.), *Procedia Computer Science*, Vol. 159, Elsevier B.V., pp. 1558–1567.
- Knuth, S. (2018), "Breakthroughs" for a green economy? Financialization and clean energy transition', *Energy Research & Social Science*, Elsevier, Vol. 41, pp. 220–229.
- Konys, A. (2020), 'How to support digital sustainability assessment? An attempt to knowledge systematization', in Cristani M. Toro C., Z.-M.C.H.R.J.J.L.C.J.L.C. (Ed.), *Procedia Computer Science*, Vol. 176, Elsevier B.V., pp. 2297–2311.
- Kozar, Ł. (2017), 'Shaping the Green Competence of Employees in an Economy Aimed at Sustainable Development', *Human Resource Management*, Institute of Labor and Social Studies, Warsaw, Vol. 6 (119) No. 119, pp. 55–67.
- Kozar, Ł. (2019), *Zielone Miejsca Pracy Uwarunkowania – Identyfikacja – Oddziaływanie Na Lokalny Rynek Pracy*, Wydawnictwo Uniwersytetu Łódzkiego, available at: <https://doi.org/10.18778/8142-836-1>.
- Kozar, Ł.J., Matusiak, R., Padaszyńska, M. and Sulich, A. (2022), 'Green Jobs in the EU Renewable Energy Sector: Quantile Regression Approach', *Energies*, Multidisciplinary Digital Publishing Institute, Vol. 15 No. 18, p. 6578.
- Kozar, Ł.J. and Sulich, A. (2023a), 'Green Jobs: Bibliometric Review', *International Journal of Environmental Research and Public Health*, Vol. 20 No. 4, p. 2886.
- Kozar, Ł.J. and Sulich, A. (2023b), 'Green Jobs: Bibliometric Review', *International Journal of Environmental Research and Public Health*, Vol. 20 No. 4, p. 2886.

- Leal Filho, W., Tripathi, S.K., Andrade Guerra, J.B.S.O.D., Giné-Garriga, R., Orlovic Lovren, V. and Willats, J. (2019), 'Using the sustainable development goals towards a better understanding of sustainability challenges', *International Journal of Sustainable Development and World Ecology*, Taylor & Francis, Vol. 26 No. 2, pp. 179–190.
- Ling, Y.H. (2019), 'Examining green policy and sustainable development from the perspective of differentiation and strategic alignment', *Business Strategy and the Environment*, John Wiley and Sons Ltd, Vol. 28 No. 6, pp. 1096–1106.
- Ludwikowska, K. (2021), 'The mediating role of employee--Oriented human resource policy in the relationship between strategic human resource management and organisational performance', *Forum Scientiae Oeconomia*, Vol. 9 No. 2, pp. 131–150.
- Macke, J. and Genari, D. (2019), 'Systematic literature review on sustainable human resource management', *Journal of Cleaner Production*, Elsevier, Vol. 208, pp. 806–815.
- Maksimov, V., Wang, S.L. and Yan, S. (2022), 'Global connectedness and dynamic green capabilities in MNEs', *Journal of International Business Studies*, Palgrave Macmillan, Vol. 53 No. 4, pp. 723–740.
- Martínez-Ferrero, J. and Frías-Aceituno, J.V. (2015), 'Relationship between sustainable development and financial performance: International empirical research', *Business Strategy and the Environment*, John Wiley & Sons, Ltd, Vol. 24 No. 1, pp. 20–39.
- Mirčetić, V., Ivanović, T., Knežević, S., Arsić, V.B., Obradović, T., Karabašević, D., Vukotić, S., et al. (2022), 'The Innovative Human Resource Management Framework: Impact of Green Competencies on Organisational Performance', *Sustainability*, MDPI, Vol. 14 No. 5, p. 2713.
- Misnevs, B., Kabashkin, I. and Uzule, K. (2021), 'A Model Describing the Required Digital and Green Competences of VET Educators for Practical Use', *6th South-East Europe Design Automation, Computer Engineering, Computer Networks and Social Media Conference, SEEDA-CECNSM 2021*, available at: <https://doi.org/10.1109/SEEDA-CECNSM53056.2021.9565883>.
- Murga-Menoyo, M.A. (2014), 'Learning for a sustainable economy: Teaching of green competencies in the university', *Sustainability (Switzerland)*, MDPI, Vol. 6 No. 5, pp. 2974–2992.
- Murillo-Ramos, L., Huertas-Valdivia, I. and García-Muiña, F.E. (2023), 'Exploring the cornerstones of green, sustainable and socially responsible human resource management', *International Journal of Manpower*, Vol. 44 No. 3, pp. 524–542.
- Nowak, A. and Kasztelan, A. (2022), 'Economic competitiveness vs. green competitiveness of agriculture in the European Union countries', *Oeconomia Copernicana*, Nicolaus Copernicus University, Vol. 13 No. 2, pp. 379–405.
- Oberhofer, P. and Dieplinger, M. (2014), 'Sustainability in the transport and logistics sector: Lacking environmental measures', *Business Strategy and the Environment*, John Wiley and Sons Ltd, Vol. 23 No. 4, pp. 236–253.
- Papademetriou, C., Ragazou, K., Garefalakis, A. and Passas, I. (2023), 'Green Human Resource Management: Mapping the Research Trends for Sustainable and Agile Human Resources in SMEs', *Sustainability (Switzerland)*, Vol. 15 No. 7, available at: <https://doi.org/10.3390/su15075636>.
- Piowar-Sulej, K. (2022a), 'Environmental strategies and human resource development consistency: Research in the manufacturing industry', *Journal of Cleaner Production*, Vol. 330, available at: <https://doi.org/10.1016/j.jclepro.2021.129538>.
- Piowar-Sulej, K. (2022b), 'Sustainable development and national cultures: a quantitative and qualitative analysis of the research field', *Environment, Development and Sustainability*, Springer Science and Business Media B.V., Vol. 24 No. 12, pp. 13447–13475.
- Piowar-Sulej, K. and Podsiadly, K. (2022), 'Technological innovation and the labor market: The two-way non-reciprocal relationships with a focus on the confectionery industry in Poland', *Journal of Entrepreneurship, Management and Innovation*, Cognitione Foundation for the Dissemination of Knowledge and Science, Vol. 18 No. 3, pp. 135–171.

- Pu, R., Li, X. and Chen, P. (2021), 'Sustainable development and sharing economy: A bibliometric analysis', *Problems and Perspectives in Management*, Pujiayi Chen, Vol. 19 No. 4, pp. 1–19.
- Scopus. (2023a), 'Searching Scopus', *Scopus LibGuide - LibGuides at Elsevier*, available at: <https://elsevier.libguides.com/Scopus/topical-search> (accessed 12 April 2023).
- Scopus. (2023b), 'Content – How Scopus Works - Scopus - Elsevier solutions', *How Scopus Works*, available at: https://www.elsevier.com/solutions/scopus/how-scopus-works/content?dgcid=RN_AGCM_Sourced_300005030 (accessed 10 March 2023).
- Shestakova, E. and Shestakov, P. (2023), 'Green principles of ecological safety of transport construction', in Bieliatynskiy A., G.A.N. (Ed.), *E3S Web of Conferences*, Vol. 383, EDP Sciences, available at: <https://doi.org/10.1051/e3sconf/202338302004>.
- Solesvik, M.Z., Torgersen, M., Andersson, G. and Valter, P. (2022), 'Green Business Models: definitions, types, and life cycle analysis', *Forum Scientiae Oeconomica*, WSB University, Vol. 10 No. 4, pp. 199–217.
- Sołoducho-Pelc, L. and Sulich, A. (2020), 'Between Sustainable and Temporary Competitive Advantages in the Unstable Business Environment', *Sustainability*, Vol. 12 No. 21, p. 8832.
- Sołoducho-Pelc, L. and Sulich, A. (2022), 'Natural Environment Protection Strategies and Green Management Style: Literature Review', *Sustainability*, Vol. 14 No. 17, pp. 1–26.
- Subramanian, N., Abdulrahman, M.D., Wu, L. and Nath, P. (2016), 'Green competence framework: Evidence from China', *International Journal of Human Resource Management*, Routledge, Vol. 27 No. 2, pp. 151–172.
- Sulich, A. (2018), 'The Green Economy Development Factors', in Soliman, K.S. (Ed.), *Vision 2020: Sustainable Economic Development and Application of Innovation Management from Regional Expansion to Global Growth*, Proceedings of the 32nd International Business Information Management Association (IBIMA), King of Prussia, PA, USA, pp. 6861–6869.
- Sulich, A. and Sołoducho-Pelc, L. (2022), 'Changes in Energy Sector Strategies: A Literature Review', *Energies*, MDPI, Vol. 15 No. 19, p. 7068.
- Sulich, A. and Zema, T. (2018), 'Green jobs, a new measure of public management and sustainable development', *European Journal of Environmental Sciences*, Charles University in Prague, Vol. 8 No. 1, pp. 69–75.
- Tabuenca, B., Moreno-Sancho, J.-L., Arquero-Gallego, J., Greller, W. and Hernández-Leo, D. (2023), 'Generating an environmental awareness system for learning using IoT technology', *Internet of Things (Netherlands)*, Vol. 22, available at: <https://doi.org/10.1016/j.iot.2023.100756>.
- Tsalis, T.A., Malamateniou, K.E., Koulouriotis, D. and Nikolaou, I.E. (2020), 'New challenges for corporate sustainability reporting: United Nations' 2030 Agenda for sustainable development and the sustainable development goals', *Corporate Social Responsibility and Environmental Management*, John Wiley & Sons, Ltd, Vol. 27 No. 4, pp. 1617–1629.
- Tsybaliuk, S., Vasylyk, A. and Stoliaruk, K. (2023), 'Green recruitment and adaptation practices in GHRM', *IOP Conference Series: Earth and Environmental Science*, Vol. 1126, available at: <https://doi.org/10.1088/1755-1315/1126/1/012029>.
- Wolf, S., Teitge, J., Mielke, J., Schütze, F. and Jaeger, C. (2021), 'The European Green Deal — More Than Climate Neutrality', *Intereconomics*, Springer Science and Business Media Deutschland GmbH, Vol. 56 No. 2, pp. 99–107.
- Wu, X., Tian, Z. and Guo, J. (2022), 'A review of the theoretical research and practical progress of carbon neutrality', *Sustainable Operations and Computers*, Elsevier, Vol. 3, pp. 54–66.
- Yafi, E., Tehseen, S. and Haider, S.A. (2021), 'Impact of Green Training on Environmental Performance through Mediating Role of Competencies and Motivation', *Sustainability*, MDPI AG, Vol. 13 No. 10, p. 5624.

- Yahya, S., Jamil, S. and Farooq, M. (2021), 'The impact of green organizational and human resource factors on developing countries' small business firms tendency toward green innovation: A natural resource-based view approach', *Creativity and Innovation Management*, Vol. 30 No. 4, pp. 726 – 741.
- Yahya, S., Khan, A., Farooq, M. and Irfan, M. (2022), 'Integrating green business strategies and green competencies to enhance green innovation: evidence from manufacturing firms of Pakistan', *Environmental Science and Pollution Research*, Springer Science and Business Media Deutschland GmbH, Vol. 29 No. 26, pp. 39500–39514.
- Zema, T. and Sulich, A. (2022), 'Models of Electricity Price Forecasting: Bibliometric Research', *Energies*, Vol. 15 No. 15, pp. 1–18.

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Employee Procrastination in Light of National Cultural Traits and Corporate Social Responsibility

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Abstract

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Corporate social responsibility (CSR), which operates as a bridge between the interests of employees and those of the organisation, should act as a counter to workplace procrastination. However, the scientific literature has not yet provided an unambiguous explanation of the prevalence of employee procrastination in enterprises that have declared corporate social responsibility that also takes the national culture into account. The main purpose of this paper is to explore employee procrastination in light of national cultural traits and corporate social responsibility. An empirical study was conducted to investigate Polish and Lithuanian private sector organisations (N=995). The surveys featured the Irrational Procrastination Scale (IPS-9), the Unintentional Procrastination Scale (UPS-6), the Susceptibility to Temptation Scale (STS-11), and the General Procrastination Scale (GPS-20). A solution to the problem of employee procrastination in organisations requires special attention be paid to social corporate responsibility, which can be used as a direct tool to activate or deactivate this phenomenon. The results of this research supplement the scientific literature on workplace procrastination with new insights that can improve our understanding of how this phenomenon is related to national cultural traits. The value of this research lies in the fact that it presents new and original data that can serve as a basis for the development of theory on the problem of employee procrastination as well as a reference point for introducing practical measures to eliminate employee procrastination in organisations by changing their CSR status. This research proposes that when introducing CSR, practitioners should develop the internal culture while taking the features of the national culture that can promote employee procrastination into account.

Key words

procrastination, employee procrastination, corporate social responsibility, national culture, cultural differences, private sector, organisations, Lithuania, Poland.

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Introduction

Procrastination among employees in organisations is usually perceived as a negative behaviour that is manifested in postponements to the start or completion of work (Ferrari and Tice, 2000; Prem et al., 2018; Unda-López et al., 2022). The dynamism of the modern business environment necessitates prompt responses to changes in operating conditions, quick managerial decisions and the timely fulfilment of assigned tasks to ensure organisational development. Such prerequisites require an investigation of employee procrastination, particularly with respect to the factors that cause it, as well as possible measures to stop it, within the organisation. However, some personal traits of employees, such as self-organisation, responsibility, and purposefulness (Krause and Freund, 2014), can be determined by factors related to their work environment. These factors include management style (Köse and Metin, 2018), corporate culture (Dempsey, 2015), poor motivation, an uncomfortable psychological climate in the team, multitasking, and pressure from management (Vveinhardt and Sroka, 2022). Special attention should be paid to corporate social responsibility (CSR), which can directly activate or deactivate employee procrastination. After all, the principles of corporate social responsibility facilitate the creation of comfortable working conditions in compliance with all social guarantees on the part of the management and employees' responsible, conscientious attitude towards work. Research has shown that managerial behaviour is of particular importance in that it affects the employees' desire to devote themselves to their work and perform tasks for the benefit of the organisation. This claim has been confirmed by Farouk and Jabeen (2018), who explored the influence of the ethical climate on employee productivity.

However, organisations operate in societies whose cultures affect both the

implementation of corporate social responsibility and employee behaviour. Hofstede (2011) discussed the difference between society and organisational culture in terms of a certain level of awareness. While public culture is characterised more by values and preferences for one or another emotional state, which are frequently unconscious, organisational culture is based more closely on visible and conscious practices and on how people perceive what is happening in their environment. Although few studies of this kind have been produced, the results of these studies with regard to the question of the extent to which procrastination is related to certain characteristics of the national culture have been ambiguous. For example, in the context of an investigation of how decisions are made in Croatia, Slovenia, Hungary, Bosnia and Herzegovina, no relationship between procrastination and liability avoidance was found (Dabić et al., 2015). However, discussing the results of another cross-cultural study, Svartdal et al. (2016) maintained that the level of individualism in a given country can influence the postponement of decisions. Yet another study comparing individualistic Canada with collectivistic Singapore found that procrastination correlations in the two contexts were similar, albeit this study also reported differences regarding the perceived negative effect of procrastination and the activities in which people engaged while procrastinating (Klassen et al., 2010).

The influence of the prevailing cultural trends on CSR also differs depending on cultural orientation. For example, a study conducted by Kucharska and Kowalczyk (2019) in Poland indicated a negative influence of masculinity and high power distance and a positive impact of long-term orientation on CSR practices. Meanwhile, several studies conducted in other countries have shown that CSR

practice in organisations reduces the influence of national culture (Jamali et al., 2020; Radovanović et al., 2022). However, due to the scarcity of research on this topic and the fact that different scales measure procrastination differently (e.g. Fernie et al. 2017; Bennett and Bacon, 2019), it is difficult to give an unambiguous answer to the question of how CSR affects procrastination while taking the various differences and similarities among public cultures into account. Therefore, this study investigates employee procrastination in organisations with different CSR statuses in two countries that have close historical and cultural ties – Poland and Lithuania. Both countries have a common history extending over several centuries, share the same religion, foster the same moral values, and exhibit a common cultural heritage. In light of the cohesion and common cultural heritage of these countries, the purpose of this research is to explore employee procrastination with regard to national cultural traits and CSR.

1. Literature review

Based on the literature regarding the theoretical and practical aspects of procrastination, it should be noted that this issue has been widely discussed (Nguyen et al., 2013; Steel et al., 2018; Pearlman-Avni and Zibenberg, 2018; Uysal and Yilmaz, 2020; He et al., 2021; Song et al., 2022; Huang et al., 2023; etc.). Procrastination is a multifaceted phenomenon, the presence and development of which can be explained by various cause-and-effect relationships. Therefore, at present, this topic is the object of comprehensive research conducted by scientists, employees, and managers alike. For this reason, scientific papers have exhibited a diversity of views on the part of both researchers and practitioners with the aim of investigating certain aspects of this problem depending on the subject or purpose of the study in question.

Procrastination as a phenomenon; the factors associated with and causes of its occurrence. As defined by Prem et al. (2018), procrastination is a form of self-regulatory failure that is characterised by the irrational postponement of tasks despite the potential for negative consequences. Defining procrastination as a voluntary or habitual postponement of unpleasant matters for a later time, Unda-López et al. (2022) added that this phenomenon is characterised by short-term benefits and long-term costs. Recent studies have distinguished between two kinds of procrastination, i.e. intentional and unintentional (Franz, 2020; Fernie et al., 2017), each of which leads to different types of procrastination (personal, academic, and workplace procrastination). Different types of procrastination occur due to different determinants. For example, personal procrastination emerges and develops in people as a form of mechanical protection of the body from the influence of external factors (e.g. the flow of information regarding the rapid development of a negative phenomenon such as the spread of the pandemic, the threat of war, or a rapid increase in prices).

Procrastination is not an entirely negative or positive phenomenon. Procrastination may occur due to exhaustion, frustration, and stress, but employees may also procrastinate in an attempt to plan their time and prioritise their tasks. Shin et al. (2021) scientifically substantiated the claim that although it is widely believed that procrastination is counterproductive, a delay in the completion of a task may have hidden benefits for the creativity of employees who procrastinate moderately. Such employees were rated more highly by their managers with regard to creativity than employees whose procrastination levels were high or low, provided that the intrinsic motivation or creative demands were high. Thus, a healthy dose of procrastination can give employees more time to consider what needs to be done. For many people,

short-term procrastination is a prioritisation strategy. Furthermore, Zabelina et al. (2018) presented the results of research on time perspective as a predictor of procrastination. Their research indicated that employees who exhibit high levels of procrastination are more pessimistic about past events; they are less focused on plans, goals, and prospects and are sure that their future is predetermined and cannot be affected by individual actions. Therefore, such employees are unmotivated and uninterested in the timely performance of their tasks within the organisation. Other authors have identified reasons for procrastination such as emotions (Spada et al., 2006), worry, perfectionism (Kurtovic et al., 2019), anxiety, depression (Stöber and Joormann, 2001), and the violation of the work-life balance (Gu et al., 2022). However, research has shown that by improving employee engagement, organisations can increase the probability of employees responding positively to organisational goals and thus reduce the likelihood of the manifestation of workplace procrastination (Grund and Fries, 2018; Hen et al., 2021; Metin et al., 2016; Rapp et al., 2013). Based on the results of the research reviewed above, it should be assumed that CSR can act as a counter to procrastination.

Corporate social responsibility (CSR). CSR is a bridge that connects the interests of the organisation and employees (Aftab et al., 2022; Jia et al., 2019). Although different approaches to CSR have been taken, all of them share one common trait: a commitment to the task of promoting social welfare, which goes beyond the immediate goals of the organisation (Agudelo et al., 2019; Jia et al., 2019). The essence of CSR in the context of employer-employee relations lies first in observation of the labour and socio-economic rights of employees and the consideration of their interests, thereby establishing additional social benefits and guarantees. The methods used to implement CSR in organisations differ depending on the economic conditions

at hand and the size of the enterprise, the owner's motives, the forms of impact, and employee expectations. Nevertheless, CSR promotes pride in the organisation and employee engagement – the context creates the conditions necessary for the successful integration of the prevailing cultural trends in the society in question (Jia et al., 2019).

The results of research conducted by Farouk and Jabeen (2018) showed that the ethical climate directs internal CSR activity through the implementation of ethical awareness in the business environment (Farouk and Jabeen, 2018). Furthermore, internal CSR increases employees' awareness of the care taken and attention paid by the company, which in turn increases their moral obligation to work optimally for the common good (Pasricha et al., 2018; Aftab et al., 2022). For example, a study conducted by Aftab et al. (2022) indicated that the ethical behaviour of leaders is a key component that encourages a sense of respect, satisfaction, trust and acceptance among employees, which is subsequently reflected in the growth of their work productivity.

Employee procrastination in organisations and corporate social responsibility. When investigating the problem of employee procrastination in organisations, special attention should be paid to social corporate responsibility, which can either activate or deactivate this phenomenon directly. Particular attention has been paid to the importance of managers' behaviour with regard to its influence on employees' desire to devote themselves to work and perform tasks for the benefit of the organisation. Regarding this issue, Kühnel et al. (2022) focused on factors that reduce employee procrastination, finding that workplace procrastination could be reduced by creating conditions of positive influence on personality and time pressure (Ferrari and Díaz-Morales, 2007; Gupta et al., 2012) – situational factors that unlock various ways of behaving. Positive influence makes people

less likely to procrastinate as it reduces behavioural inhibitions and facilitates the implementation of intentions. In addition, research conducted by Azim (2016) demonstrated positive relationships among perceived CSR and organisational commitment, employee engagement, and organisational behaviour. Scholarly research has conceptualised an integrated model for the relationships among CSR, organisational commitment, employee engagement, and CSR. Onkila and Sarna (2022) revealed the prevalence of the organisational implementation of CSR and organisational benefits in research. Employees are perceived mainly as implementers of a top-down sustainability policy and as mediators of the organisation's CSR-related benefits. Most research on CSR has focused on the organisational level, while the individual level of analysis has been viewed as a "black box" in investigations of the antecedents of CSR engagement or disengagement (Sendlhofer, 2020). Sendlhofer (2020) offered insights into small and medium-sized enterprises that are recognised as pioneers of CSR.

Although the literature has suggested that the owner-manager is critical in the implementation of CSR, this research showed that CSR was driven by employees. The employees of the central firm voluntarily joined forces based on their shared understanding of moral responsibility for CSR and developed strict goals to be achieved by 2030. Despite their strong ethical and moral perspective during the implementation of CSR, they abdicated their moral responsibility for CSR in different contexts. It has been claimed that procrastination is a particularly relevant context of nonengagement when people are aware of their moral responsibility for CSR.

2. Methodology

The study focused on 995 employees of private sector organisations (male $N=448$, $LT=205$, $PL=243$; female $N=547$, $LT=290$, $PL=257$). Table 1 presents the characteristics of the research participants and the organisations they represent, both by country and for the total sample.

Table 1. Distribution of respondents by the CSR status of organisations

The organisation's CSR status	LT	PL	Total
Seeking to implement CSR	106	177	283
CSR organisations	214	211	425
Not seeking to implement CSR	175	112	287
Total	495	500	995

Source: own elaboration

Due to the aims of the research, Polish and Lithuanian companies operating in the private sector were selected. After obtaining permission from managers to conduct the survey, employees were informed that their participation in the survey was voluntary and was subject to their self-determination. The participants were informed that the principles of privacy, anonymity

and confidentiality would be respected. The survey was conducted in a manner that observed research ethics, thus ensuring that participants' rights were not violated and that the participants themselves were not exploited. The questionnaire was uploaded onto an online survey platform. As the survey was administered remotely, the link to the questionnaire was sent to the

participants. Due to the protections included in the questionnaire, the respondents were not permitted to answer by giving the same ratings on the Likert scale, and the questionnaire could not be completed on the same computer a second time. These settings did not allow the participants to fill in the questionnaires mechanically or dishonestly; in addition, the questionnaire included control questions. Finally, respondents could confirm and send the questionnaire only after answering all questions. Therefore, there were no incomplete questionnaires.

The survey was based on the following scales: the Irrational Procrastination Scale (IPS-9), an example item of which is “I put things off so long that my well-being or efficiency unnecessarily suffers” (Steel, 2010); the Unintentional Procrastination Scale (UPS-6), an example item of which is “I rarely begin tasks as soon as I am given them even if I intend to” (Fernie et al., 2017); the Susceptibility to Temptation Scale (STS-11), an example item of which is “I will crave a pleasurable diversion so sharply that I find it increasingly hard to stay on track” (Steel, 2010); and the General Procrastination Scale (GPS-20), an example item of which is “In preparing for

some deadline, I often waste time by doing other things” (Lay, 1986).

The results of the study are presented in Tables 2-5. They highlight the statistically significant differences between Lithuanian and Polish employees as well as among organisations with different CSR statuses in both countries.

3. Research results

First, general procrastination in organisations that do not have CSR status was tested. Statistically significant differences were found in both countries, and procrastination was higher in Poland (Lithuania: $M = 2.73$, $SD = .61$, $p = .009$; Poland: $M = 2.95$, $SD = .84$, $p = .009$). No significant differences were exhibited by organisations occupying an intermediate position in terms of status, although the level of procrastination was lower in both countries in this case. The lowest level of procrastination was found among enterprises that had declared that they operated in accordance with CSR requirements and had certificates confirming this fact (Lithuania: $M = 2.47$, $SD = .56$ and Poland: $M = 2.65$, $SD = .61$, $p = .009$) (Table 2).

Table 2. General procrastination with regard to different CSR statuses

The organisation's CSR status	LT=175		PL=112		Student t	
	Mean	SD	Mean	SD	t	p
Not seeking to implement CSR	2.73	0.61	2.95	0.84	-2.629	0.009**
Seeking to implement CSR	2.66	0.61	2.61	0.64	0.623	0.534
CSR organisations	2.47	0.56	2.65	0.61	-3.150	0.002**

Source: own elaboration

Although UPS mean scores were lower in Poland than in Lithuania ($M = 2.71$, $SD = 1.06$, $p = .116$), the difference is not sufficiently large to be considered nonaccidental. In general, an emerging trend should

be noted, according to which the means of procrastination as measured by three scales (IPS, UPS and STS) were slightly lower in the case of Poland, but these differences were also not statistically significant (Table 3).

Table 3. Employee procrastination in Lithuanian and Polish organisations that do not seek to implement CSR

Scales	LT=175		PL=112		Student t	
	Mean	SD	Mean	SD	t	p
Irrational Procrastination Scale (IPS)	3.12	0.70	3.00	1.10	1.022	0.308
Unintentional Procrastination Scale (UPS)	2.89	0.80	2.71	1.06	1.577	0.116
Susceptibility to Temptation Scale (STS)	3.11	0.78	3.09	0.90	0.222	0.825

Source: own elaboration

The results of the t test shown in Table 4 indicate that the difference between the means of unintentional and general procrastination is statistically significant. That is, the mean

of unintentional procrastination is higher in Lithuania ($M = 2.62$, $SD = .76$, $p < .001$), while the mean of general procrastination is higher in Poland ($M = 2.65$, $SD = .61$, $p = .002$).

Table 4. Employee procrastination in socially responsible Lithuanian and Polish organisations

Scales	LT=214		PL=211		Student t	
	Mean	SD	Mean	SD	t	p
Irrational Procrastination Scale (IPS)	2.88	0.76	2.48	0.85	5.141	0.0001**
Unintentional Procrastination Scale (UPS)	2.62	0.76	2.30	1.01	3.761	0.0001**
Susceptibility to Temptation Scale (STS)	2.86	0.75	2.81	0.91	0.705	0.481

Source: own elaboration

The comparison of the GPS results of organisations that do not pursue CSR and those that already have this status shows that, in general, the level of procrastination changes alongside the social responsibility of organisations. No statistically significant differences were found between the two

countries regardless of the organisation's status in terms of CSR. For example, susceptibility to temptation among companies not pursuing CSR was higher in Lithuania ($M = 3.11$, $SD = .78$) than in Poland ($M = 3.09$, $SD = .90$); however, these differences were accidental ($p = .825$) (Table 5).

Table 5. Susceptibility to temptation with regard to organisations' different CSR statuses

The organisation's CSR status	LT=175		PL=112		Student t	
	Mean	SD	Mean	SD	t	p
Not seeking to implement CSR	3.11	0.78	3.09	0.90	0.222	0.825
Seeking to implement CSR	2.98	0.84	3.07	0.77	-0.978	0.329
CSR organisations	2.86	0.75	2.81	0.91	0.705	0.481

Source: own elaboration

Analysing the situation of different groups of Polish and Lithuanian companies, the positive Z indicators shown in Table 6 are marked in pink and indicate a relatively poor situation with respect to procrastination. In the case of Poland, $z > 0.25$ was generally established only when measuring procrastination on the GPS among those working in the companies that did not seek CSR; in contrast, in

the case of Lithuania, a relatively good situation was found in companies that were socially responsible. Meanwhile, only in Lithuania was the situation worse with regard to irrational procrastination found among employees of companies that were either seeking or not seeking CSR and with regard to unintentional procrastination among employees of companies that were not seeking CSR (Table 6).

Table 6. Procrastination in organisations with different CSR statuses

Scales	Poland			Lithuania		
	Seeking to implement CSR	CSR	Not seeking to implement CSR	Seeking to implement CSR	CSR	Not seeking to implement CSR
IPS	-0.31	-0.38	0.22	0.26	0.09	0.36
UPS	-0.18	-0.32	0.13	0.15	0.04	0.33
STS	0.13	-0.20	0.14	0.01	-0.13	0.17
GPS	-0.07	0.00	0.46	0.01	-0.28	0.11

Statistical outliers

$z > 0.25$	
$z < -0.25$	

Source: own elaboration

4. Discussion

In this study, employee procrastination was tested in two countries that exhibit certain historical and cultural commonalities as well as several differences that emerge based on Hofstede’s (1991; 2011) classification. Unlike previous studies of a similar type (e.g. Chen et al., 2019; Jamali et al., 2020; Klassen et al., 2010; Kucharska and Kowalczyk, 2019), types of procrastination were investigated and measured on different scales that take the ways in which they are manifested into account depending on the status of companies with regard to CSR. The research results show that in companies without CSR status, the level of general procrastination was higher in Poland, whose national culture is similar to Lithuania in terms of

individualism but is also characterised by stronger masculinity and greater power distance. Indirectly, this finding agrees with the results reported by Klassen et al. (2010). Although their study was conducted in an academic setting and tested the influence of collectivism and individualism on procrastination, higher procrastination was evident in Canada, where power distance was lower than in Singapore. Since individualism is almost the same in Lithuania and Poland, our study shows that power distance is another factor that should be taken into account when analysing the reasons for procrastination. In countries that distinguish themselves by exhibiting high power distance, individualism and masculinity, enterprises care less about their employees and communality (Thanetsunthorn, 2015), and

employees experience more tension when interacting with their managers (Metin et al., 2016); therefore, work can be postponed for reasons other than the fact that individuals themselves tend to procrastinate on tasks unintentionally. Furthermore, in our study, CSR practices were associated with lower levels of procrastination regardless of the country in which companies operated. This finding suggests that the implementation of CSR practices is another important factor that can mitigate procrastination, although certain differences remain ($p = .009$). Although some research has shown that the influences of power distance, individualism and masculinity are not significant with respect to the development of CSR itself (Halkos and Skouloudis, 2017), Peng et al. (2014) found that power distance and masculinity negatively affected CSR. Interestingly, differences among countries levelled off ($p = .534$) in enterprises that occupied an intermediate position, that is, in enterprises that made efforts to obtain CSR certification. Sendlhofer's (2020) study demonstrated that employees usually engage in CSR activities but that their commitment does not have a significant impact on careers and salaries, which is why they tend to withdraw and exhibit "normalising and routinising" models. In other words, during the introductory stage, greater effort may be mobilised, and more hope can be held, the decline of which leads to procrastination (Gadosey et al., 2021).

As expected, the test of unintentional procrastination indicated no significant differences between the two countries. This finding confirms that unintentional procrastination refers to unconscious behaviour that is usually dysfunctional and unrelated to active decisions to postpone tasks (Bennett and Bacon, 2019; Li et al., 2022). In this case, it cannot be claimed that external pressure and masculinity that encourages competition and a greater focus on goals (Hofstede, 1991) could cause people to be

less likely to irrationally postpone tasks. As shown in a study conducted by Svartdal et al. (2016), the country's individualism score may influence interpretations of delay and timeliness-related elements of decision-making. The aforementioned study involved six countries that differed in terms of individualism scores, which were surveyed using the Pure Procrastination and Unintentional Procrastination scales. Meanwhile, individualism scores do not differ between Lithuania and Poland (60 points). Using the General Procrastination Scale, our research revealed differences ($p = .002$) that were not shown by the Unintentional Procrastination scale or other scales. Thus, a similar individualism score across countries may be one condition that makes the General Procrastination Scale better suited to this context.

Since CSR implements practices that change the corporate culture, which differs from the national culture (Jamali et al., 2020; Radovanović et al., 2022), we assumed that we would find no significant differences with regard to procrastination in the companies that had declared CSR. Only the Susceptibility to Temptation Scale did not indicate such differences ($p = .481$), while the scores of the Irrational and Unintentional Procrastination scales in both cases were higher in Lithuania. It should be noted that the test of general procrastination yielded the opposite results, although Steel's (2010) meta-analysis showed that the General and Irrational Procrastination scales were functionally equivalent. However, this study did not consider the cultural peculiarities of the populations. In addition, for example, the Irrational Procrastination Scale is sensitive to gender differences, as male participation results in higher procrastination indicators (Shaw, Zhang, 2021), while the proportions of participants by gender in the study were unequal, which could have influenced the results. On the other hand, the assumption that susceptibility to temptation does not

differ between the two countries regardless of CSR status was confirmed. This finding shows that impulsivity and susceptibility to temptation, as measured by the Susceptibility to Temptation Scale (Steel, 2010), remain similar. Unfortunately, we were not able to compare these results with those of other studies, but in this context of susceptibility to temptation, the insights of Chen et al. (2014) are rather interesting. The authors compared susceptibility to unfair treatment between students in the US (individualism) and China. Chinese society, which is collectivist, is more strongly characterised by efforts to preserve one's "public" face, and students succumb to temptation more easily in an environment in which they are not being observed. The authors drew attention to the role of religion, highlighting the moral influence of Christianity in the fight against temptations. In addition, Milyavskaya et al. (2015) found that motivation reduced impulsive susceptibility to temptation and contributed to self-regulation. As previously noted, the societies of Lithuania and Poland share the same strong religious traditions, which could have influenced their similar reactions to temptations. Of course, these assumptions seem to be speculative, but they can serve as an incentive for further research that can include the effect of different religions.

In addition to the limited possibility of comparing results, this study did not investigate the cultural traits exhibited by individual organisations separately. As previously noted, when introducing CSR practices, a targeted selection of employees with certain features may be performed; therefore, in other studies, the situations in individual enterprises could be compared. Furthermore, testing of homogeneous samples with regard to gender should be performed. Although this task was not accomplished in our study, that fact does not diminish the value of the knowledge we obtained. In previous studies, procrastination

has usually been measured in cultures that differ in terms of their collectivism and individualism scores, whereas in this study, individualism is a characteristic of both Polish and Lithuanian cultures. Therefore, in the future, the interaction of this feature with other aspects of organisations should be investigated in more detail. Since the study was based on self-awareness tests, new knowledge could be provided through the use of mixed research methods.

Conclusions

Although the implementation of CSR practices is related to less frequent employee procrastination regardless of the prevailing features of the national culture, several reservations were recorded. Employee susceptibility to temptation can remain similar in cultures that differ in terms of power distance, masculinity, and femininity. This finding shows that external pressure and a focus on goals that are typical of masculine cultures are not necessarily the determining factor in this context. In addition, the Irrational and Unintentional Procrastination scales indicated opposite results than the General Procrastination scale. Procrastination is a multidimensional phenomenon; therefore, when studying it across different cultures, it makes sense to use several scales to take into account the different reasons why employees do not focus on tasks equally.

The results of this research indicate that the level of procrastination exhibited by the employees of Polish and Lithuanian organisations depends on the status of the company's corporate social responsibility. These findings may be useful for shareholders and managers of organisations who seek ways of reducing workplace procrastination and offer new guidelines for cross-cultural research on procrastination that takes into account the peculiarities created by CSR practices. The results of this research can serve

as a scientific basis for the development of theory regarding the effect of CSR in organisations on the procrastination of its employees and constitute a reference point for the development of practical measures aimed at eliminating employee procrastination in organisations by increasing the level of their CSR. In addition, the findings of this research encourage us to focus not only on differences among countries but also on the common features that are characteristic of individual cultures.

References

- Aftab, J., Sarwar, H., Amin, A., Kiran, A. (2022), Does CSR mediate the nexus of ethical leadership and employee's job performance? Evidence from North Italy SMEs. *Social Responsibility Journal*, 18(1), 154-177. DOI:10.1108/SRJ-09-2020-0393.
- Agudelo, L. M. A., Jóhannsdóttir, L., Davídsdóttir, B. (2019), A literature review of the history and evolution of corporate social responsibility. *International Journal of Corporate Social Responsibility*, 4(1). DOI:10.1186/s40991-018-0039-y.
- Azim, M. (2016), Corporate Social Responsibility and employee behavior: mediating role of organizational commitment. *Review of Business Management*, 18, 207-225. DOI:10.7819/rbgn.v18i60.2319.
- Bennett, C., Bacon, A. M. (2019), At long last – A reinforcement sensitivity theory explanation of procrastination. *Journal of Individual Differences*, 40(4), 234-241. DOI:10.1027/1614-0001/a000296.
- Chen, J., Tang, T. L. P., Tang, N. (2014), Temptation, Monetary Intelligence (Love of Money), and Environmental Context on Unethical Intentions and Cheating. *Journal of Business Ethics*, 123, 197-219. DOI:10.1007/s10551-013-1783-2.
- Chen, Z. F., Hong, C., Occa, A. (2019), How different CSR dimensions impact organization-employee relationships: The moderating role of CSR-culture fit. *Corporate Communications: An International Journal*, 24(1), 63-78. DOI: 10.1108/CCIJ-07-2018-0078.
- Dabić, M., Tipurić, D., Podrug, N. (2015), Cultural differences affecting decision-making style: a comparative study between four countries. *Journal of Business Economics and Management*, 16(2), 275-289. DOI:10.3846/16111699.2013.859172.
- Dempsey, J. (2015), Moral Responsibility, Shared Values, and Corporate Culture. *Business Ethics Quarterly*, 25(3), 319-340. DOI:10.1017/beq.2015.31.
- Farouk, S., Jabeen, F. (2018), Ethical climate, corporate social responsibility, and organizational performance: evidence from the UAE public sector. *Social Responsibility Journal*, 14(4), 737-752. DOI:10.1108/SRJ-01-2017-0002.
- Fernie, B. A., Bharucha, Z., Nikčević, A. V., Spada, M. M. (2017), The Unintentional Procrastination Scale. *Journal of Rational-Emotive & Cognitive-Behavior Therapy*, 35, 136-149. DOI:10.1007/s10942-016-0247-x.
- Ferrari, J. R., Díaz-Morales, J. F. (2007), Procrastination: Different time orientations reflect different motives. *Journal of Research in Personality*, 41(3), 707-714. DOI:10.1016/j.jrp.2006.06.006.
- Ferrari, J. R., Tice, D. M. (2000), Procrastination as a self-handicap for men and women: A task-avoidance strategy in a laboratory setting. *Journal of Research in Personality*, 34(1), 73-83. DOI:10.1006/jrpe.1999.2261.
- Franz, I. (2020), Unintentional procrastination, self control, and academic achievements. *Education Economics*, 28(5), 508-525. DOI:10.1080/09645292.2020.1801596.
- Gadosey, C., K., Schnettler, T., Scheunemann, A., Fries, S., Grunschel, C. (2021), The intraindividual co-occurrence of anxiety and hope in procrastination episodes during exam preparations: An experience sampling study. *Learning and Individual Differences*, 88, 102013. DOI:10.1016/j.lindif.2021.102013.
- Grund, A., Fries, S. (2018), Understanding procrastination: A motivational approach. *Personality and Individual Differences*, 121(1), 120-130. DOI:10.1016/j.paid.2017.09.035.

- Gu, X., Xu, G., Qian, C., Chang, S., Deng, D. (2022), Excess and Defect: How Job-Family Responsibilities Congruence Effect the Employee Procrastination Behavior. *Psychology Research and Behavior Management*, 7(15), 1465-1480. DOI:10.2147/PRBM.S365079.
- Gupta, R., Hershey, D.A., Gaur, J. (2012), Time perspective and procrastination in the workplace: an empirical investigation. *Current Psychology*, 31(2), 195-211. DOI:10.1007/s12144-012-9136-3.
- Halkos, G., Skouloudis, A. (2017). Revisiting the relationship between corporate social responsibility and national culture: A quantitative assessment. *Management Decision*, 55(3), 595-613. DOI:10.1108/MD-12-2016-0868.
- He, Q., Wu, M.Y., Wu, W.H., Fu, J.T. (2021), The Effect of Abusive Supervision on Employees' Work Procrastination Behavior. *Frontiers in Psychology*, 12, Article Number 596704. DOI:10.3389/fpsyg.2021.596704.
- Hen, M., Goroshit, M., Viengarten, S. (2021), How decisional and general procrastination relate to procrastination at work: An investigation of office and non-office workers. *Personality and Individual Differences*, 172, 110581. DOI:10.1016/j.paid.2020.110581.
- Hofstede Insights, Country comparison. Retrieved from: www.hofstede-insights.com (accessed: 19.10.2022).
- Hofstede, G. (1991), *Cultures and organizations: Software of the mind*. London: McGraw-Hill.
- Hofstede, G. (2011), Dimensionalizing Cultures: The Hofstede Model in Context. *Online Readings in Psychology and Culture*, Unit 2. Retrieved from <http://scholarworks.gvsu.edu/orpc/vol2/iss1/8> (accessed: 18.10.2022).
- Huang, Q.F., Zhang, K.L., Huang, Y.F., Bodla, A.A., Zou, X. (2023), The Interactive Effect of Stressor Appraisals and Personal Traits on Employees' Procrastination Behavior: The Conservation of Resources Perspective. *Psychology Research and Behavior Management*, 16, 781-800. DOI: 10.2147/PRBM.S399406.
- Jamali, D., Samara, G., Zollo, L., Ciappei, C. (2020), Is internal CSR really less impactful in individualist and masculine Cultures? A multilevel approach. *Management Decision*, 58(2), 362-375. DOI:10.1108/MD-11-2018-1260.
- Jia, Y., Yan, J., Liu, T., Huang, J. (2019), How Does Internal and External CSR Affect Employees' Work Engagement? Exploring Multiple Mediation Mechanisms and Boundary Conditions. *International Journal of Environmental Research and Public Health*, 16(14), 2476. DOI:10.3390/ijerph16142476.
- Klassen, R. M., Ang, R. P., Chong, W. H., Krawchuk, L. L., Huan, V. S., Wong, I. Y. F., Yeo, L. S. (2010), Academic Procrastination in Two Settings: Motivation Correlates, Behavioral Patterns, and Negative Impact of Procrastination in Canada and Singapore. *Applied Psychology*, 59(3), 361-379. DOI:10.1111/j.1464-0597.2009.00394.x.
- Kose, A. G., Metin, U. B. (2018), Linking leadership style and workplace procrastination: The role of organizational citizenship behavior and turnover intention. *Journal of Prevention and Intervention in the Community*, 46(3), 245-262. DOI:10.1080/10852352.2018.1470369A.
- Krause, K., Freund, A. M. (2014), How to beat procrastination: The role of goal focus. *European Psychologist*, 19(2), 132. DOI:10.1027/1016-9040/a000153.
- Kucharska, W., Kowalczyk, R. (2019), How to achieve sustainability? – Employee's point of view on company's culture and CSR practice. *Corporate Social Responsibility and Environmental Management*, 26(2), 453-467. DOI:10.1002/csr.1696.
- Kühnel, J., Bledow, R., Kuonath, A. (2022), Overcoming Procrastination: Time Pressure and Positive Affect as Compensatory Routes to Action. *Journal of Business and Psychology*. DOI:10.1007/s10869-022-09817-z.
- Kurtovic, A., Vrdoljak, G., Idzanovic, A. (2019), Predicting procrastination: The role of academic achievement, self-efficacy and perfectionism. *International Journal of Educational Psychology*, 8(1), 1-26. DOI:10.17583/ijep.2019.299.
- Lay, C. (1986), At last, my research article on procrastination. *Journal of Research in Personality*, 20(4), 474-495. DOI:10.1016/0092-6566(86)90127-3.

- Li, X., Zhou, M., Zhang, X. (2022), Rational and Irrational Beliefs in Understanding Academic Procrastination. *The Journal of Genetic Psychology*, 183(1), 23-39. DOI:10.1080/00221325.2021.1997895.
- Metin, U. B., Taris, T. W., Peeters, M. C. W. (2016), Measuring procrastination at work and its associated workplace aspects. *Personality and Individual Differences*, 101, 254-263. DOI: 10.1016/j.paid.2016.06.006.
- Milyavskaya, M., Inzlicht, M., Hope, N., Koestner, R. (2015), Saying "no" to temptation: Want-to motivation improves self-regulation by reducing temptation rather than by increasing self-control. *Journal of Personality and Social Psychology*, 109(4), 677-693. DOI:10.1037/pspp0000045.
- Nguyen, B., Steel, P., Ferrari, J.R. (2013), Procrastination's Impact in the Workplace and the Workplace's Impact on Procrastination. *International Journal of Selection and Assessment*, 21(4), 388-399. DOI:10.1111/ijsa.12048.
- Onkila, T., Sarna, B. (2022), A systematic literature review on employee relations with CSR: State of art and future research agenda. *Corporate Social Responsibility and Environmental Management*, 29(2), 435- 447. DOI:10.1002/csr.2210.
- Pasricha, P., Singh, B., Verma, P. (2018), Ethical leadership, organic organizational cultures, and corporate social responsibility: an empirical study in social enterprises. *Journal of Business Ethics*, 151(4), 941-958. DOI:10.1007/s10551-017-3568-5.
- Pearlman-Avnion, S., Zibenberg, A. (2018), Prediction and job-related outcomes of procrastination in the workplace. *Journal of Prevention & Intervention in the Community*, 46(3), 263-278. DOI:10.1080/10852352.2018.1470418.
- Peng, A. Y. S., Dashdeleg, A. U., Chih, H. L. (2014), National Culture and Firm's CSR Engagement: A Cross-Nation Study. *Journal of Marketing & Management*, 5(1), 38-49.
- Prem, R., Scheel, T. E., Weigelt, O., Hoffmann, K., Korunka, C. (2018), Procrastination in daily working life: A diary study on within-person processes that link work characteristics to workplace procrastination. *Frontiers in Psychology*, 9, 1087. DOI:10.3389/fpsyg.2018.01087.
- Radovanović, G., Miletić, L., Karović, S., Mijatović, M. D., Bubulj, M. (2022), Influence of National Culture in Companies with Different Ownership on Employees' CSR Perception in a Developing Country: The Case of Serbia. *Sustainability*, 14(4), 2226. DOI:10.3390/su14042226.
- Rapp, A. A., Bachrach, D. G., Rapp, T. L. (2013), The influence of time management skill on the curvilinear relationship between organizational citizenship behavior and task performance. *Journal of Applied Psychology*, 98(4), 668-677. DOI:10.1037/a0031733.
- Sendlhofer, T. (2020), Decoupling from Moral Responsibility for CSR: Employees' Visionary Procrastination at a SME. *Journal of Business Ethics*, 167, 361-378. DOI:10.1007/s10551-019-04174-z.
- Shaw, A., Zhang, J. J. (2021), A Rasch Analysis of the Irrational Procrastination Scale (IPS). *Frontiers in Psychology*, 11, 615341. DOI:10.3389/fpsyg.2020.615341.
- Shin, J., Adam M. Grant, A. M. (2021), When Putting Work Off Pays Off: The Curvilinear Relationship between Procrastination and Creativity. *Academy of Management Journal*, 64(3). DOI:10.5465/amj.2018.1471.
- Song, Z. J., Gull, N., Asghar, M., Sarfraz, M., Shi, R., Rafique, M. A. (2022), Polychronicity, Time Perspective, and Procrastination Behavior at the Workplace: An Empirical Study. *Anales de Psicologia*, 38(1), 355-364. DOI:10.6018/analesps.427401.
- Spada, M. M., Hiou, K., Nikcevic, A. V. (2006), Metacognitions, emotions, and procrastination. *Journal of Cognitive Psychotherapy*, 20(3), 319-326. DOI:10.1891/jcop.20.3.319.
- Steel, P. (2010), Arousal, avoidant and decisional procrastinators: Do they exist? *Personality and Individual Differences*, 48(8), 926-934. DOI:10.1016/j.paid.2010.02.025.
- Steel, P., Svartdal, F., Thundiyil, T., Brothen, T. (2018), Examining Procrastination Across Multiple Goal Stages: A Longitudinal Study of Temporal Motivation Theory. *Frontiers in Psychology*, 9, 327. DOI:10.3389/fpsyg.2018.00327.

- Stöber, J., Joormann, J. (2001), Worry, procrastination, and perfectionism: Differentiating amount of worry, pathological worry, anxiety, and depression. *Cognitive Therapy and Research*, 25(1), 49-60. DOI:10.1023/A:1026474715384.
- Svartdal, F., Pfuhl, G., Nordby, K., Foschi, G., Klingsieck, K. B., Rozental, A., Carlbring, P., Lindblom-Ylänne, S., Rębkowska, K. (2016), On the Measurement of Procrastination: Comparing Two Scales in Six European Countries. *Frontiers in Psychology*, 7, 1307. DOI:10.3389/fpsyg.2016.01307.
- Thanetsunthorn, N. (2015), The impact of national culture on corporate social responsibility: evidence from cross-regional comparison. *Asian Journal of Business Ethics*, 4, 35-56. DOI:10.1007/s13520-015-0042-2.
- Unda-López, A., Osejo-Taco, G., Vinueza-Cabezas, A., Paz, C., Hidalgo-Andrade, P. (2022), Procrastination during the COVID-19 Pandemic: A Scoping Review. *Behavioral Sciences*, 12(2), 38. DOI:10.3390/bs12020038.
- Uysal, H.T., Yilmaz, F. (2020), Procrastination in the workplace: The role of hierarchical career plateau. *Upravlenets-The Manager*, 11(3), 82-101. DOI:10.29141/2218-5003-2020-11-3-7.
- Vveinhardt, J., Sroka, W. (2022), What determines employee procrastination and multitasking in the workplace: personal qualities or mismanagement?. *Journal of Business Economics and Management*, 23(3), 532-550. DOI:10.3846/jbem.2022.16178.
- Zabelina, E., Chestyunina Y., Trushina, I., Vedeneyeva, E. (2018), Time Perspective as a Predictor of Procrastination. *Procedia – Social and Behavioral Sciences*, 238, 87-93. DOI:10.1016/j.sbspro.2018.03.011.

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Bibliometric Analysis of the Global Research Landscape on Healthcare Resilience During Critical Events

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Abstract

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Over the past decade, natural and human-caused disasters have increased in frequency and intensity, resulting in significant human losses and the widespread deterioration of health. These critical events threaten the healthcare sector, making it challenging to operate safely and continuously. This paper aims to review and assess the international scientific landscape on healthcare resilience during critical events. The research was based on scientific documents published in high-quality scientific journals indexed in the Scopus database. The search for relevant documents was conducted by using the keywords 'critical events, healthcare, and resilience' in the titles, abstracts, and keywords of the articles. The research sample comprises 720 publications in the fields of medicine, psychology, nursing, and health. The study period covers 2000-2023 (to 1 June 2023). This study followed a logical sequence to achieve its research goal. The first stage involved searching for, collecting, and pre-processing relevant articles. Next, various bibliometric techniques were used to analyse and visualise the findings. The bibliometric analysis involved the biblioshiny and VOSviewer 1.6.16 software toolkit and Scopus analytical tools. In the third stage, the results were integrated, and directions for future research were discussed. The bibliometric analysis reveals a growing trend in research on healthcare resilience during critical events. The findings determined that the key themes in the analysed scope of scientific literature are resilience, climate change, and emerging research areas. Furthermore, the research emphasises the need for further investigation into strengthening healthcare resilience during human-caused critical events such as crime, terrorism, wars, and cyber-attacks, which have been on the rise. The theoretical implications of the paper contribute to understanding the patterns and developments in the scientific literature, while the practical implications offer guidance for conducting bibliometric analyses and insights for future research. It should be noted that the

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findings of this study are limited to data from the Scopus database; future studies should incorporate a broader range of data sources for a more comprehensive analysis.

Key words

healthcare resilience, biblioshiny, bibliometric analysis, critical events, scientific output.

Introduction

Natural (floods, earthquakes, storms, hurricanes, etc.) and human-caused (crime, terrorism, wars, cyber-attacks, etc.) disasters have been steadily rising, displaying an upward trend in frequency and intensity over the last decade. Intense urban development has resulted in the rise of the frequency and severity of climate change, extreme weather events and natural hazards (Zhang et al., 2023; Kwilinski et al., 2023; Kuzior et al., 2022). This phenomenon has been demonstrated to negatively impact vital infrastructure systems such as water and sewage treatment, transportation, and power supply (Murray and Ebi, 2012; Kwilinski et al., 2023; Pimonenko et al., 2015). Meanwhile, the rush of medical technologies makes healthcare more dependent on the energy sector (Ziabina et al., 2021; Dzwigol et al., 2023; Ziabina et al., 2023; Coban et al., 2023; Kotowicz et al., 2022; Us et al., 2021; Drożdż et al., 2021; Lyulyov et al., 2021). In this view, considering the vulnerability of the healthcare sector to interruptions in the energy system (Polcyn et al., 2022; Kharazishvili et al., 2021; Gavkalova et al., 2022), climate change, extreme weather events, and natural hazards endanger (Hussain et al., 2021; Pimonenko et al., 2017) the ability of healthcare to operate safely and continuously (Klinger et al., 2014).

It stands to reason that the energy crisis provokes disruptions in the pharmaceutical industry supply chain (Kostyrko et al., 2021; Lyulyov et al., 2021; Miśkiewicz et al., 2021; Dzwigol et al., 2023; Melnychenko et al., 2021; Kwilinski et al., 2023; Miśkiewicz, 2020). Moreover, the Russian war against Ukraine has intensified the global energy crisis and

dramatically increased energy costs. The above has created the risk of power cuts that may make it impossible to produce active pharmaceutical ingredients and medicines locally. The soaring costs of energy, labour and raw materials in other regions can also impact drugmakers as they navigate the balance between securing their supply chains and maximising profits (Kuzior et al., 2021; Miśkiewicz, 2022; Kwilinski et al., 2023; Miśkiewicz, 2018). This leads pharmaceutical companies to reassess their strategies and potentially make adjustments to maintain profitability while ensuring a reliable supply of medicines (Dukart et al., 2022).

Owing to the COVID-19 pandemic, national governments have allocated significant funds to vaccination programs, strengthening healthcare infrastructure and staffing (Smilianov et al., 2020; Lyulyov and Moskalenko, 2020). However, the global economic slowdown has disrupted their plans to maintain or increase spending in order to address non-COVID healthcare backlogs and staffing issues (EIU, 2022). According to the EIU (2022), total healthcare spending (in both the public and private sectors) is predicted to increase by 4.9% in nominal US dollar terms in 2023. However, considering inflation, spending would decline in real terms. Consequently, healthcare providers must inevitably reconsider service provision, potentially reducing non-essential services and increasing waiting lists. OECD data suggests that preventive care and pharmaceuticals were most affected by spending cuts following the global financial crisis of 2008-09, and

a similar pattern is anticipated (Kirigia et al., 2011). Despite this, recruiting and retaining healthcare personnel will prove challenging as wages also decrease in real terms.

Critical events often result in human losses and deterioration of health requiring immediate and adequate medical care. Overall, healthcare institutions and emergency services must cope with the abrupt inflow of patients during external critical events, which expose the entire system to the risk of collapse (Arefieva et al., 2021). However, the healthcare sector faces criticism due to its high cost and poor performance, with particular concerns surrounding hospital emergency departments. These departments are grappling with limited resources while experiencing a growing influx of patients. Previous research indicates that most emergency departments would struggle to cope with the demands in the event of a major disaster, and even under normal circumstances, some departments are already operating near maximum capacity (Xiao et al., 2012). In this view, the critical events prove the unpreparedness of the healthcare sector for such a burden and the slowness of the response to emergencies. Thus, there is an urgent need to strengthen healthcare resilience and encourage the health workforce as an integral part of any sustainable healthcare system (Durand-Moreau, 2022).

The abovementioned factors have shown that the healthcare sector faces different challenges resulting from critical events, whether natural, biological, or human-caused. In turn, the preliminary analysis of the scientific treatises has revealed a theoretical gap, namely the absence of comprehensive research on healthcare resilience during critical events.

The aim of this paper is to review and assess the international scope of scientific literature addressing healthcare resilience during critical events. The initial data were retrieved from the Scopus database, which is considered to be the largest multi-disciplinary database. The publications search was run using the keywords ‘critical events, healthcare,

and resilience’ in the titles, abstracts, and keywords of articles. Since the critical events could be defined differently (e.g. extreme events), the search of publications does not specify the type of such events. The study provides quantitative and qualitative insights into the general landscape of the theory addressing healthcare resilience to critical events to elaborate on the meaningful overview of academic interest in developing the theory of healthcare resilience during critical events. The study makes theoretical contributions by identifying directions for future research into developing healthcare resilience during critical events.

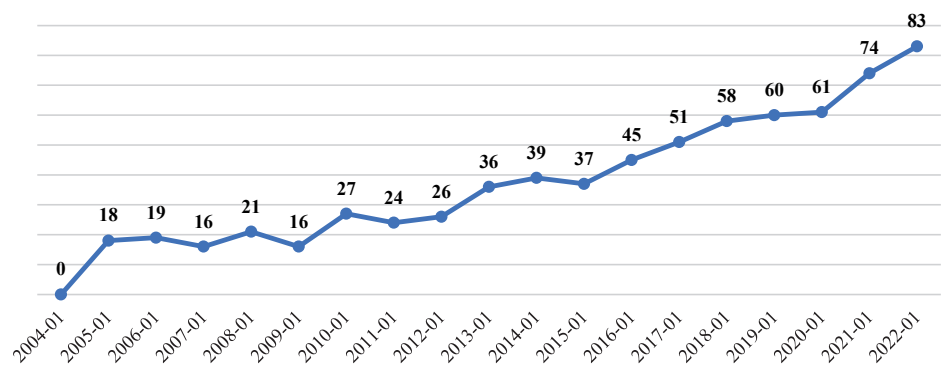
The structure of this paper is as follows: the introduction presents the research problem and the necessity of analysing the scope of scientific literature addressing healthcare resilience during critical events; the literature review section displays the preliminary findings of the scientific literature analysis on the investigated topic; the methodology section provides the material and methods involved in this study for achieving the research aim; the research results section refers to the results of bibliometric analysis; and the concluding section discusses the related conclusions and suggests directions for further research.

1. Literature review

The analysis of web research shows that web searches for ‘resilience’ in healthcare by global netizens increased by 4.2 times in January 2023 when compared to January 2005 (Figure 1). At the same time, netizens were mostly interested in searching for information on stress resilience, resilience health, mental resilience, emotional resilience, resilience care, building resilience, coping, etc. Considering the general web search requests over the last five years (2018-2023), the summary shows that the topics of climate resilience, stress resilience, mental resilience, business resilience, emotional

resilience, community resilience, cyber resilience, and disaster resilience are gaining popularity in the global web environment (Google Trends, 2023).

Figure 1. The dynamics of web searches for ‘resilience’ in healthcare (January 2005-2023)



Source: developed by the authors using the Google Trends web tool

According to the Google Books Ngram Viewer data (2023), the term ‘resilience’ in English literature came into use at the beginning of the 17th century. ‘Resilience’ originates from the Latin verb ‘resilire’, which means to “rebound or recoil” (Zhong et al., 2014). It refers to the inherent processes and capacities that empower the subject (individuals, technical or natural systems) to successfully overcome, withstand, adapt to, and recover from profound crises (Southwick et al., 2014). It encompasses the ability to bounce back, restore functionality, and thrive in the face of adversity. Resilience involves a dynamic interplay between various factors, including psychological, social, and organisational elements, and it plays a crucial role in fostering robustness and sustainability in the face of challenges and disruptions (Talubo et al., 2022; Pasquinelli and Sjöholm, 2015).

A review of the scientific literature shows that the term ‘resilience’ is used in various disciplines (Kuzior et al., 2021; Chen et al., 2022; Abazo, 2021; Dong et al., 2022; Dzwigol, 2020; Guan et al., 2022; Kharazishvili et al., 2022). Werner and Smith (1977) investigated resilience from a psychological point of view, having explored resilience and recovery in

adolescence and adulthood under the influence of perinatal stress and the quality of the family atmosphere. In an ecological context, resilience is acknowledged as the capacity to persist and endure in the face of change (Holling, 1973). In turn, Adger (2000) considered the concept of social resilience to refer to the capacity of collectives or societies to effectively deal with external pressures and disruptions stemming from alterations in the realms of society, politics, and the environment. Wiig et al. (2022) pointed out that from the organisational perspective, resilience is presented as the capacity to adapt and embrace change as a base for high-quality levels. Based on the above, it could be stated that resilience pertains to the subject’s flexibility, adaptation, improvisation, response, and adjustment to different critical events (Aase et al., 2020).

The international scope of literature presents several recent studies investigating critical events in healthcare (Woloshynowych et al., 2005; Kirigia et al., 2011; Yazdani et al., 2022; Lloyd-Smith, 2020). Achour et al. (2014) revealed three significant challenges encountered by healthcare facilities. Firstly, there is an inherent vulnerability of infrastructure

to natural hazards, which puts healthcare facilities at risk. Secondly, alternative energy sources and supplies for healthcare utilities often exhibit low levels of performance, hindering their ability to ensure uninterrupted services during disruptions. Lastly, there is a lack of adequate consideration of healthcare utility supplies in resilience codes and legislations, which undermines their ability to effectively prepare for and respond to critical events. Cimellaro et al. (2010) have introduced a comprehensive model that seeks to quantitatively assess the resilience of hospital systems in the context of disasters. The model defines resilience as the system's capacity to sustain functionality and effectively recover from losses resulting from extreme events. On the other hand, Kunzler et al. (2020) focused on the resilience of healthcare professionals. The findings showed that resilience training for healthcare professionals has the potential to enhance their resilience and potentially decrease symptoms of depression and stress immediately after completion of the training.

Individuals, communities, or states are not exempt from the influence of critical events or associated losses (Pimonenko and Cebula, 2015; Sokolovska et al., 2020; Su et al., 2023; Tambovceva et al., 2020; Wang et al., 2023; Szczepańska-Woszczyna et al., 2022; Stępień et al., 2023). These can include natural hazards, outbreaks of infectious disease, acts of terrorism, social unrest, or financial crises (Cutter et al., 2013; Kwilinski et al., 2020; Kharazishvili et al., 2020; Kianpour et al., 2021; Kuzior et al., 2022). With temperatures increasing worldwide, more people require emergency medical assistance for various health issues caused by climate change (Humphrey and Dresser, 2023). These include heat exhaustion and heat stroke due to extreme heat, respiratory problems caused by air pollution leading to asthma, and the spread of infectious diseases resulting from flooding and changes in ecosystems, which prompt the relocation of ticks, mosquitoes, and other

pests. News headlines frequently highlight the physical and emotional trauma experienced due to climate-related disasters such as hurricanes, wildfires, tornadoes, and floods.

The consequences of such events can be far-reaching, affecting nations and communities (Chen et al., 2023; Kwilinski et al., 2022; Moskalenko et al., 2022; Nawawi et al., 2022; Panchenko et al., 2021; Pimonenko et al., 2020; Vaničková et al., 2020). As a result, communities and nations as a whole are confronted with challenging decisions encompassing fiscal, social, cultural, and environmental considerations (Cutter et al., 2013; Rui et al., 2019; Wang et al., 2022; Moskalenko et al., 2022; Chen et al., 2021). These decisions aim to safeguard fundamental security and enhance the overall quality of life in the face of hazards, intentional attacks, and disasters.

With reference to the literature on healthcare resilience, Wiig et al. (2022) considered healthcare resilience to be the capacity to ensure the healthcare system is able to adjust to challenges and changes at different levels while supporting high-quality care. According to the definition by the Organisation for Economic Co-operation and Development, health system resilience refers to the capacity of healthcare systems to not only anticipate and prepare for shocks and disruptions but also to mitigate their adverse impacts, recover promptly, and adapt by incorporating lessons learned to enhance efficiency and preparedness (OECD, 2023). In terms of healthcare output, resilience entails sustaining and enhancing the functioning of health system components, including governance, service delivery, resource generation, and financing. The ultimate objective is to ensure the continuity of a health system's goals, particularly in improving population health, even in the face of critical events (EOHSP, 2023). Aase et al. (2020) noted that resilient healthcare relies on the presence of adaptive capacity within the healthcare system. It entails utilising both internal and external

resources to adjust and accommodate the dynamic demands of everyday operations. Examples include adapting care processes in response to variations in demand or time constraints. By effectively addressing challenging issues, resilient healthcare systems are able to sustain high-quality services and ensure continuity of care.

The healthcare sector faces the challenge of coordinating resources during critical events while the demand for healthcare services increases (Miśkiewicz et al., 2022; Xu et al., 2023; Pimonenko et al., 2017; Kwilinski et al., 2022). Here it is noteworthy that resilience offers organisations the opportunity to allocate resources effectively by integrating considerations of both safety and productivity (Henriksen et al., 2008; Pimonenko et al., 2021; Kwilinski et al., 2020). The integrated approach allows organisations to balance the issues of safety and maximising productivity, leading to more efficient and effective operations (Petroye et al., 2020; Kwilinski et al., 2020; Lyulyov et al., 2019). Effective coordination relies on the active collaboration of individuals on the ground, such as hospital staff, to ensure adherence to established procedures. However, the behaviour and stress levels of certain staff members may have exacerbated the situation and posed challenges to the emergency response. In this view, a large stream of literature highlights the crucial impact of management on providing quality-of-care outcomes, including during critical events (Sfantou et al., 2017; Ree et al., 2021; Dzwigol-Barosz and Dzwigol, 2021; Acheampong et al., 2023; Kwilinski and Kuzior, 2020; Yevdokimov et al., 2018). Effective healthcare management is crucial in pre-hospital care in terms of utilising the available resources for timely treatment (Achour et al., 2016; Trzeciak et al., 2022; Saługa et al., 2020; Lyulyov and Shvindina, 2017; Dzwigol, 2021).

Managers of healthcare organisations should be able to promptly gather the necessary information to effectively respond

to critical events; enhance the efficient use of available resources to ensure their effective allocation and utilisation during emergencies; provide healthcare staff members who fulfil their vital roles within the rescue chain and possess the necessary skills and knowledge to respond effectively in emergencies; enhance support for the well-being of healthcare and rescue teams, including addressing their welfare, providing assistance for post-traumatic stress disorder and delivering relevant training; and improve the communication between teams and agencies both before and after a critical event to foster better coordination and collaboration, enabling a more efficient and comprehensive emergency response (Achour et al., 2016; Kwilinski et al., 2021; Prokopenko et al., 2020; Miśkiewicz, 2021; Tih et al., 2016).

Regarding the literature on healthcare resilience, Berg and Aase (2019) mentioned that anticipation, sensemaking, adaptation, and trade-offs are the cognitive and behavioural strategies defining resilience within organisations. Thus, the anticipation strategy involves the capacity of an organisation to foresee and prepare for potential shifts or risks before actualisation. Adaptation strategy entails navigating complexity by modifying actions or behaviour in challenging circumstances, displaying flexibility, and improvising as needed. To effectively adapt to novel situations or demands, it becomes essential to comprehend and make sense of ongoing events. This process is known as sensemaking, which is closely tied to the notion of trade-offs arising when choices must be made between conflicting objectives and tensions.

The abovementioned theoretical findings indicate many studies addressing healthcare resilience during critical events. Therefore, the current research is inclined to conduct a comprehensive bibliometric analysis to review and assess the international scope of scientific literature devoted to healthcare resilience during critical events.

2. Methodology

Using data from the Scopus scientific database, this study examined publications on healthcare resilience during critical events until 1 June 2023. It is worth noting that the Scopus database was chosen as the source of primary data as it is a widely recognised

and influential multi-disciplinary citation database. For instance, the Scopus database contains over 84 million documents and involves approximately 18 million researchers worldwide, affiliated with around 95,000 institutions. It is worth noting that Health Sciences is one of the primary subject areas (23%) (Elsevier, 2022).

Figure 2. Research design

DATA IDENTIFICATION AND COLLECTION <i>using the Scopus toolkit</i>	
DATA COLLECTION	DATA PREPROCESSING
determining the search terms → search in titles, abstracts, and keywords <i>Records identified from Scopus (n = 6831)</i>	adjusting the period of publication and subject areas <i>Records after filtering (n = 720)</i>
DATA ANALYSIS AND VISUALISATION <i>using Biblioshiny and VOSviewer toolkits</i>	
PERFORMANCE ANALYSIS	SCIENCE MAPPING
analysis of publication-related metrics (total number of articles, journals, authors, countries, and affiliations)	Citation analysis, co-authorship analysis, co-citation analysis, and co-word analysis

Source: developed by the authors

Therefore, utilising data from Scopus makes it possible to comprehensively assess the global research output and provide a critical overview of healthcare resilience during critical events (Dzwigol, 2022; Us et al., 2022; Szczepańska-Woszczyzna and Gatnar, 2022). This study applied bibliometrics and knowledge visualisation methods to examine the relationship between articles and keywords, presenting a comprehensive overview of emerging trends and potential research opportunities in the investigated field (Soliman et al., 2021; Dubina et al., 2020; Pimonenko et al., 2021; Letunovska et al., 2021; Us et al., 2020). The research encompassed the analysis of publication dynamics, key research trends, prolific scholars and their collaborations, and the contributions of journals, affiliations, and countries in developing the investigated topic. The primary advantage of employing bibliometric analysis is its ability

to ensure a quantitative and objective literature review, minimising the subjective biases of the authors (Vakulenko et al., 2021; Soliman et al., 2023; Ziabina and Pimonenko, 2020; Bilan et al., 2020). The bibliometric R package and VOSviewer 1.6.16 software toolkit were utilised to conduct the bibliometric analysis. In the initial stage, the analysis involved searching for, collecting, and preprocessing articles relevant to the research topic (Figure 2). Subsequently, various bibliometric techniques were employed to analyse and visualise the findings. Finally, the results were synthesised, and potential directions for future research were discussed.

2.1 Data identification and collection

The research included a comprehensive bibliometric analysis on global scholarly publications focusing on healthcare resilience in coping with critical events. The initial

dataset was obtained from the Scopus interdisciplinary database, most recently accessed on 1 June 2023. The Scopus database was chosen because it covers global scientific journals from various subject areas extensively (Falagas et al., 2008). Table 1 outlines the article search process carried out in several stages.

Table 1. Data collection steps on Scopus

N°	Query	Description	No. of papers
1	TITLE-ABS-KEY	(critical AND event*) AND healthcare AND resilience)	6831
2	PUBYEAR	1999 > PUBYEAR < 2023 (until June)	6807
3	LIMIT-TO SUBJAREA	Medicine AND Psychology AND Nurse AND Health	720

Source: developed by the authors

The search was conducted using the keywords ‘critical events’, ‘healthcare’, and ‘resilience’. Moreover, the Boolean operator ‘AND’ was applied to include all the abovementioned keywords and the combinations thereof. To ensure the inclusion of the most relevant publications, the search results were limited to specific subject fields: 1) medicine, 2) psychology, 3) nursing, and 4) health. The research encompassed publications from 2000 to 2023 (up to June 1). Notably, the initial dataset comprised 6796 publications. However, after applying filter limitations, the number of publications included in the bibliometric analysis amounted to 720 (Table 2).

Table 2. The main information about the filtered dataset

Description	Results
Documents (articles)	720
Single-authored documents	98
Average citation per document	29.48
Average age of documents	5.25
Annual growth rate (%)	119
Sources (Journals, Books, etc.)	438
Authors’ keywords	2071
Authors	3077
Authors of single-authored documents	96
Co-authors per document	4.52
International co-authorship (%)	28.89
Timespan	2000-2023 (to 1 June)

Source: developed by the authors

Following the filtering process, the analysis was conducted on a total sample of 720 articles, comprising 98 single-authored articles and 622 co-authored articles. These articles were derived from 438 different sources. The dataset involved a total of 3077 authors, with 96 authors contributing to single-authored articles. International co-authorship comprised 28.89%. On average, each article has approximately five co-authors. The average age of each document was 5.25 years, while the annual growth rate was 11.9%.

2.2 Science mapping

The intellectual structure of the analysed literature was constructed using a distance-based approach known as co-citation analysis. This method allowed for the visualisation of the collaborative relationships among scholars worldwide, thereby providing insights into the collaboration patterns within the research field. The citation analysis was conducted to detect the most influential articles and delve into the linkages among analysed articles; the co-authorship analysis identified the social interaction among authors worldwide by countries; the co-citation analysis determined the research themes most developed by the authors; and the co-word analysis included the trend analysis of research themes, as well as the analysis of the relationships among themes.

Co-word network analysis and clustering techniques allowed the researchers to define the typologies of themes related to the examined keywords. The study identified distinct themes within the research field by analysing the relationships and co-occurrences among keywords. These themes were represented in a two-dimensional diagram comprising four quadrants based on centrality and density (Corte et al., 2021).

The analysis of the two-dimensional diagram yielded the following interpretations for each quadrant:

1. the upper-right quadrant: this quadrant represents keywords with high centrality and density, indicating their significance and influence in the subject area. These keywords correspond to well-established and significant motor themes within the research field.
2. the upper-left quadrant: keywords in this quadrant exhibit high density but low centrality, suggesting niche themes with limited importance in the broader context of the subject area.
3. the lower-left quadrant: keywords in this quadrant have low centrality and density, indicating emerging or disappearing research-related themes. These keywords represent areas that are currently gaining attention or losing relevance within the research field.
4. the lower-right quadrant: this quadrant comprises keywords with high centrality but low density. These keywords represent primary themes that are fundamental to the studied scientific field. They may serve as foundational concepts or core areas of research.

To construct the thematic map visualising the key themes identified within the scientific scope of the analysed literature, the authors' keyword method was employed as the field of analysis; a total of 250 words were considered in the analysis; clusters with a frequency of at least six words were included in the thematic map; five labels were assigned to each cluster, representing the key themes within that cluster; and the label size for each cluster was set to 0.3, indicating the prominence of the labels within the map.

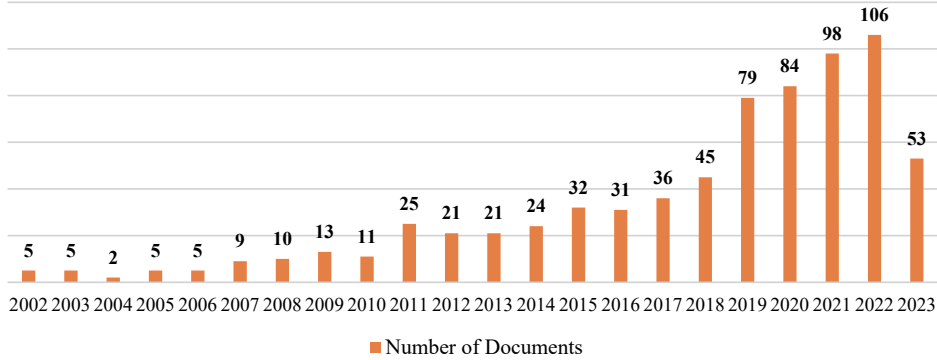
3. Research results

The popularity of investigations on healthcare resilience during critical events continues to grow. Figure 3 demonstrates that the number of documents considered increased by 21.1 times from 2002 to 2023 (up

to June 1). In turn, the analysis of annual scientific production showed no articles on the research topic before 2002 in the Scopus database. It is worth noting the first steep increase in publications analysed in 2011 (by 2.3 times). The analysis of documents published in this period shows that scholars were involved in investigations of the influence of extreme heat on public health (Bi et al., 2011), the risks of extreme weather events on health resilience (Ebi, 2011),

resilience to the impact of climate change under flood mitigation policy (Thomas et al., 2011), resilience in critical occupations (Meadows et al., 2011), etc. Furthermore, the second significant increase in the number of publications analysed was in 2019 (by 1.8 times), caused mostly by the COVID-19 pandemic. Following the formula derived by Shi et al. (2019), the average annual growth rate of publication activity was found to be 24.95 publications per year.

Figure 3. The dynamics of publication activity, 2000-2023 (to 1 June)



Source: developed by the authors

In order to identify the most influential articles in the scope of research on the issues of healthcare resilience in view of critical events, this study detected the most cited articles in the Scopus database. According to Table 3, a study on “Managing the health effects of climate change” by Costello et al. (2009) is considered to be fundamental in exploring the analysed topic (1734 citations

in Scopus). The authors elaborated on the comprehensive analysis to determine the adverse influence of the climate on health. In the study, the authors highlighted the necessity of alleviating poverty and taking climate adaptation measures. Table 3 reveals that the top five most-cited publications mainly cover the issues of stress and climate change in healthcare resilience.

Table 3. Top 10 representative papers, 2000-2023 (to 1 June)

N°	Author(s)/ Year	Title	TC
1	Costello et al., 2009	Managing the health effects of climate change	1734
4	Masten, 2011	Resilience in children threatened by extreme adversity: Frameworks for research, practice, and translational synergy	557
7	Cicchetti, 2010	Resilience under conditions of extreme stress: a multilevel perspective	341
9	Keim, 2008	Building human resilience: the role of public health preparedness and response as an adaptation to climate change	267
10	Gillespie et al., 2009	Risk and resilience: genetic and environmental influences on development of the stress response	264

Note: TC – Total citations

Sources: developed by the authors

According to the Scopus database, the American scholar Kristie L. Ebi has contributed most significantly to developing a scientific treatise on healthcare resilience to critical events (Table 4). However, the publications on healthcare resilience are only 2% of the scholar's total output. On the other hand, the analysis of statistical data showed that on 1 June 2023, the most influential scholars according to the h-index were Kristie L. Ebi (74), George A. Bonanno (71), and Ann S. Masten (70). In turn, the most frequently cited scholars were Ann S. Masten (27,567 citations), George A. Bonanno (26,991 citations), and Kristie L. Ebi (25,521 citations).

In this view, it is appropriate to mention that the scientific interests of Kristie L. Ebi mainly cover heat waves, climate change, carbon, global temperature increases, the urban climate, and resilience. In turn, George A. Bonanno is primarily interested in investigating emotions, cognitive strategies, coping behaviour, and psychological

support. Helen L. Berry devotes her studies primarily to medicine, the social sciences, arts and humanities, environmental science, and nursing. David M. Dunkley investigates psychological issues, including burnout, anxiety, self-determination theory, need satisfaction, etc. In turn, Sari R. Kovats, Ann S. Masten, Geoffrey Gerard Morgan, and Caitlin S. Rublee mainly contributed to the topics of climate change, disaster, post-traumatic stress disorder, terrorist attacks, psychological resilience, mental health, etc. Luca Pietrantoni has significantly contributed to investigating environmental quality, safety climate, occupational stress, personnel, and climate change, while Gabriele Prati studies well-being.

To summarise the areas of interest of researchers, it could be concluded that studies on healthcare resilience are intertwined with various subject areas such as psychology, environmental science, social science, neuroscience, art, humanities, etc.

Table 4. The most influential scholars according to Scopus, 2000-2023 (to 1 June)

N°	Authors	NP/TP	TC	h-index	Country / Affiliation
1	Kristie L. Ebi	7/328	25,521	74	USA / University of Washington
2	George A. Bonanno	6/241	26,991	71	USA / Columbia University
3	Helen L. Berry	4/85	3683	33	Australia / Macquarie University
4	David M. Dunkley	3/42	2583	26	Canada / Université McGill
5	Sari R. Kovats	3/152	15,332	56	UK / London School of Hygiene & Tropical Medicine
6	Ann S. Masten	3/180	27,567	70	USA / University of Minnesota Twin Cities
7	Geoffrey Gerard Morgan	3/143	4563	41	Australia / The University of Sydney School of Public Health
8	Luca Pietrantoni	3/118	3043	28	Italy / Alma Mater Studiorum Università di Bologna
9	Gabriele Prati	3/135	3760	30	Italy / Alma Mater Studiorum Università di Bologna
10	Caitlin S. Rublee	3/22	143	8	USA / Medical College of Wisconsin

Note: NP – Number of papers; TC – Total citations; TP – Total papers.

Sources: developed by the authors based on Scopus data

Table 5 presents the most productive sources indexed in Scopus databases by the number of documents devoted to investigating healthcare resilience during critical events. It is worth mentioning that all journals included herein have a high impact factor (Q1-2), indicating the reliability of the journals. The largest number of documents was published in the Swiss journal ‘International Journal of Environmental Research and Public Health’, which was included in the Scopus database in 2004. Among the sources considered, this journal has the highest h-index (167).

The indicators of the CiteScore rank 2022 show that the most cited journals from 2019 to 2022 were the Dutch journal ‘Safety Science’ and the UK journal ‘Environmental

Research Letters’. The journal ‘Safety Science’ was cited 19,884 times in 1507 documents, while ‘Environmental Research Letters’ noted 33,660 citations from 3321 documents. The journal ‘Safety Science’ is highly ranked, and its papers are in the top 3% in the category of Social Sciences: Safety Research (ranked third of 103) and Medicine: Public Health, Environmental and Occupational Health (16th of 577). The papers of the UK journal ‘Environmental Research Letters’ are in the top 5% in the category of Medicine: Public Health, Environmental and Occupational Health (ranked 29th of 577) and in the top 10% in the category of Environmental Science: General Environmental Science (22nd out of 227).

Table 5. The most productive sources, 2000-2023 (to 1 June)

N°	Source / Country	NP/ TP	h-index	CiteScore 2022	SJR 2022/Q	Publisher	Years in Scopus
1	International Journal of Environ- mental Research and Public Health / Switzerland	42/ 60,669	167	5.4	0.828/2	MDPI	2004- present
2	Environmental Research Letters / UK	34/ 6992	164	10.1	2.119/1	Institute of Physics Publishing	2006- present
3	Risk Analysis / UK	23/ 5128	146	7.8	0.931/1	Wiley-Blackwell	1981- present
4	Safety Science / Netherlands	12/ 5186	140	12.4	1.429/1	Elsevier	1991- present
5	Australian Journal of Emergency Management / Australia	9/ 1161	30	0.8	0.199/2	Australian Institute for Disaster Resilience	1998- present

Notes: NP – Number of papers; TP – Total papers.

Sources: developed by the authors

The results show that 1329 affiliations were involved in investigating healthcare resilience during critical events. Table 6 shows that medicine is the dominant subject area for the 10 most relevant affiliations worldwide by the number of published documents according to the filtered Scopus dataset. Of these, four of the 10 organisations are from the USA (the University of California, Columbia University, the University of Washington, and Harvard Medical School), two from the UK (University College

London and London School of Hygiene and Tropical Medicine), two from Canada (the University of British Columbia and the University of Toronto), one from South Africa (the University of Cape Town), and one from Australia (the University of Sydney). The most prolific affiliation was the University of California; authors affiliated with that institution have published 21 documents on the studied topic. One affiliated institution published around two articles on average from 2000 to 1 June 2023.

Table 6. Most relevant affiliations, 2000-2023 (to 1 June)

N°	Affiliation	NP/TP	No. of authors	Dom. sub. area	Country
1	The University of California	21/239,238	29,109	Medicine	USA
2	University College London	19/262,690	34,805	Medicine	UK
3	Columbia University	18/236,119	34,417	Medicine	USA
4	The University of Washington	18/303,444	54,121	Medicine	USA
5	The University of British Columbia	15/232,762	46,860	Medicine	Canada
6	The University of Cape Town	14/75,768	13,869	Medicine	South Africa
7	Harvard Medical School	13/391,934	47,803	Medicine	USA
8	The University of Toronto	10/381,534	67,663	Medicine	Canada
9	The University of Sydney	11/222,196	27,975	Medicine	Australia
10	London School of Hygiene and Tropical Medicine	11/56,073	6843	Medicine	UK

Sources: developed by the authors

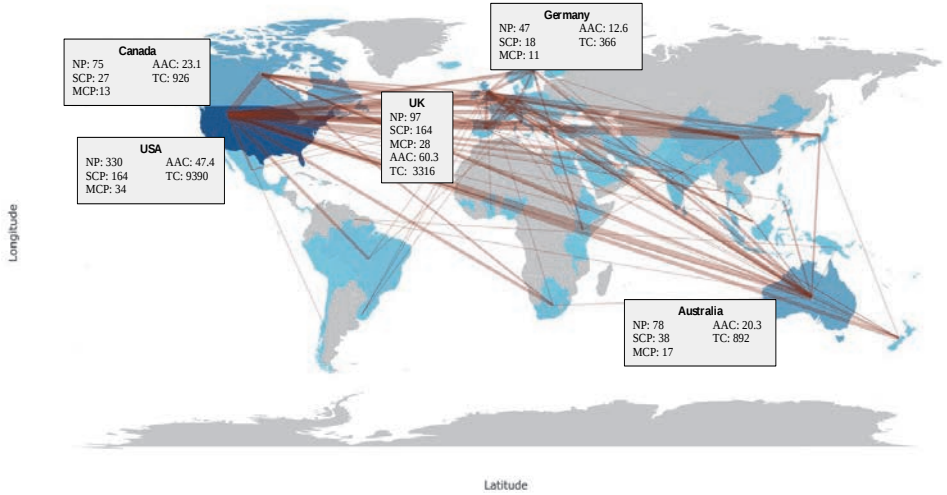
The publication of papers in different countries could indicate a country’s significance and impact in the field of healthcare resilience to a certain extent (Figure 4). The quality and quantity of research papers produced by a particular country could demonstrate the level of scientific activity and expertise in addressing healthcare resilience in view of critical events. Therefore, in the next stage, this study browsed the investigated documents by country. The findings showed that 75 countries have contributed to the investigation of healthcare resilience during critical events. In turn, the top five countries on this list are the USA (330 documents), the UK (97 documents), Australia (78 documents), Canada (75 documents), and Germany (47 documents). At the same time, the rating of the most cited country is slightly different. The most cited country was the USA (a total of 9390 citations), the UK (3316 citations), Canada (926 citations), Australia (892 citations), and Germany (366 citations). Despite the total number of citations in the USA being the largest, the indicator of average article citations shows that articles by UK scholars are the most cited

(60.3 citations per document), ahead of the USA with 47.4 citations per document.

However, it is essential to mention that publication output alone may not comprehensively assess a country’s overall importance and influence in the investigated field. Therefore, it is appropriate to consider the authors’ collaborations. Thus, the analysis of corresponding authors shows that not all countries have single or multiple country publications. Among the 75 countries included, the ones with single-country publications are Chile, Greece, the Czech Republic, Kenya, the Philippines, Slovakia, Sri Lanka, and the UAE, while those without multiple country publications are Iran, Cyprus, Denmark, Finland, Japan, Panama, Turkey, and Ukraine. On the other hand, the top five countries with the best intra- and inter-country collaborations were the USA, the UK, Australia, Canada and Germany.

Figure XX shows that the USA has the most extensive worldwide co-authorship network with 67 collaborations, followed by Australia – 49 collaborations, the UK – 43 collaborations, Germany – 37 collaborations, and Canada – 27 collaborations.

Figure 4. Scientific production by country, 2000-2022 (to 1 June)



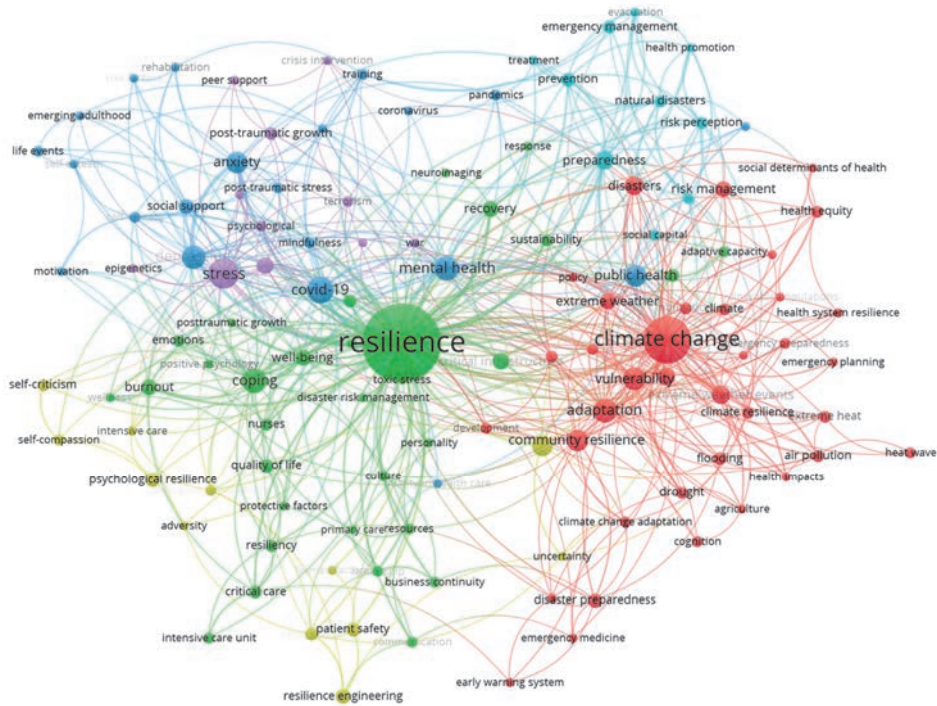
Notes: NP – Number of papers; SCP – Single country publications; MCP – Multiple country publications; AAC – Average article citations; TC – Total citations.

Source: developed by the authors

Figure 5 visualises the co-occurrence of keywords, creating a map that identifies the main scientific clusters within the scope of the investigated literature analysed from 2000 to 1 June 2023. This map identifies the relationships between different keywords, providing insights into the main themes and areas of focus within the

literature on healthcare resilience during critical events. Examining the clusters and the associations between them allows for a better understanding of key scientific areas and the interplay between different topics in the literature on healthcare resilience during critical events.

Figure 5. Network visualisation of keyword co-occurrences according to Scopus data, 2000-2023 (to 1 June)



Source: developed by the authors

In this study, the keyword co-occurrences network map was developed based on the results of analysing the links, total link strengths, and occurrence of the authors' keywords. Herewith, the limitation of a minimum of three keyword co-occurrences was introduced. Consequently, 171 keywords out of 2066 met this threshold, creating six clusters within the scope of the investigated literature on healthcare resilience during critical events. The clusters in the analysis were labelled based on the core keyword within each cluster that had the highest number of occurrences, links, and total link strengths. This approach could ensure that the clusters were named according to the most prominent and central keyword, which clearly represents the main theme within each cluster.

Therefore, the biggest (red) cluster depicts research on climate change, the second

(green) cluster – resilience in coping with stress, the third (blue) cluster – the influence of COVID-19 on mental health, the fourth (yellow) cluster – risks triggered by climate change, the fifth (purple) cluster – the nature of stress, and the sixth (cyan) cluster – preparedness for critical events.

The analysis of the first cluster shows that the term 'resilience' has the strongest links with 'coping' and 'climate change'. Thus, the findings show that in the view of critical events, scholars worldwide mostly investigated the issues of health system resilience regarding extreme weather events such as global warming, flooding, extreme heat, drought, etc. The first (red) cluster shows that the scholars elaborated on strengthening community resilience, looking into the social determinants of health, emergency planning and preparedness, disaster

management and preparedness, disaster risk reduction, early warning systems, emergency medicine, disaster preparedness, adaptation and mitigation to climate change, etc.

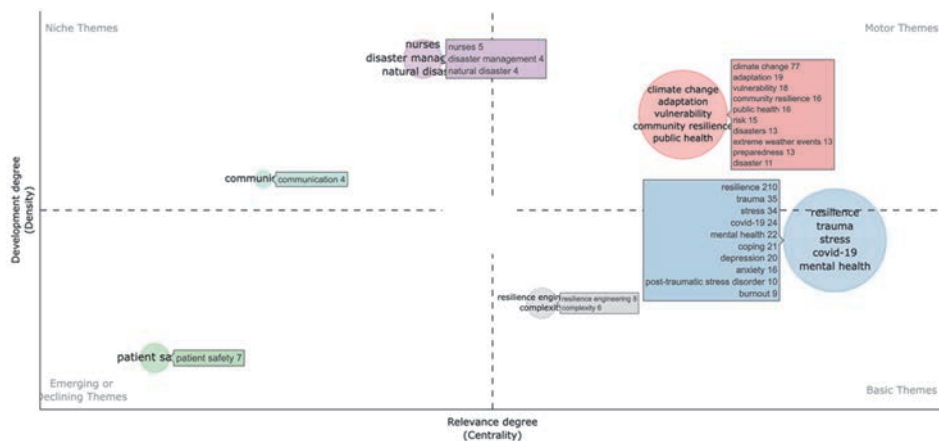
A great deal of attention is paid to investigating the psychological and mental features of healthcare resilience. The second (green) cluster shows that scholars' attention is primarily devoted to investigating burnout, emotions, leadership, positive psychology, well-being, wellness, quality of life, etc.

The unexpected spark of COVID-19 boosted the scientific interest in investigating healthcare resilience. In this view, the scholars investigated the influence of COVID-19 on public health, healthcare quality, risk factors, social support, mindfulness, training, etc. The fourth (yellow) cluster reveals the scope of studies on the risks triggered by climate change. In this view, the scholars elaborated mostly on patient safety,

psychological resilience, intensive care, etc. In turn, the fifth (purple) cluster shows studies investigating the psychological consequences of terrorism and war events. The sixth (cyan) cluster concerns preparedness for critical events such as natural disasters, health promotion, emergency management, risk perception, social capital, treatment, etc.

Figure 6 establishes a typology of the themes within the scope of the analysed literature on healthcare resilience during critical events. This study utilised the authors' keyword field to design a thematic map. By categorising and organising the keywords into distinct themes, the map visually represents the main topics in the analysed literature (basic, motor, emerging or declining, and niche themes). It allows one to look into the different thematic areas within the field of study, facilitating a better understanding of the overall landscape of the research.

Figure 6. Thematic map, 2000-2023 (to 1 June)



Source: developed by the authors

Thus, the basic themes are presented in the lower-right quadrant, which comprises keywords with high centrality but low density. Figure 6 shows that resilience is a fundamental theme in the studied scientific field. Scholars devoted specific attention to investigating resilience in the context of coping with stress, mental health, the

influence of COVID-19, depression, burnout, anxiety, etc. On the other hand, the upper-right quadrant consists of keywords with high centrality and density, indicating their significance and influence in the subject area. Therefore, the motor theme indicates that a well-established and significant research field is the issue of climate

change investigated in the view of adaptation, vulnerability, community resilience, public health, extreme weather events, disasters, etc. The niche themes presented in the upper-left quadrant with high density but low centrality indicate that papers devoted to investigating issues on communication and the influence of natural disasters on nurses are of limited importance in the broader context of the subject area. In turn, the lower-right quadrant with low centrality and density seems to indicate that studies on developing patient safety during adverse events and epidemics are an emerging research-related theme in the investigated scope of the literature.

4. Discussion and conclusions

The findings of the bibliometric analysis showed that research on healthcare resilience during critical events continues to expand. Therefore, this study employed bibliometric methods to investigate the scientific output on healthcare resilience during critical events. Bibliometrics offers a key advantage by providing a quantitative and objective analysis of the global scientific treatise, reducing the influence of the authors' inherent subjectivity. This study ensures a robust and systematic literature review by employing rigorous bibliometric analysis. Additionally, knowledge visualisation techniques were applied for a comprehensive overview of emerging trends and potential research opportunities within the investigated research field. By combining bibliometric analysis with knowledge visualisation, this study provides a holistic approach to exploring and analysing the scientific output on healthcare resilience during critical events, offering objective insights and uncovering new directions for further investigation.

The findings of performance and intellectual analysis indicated that a study by Costello et al. (2009) entitled "Managing the health effects of climate change", published

in *The Lancet*, is regarded as fundamental in exploring the analysed topic. This study has garnered 1734 citations in Scopus, reflecting its significant impact and influence in the investigated field. The authors conducted a comprehensive analysis to assess the adverse effects of climate change on health.

It should be noticed that the most frequently cited publications in the analysed field focus on the social aspect of healthcare resilience. They highlight the increasing burden of stress and the need to address the social determinants of health in the context of resilience. These oft-cited publications highlight the importance of understanding and addressing social factors in healthcare resilience during critical events.

The Swiss journal "International Journal of Environmental Research and Public Health" is the most productive source indexed in the Scopus database in terms of the number of documents dedicated to the investigation of healthcare resilience during critical events. According to the results, the investigation of healthcare resilience during critical events involved a total of 1329 affiliations. Among these affiliations, the most prolific was the University of California, with its authors publishing a total of 21 documents on the studied topic. On average, each affiliated institution published approximately two articles from 2000 to 1 June 2023, indicating a moderate level of contribution per institution in the field of healthcare resilience research.

The findings of the analysis revealed that a total of 75 countries have contributed to the investigation of healthcare resilience during critical events. Among these countries, the top five in terms of the number of documents published are the USA (330 documents), the UK (97 documents), Australia (78 documents), Canada (75 documents), and Germany (47 documents). However, when considering citation impact, the ranking slightly differs. The USA emerged as the most cited country, with a total citation

count of 9390 followed by the UK (3316 citations), Canada (926 citations), Australia (892 citations), and Germany (366 citations). While the USA has the highest total citation count, when examining the average number of citations per document, the articles authored by UK scholars stand out with an average of 60.3 citations per document. In comparison, the USA averages 47.4 citations per document. This suggests that although the USA has the highest overall citation count, articles by UK scholars tend to receive a higher average number of citations, indicating a potentially higher impact on the field of healthcare resilience during critical events.

Analysing the countries of corresponding authors reveals that not all countries have single or multiple country publications. Among the 75 countries involved, some countries do not have publications where all authors are from the same country, while others do not have publications by authors from multiple countries. Specifically, the countries without single-country publications are Chile, Greece, Czech Republic, Kenya, Philippines, Slovakia, Sri Lanka, and UAE; while the countries without multiple country publications are Iran, Cyprus, Denmark, Finland, Japan, Panama, Turkey, and Ukraine.

On the other hand, the top five countries in terms of intra- and inter-country collaborations are the USA, UK, Australia, Canada, and Germany. These countries have demonstrated strong collaborations both within their own countries and with researchers from other countries. These collaborations signify the global engagement and knowledge exchange among researchers in healthcare resilience during critical events.

In this study, a keyword co-occurrences network map was created by analysing the links, total link strengths, and occurrences of authors' keywords. The map revealed several distinct clusters representing different research directions within the field of

healthcare resilience during critical events. The largest cluster, focused on research related to climate change, indicates a significant research direction exploring the impact of climate change on healthcare resilience. The second cluster focused on understanding and promoting resilience in individuals and communities facing stressful situations. The third cluster centred around the influence of COVID-19 on mental health, reflecting the growing research interest in exploring the mental health implications of the COVID-19 pandemic. The fourth cluster revolved around the risks triggered by climate change. This cluster constitutes research investigating the various risks and vulnerabilities associated with climate change and their impact on healthcare resilience. The fifth cluster encompasses research examining the nature, causes, and effects of stress in the context of healthcare resilience during critical events; and the sixth cluster represents research exploring measures to enhance preparedness and response capabilities in the face of critical events.

These distinct clusters in the keyword co-occurrences network map provide a visual representation of the main research directions and themes within the field of healthcare resilience during critical events, highlighting the diverse areas of focus and the interconnectedness of different research topics.

The typology of themes within the scope of the analysed literature on healthcare resilience during critical events highlights the fact that the primary themes in the field are centred around resilience. Scholars have dedicated particular attention to investigating resilience concerning coping with stress, mental health, the influence of COVID-19, depression, burnout, anxiety, and other related factors. These themes reflect the importance of understanding and promoting resilience in healthcare settings during critical events.

On the other hand, the motor theme in the field revolves around well-established

and significant research on issues related to climate change. This includes adaptation, vulnerability, community resilience, public health, extreme weather events, and disasters. The extensive research in this area underscores the recognition of climate change as a critical factor impacting healthcare resilience. In contrast, the niche themes indicate that papers focused on communication and the influence of natural disasters on nurses are of limited importance in the broader context of the subject area. While these themes may be relevant within specific contexts, they may not have gained significant prominence or influence compared to the broader themes of resilience and climate change. Furthermore, the typology suggests that developing patient safety during adverse events and epidemics is an emerging research-related theme in the investigated scope of the literature. It indicates a growing interest and focus on enhancing patient safety measures, specifically in the context of adverse events and epidemics, recognising its importance to healthcare resilience.

Overall, this typology of themes provides insights into the main focus areas within the studied scientific field of healthcare resilience during critical events, highlighting the significance of resilience, climate change, and emerging research-related themes. At the same time, the results of the keyword co-occurrences analysis indicated the need to deepen the studies on strengthening healthcare resilience during human-caused critical events (such as crime, terrorism, wars, cyber-attacks, etc.), which have been steadily rising, displaying an upward trend in frequency and intensity over the last decade.

Indeed, the healthcare sector has undergone significant technological advancements in the past decade, primarily through integrating medical devices with information technology (IT). This integration has led to the development of a critical

Health Care Information Infrastructure, which offers substantial benefits for healthcare service delivery. However, Islam et al. (2021) noted that the increased digital interconnectivity among medical and IT devices has also introduced new threats to infrastructure security. With sensitive patient healthcare information and the widespread accessibility of medical devices, the risk of cyber-attacks has escalated, potentially leading to disruptions in healthcare service delivery. Secure access control is crucial for establishing a trustworthy healthcare system and defending against cyber-attacks (Soni et al., 2023). Implementing robust access control measures can help mitigate security threats and protect the integrity and confidentiality of medical information. Consequently, there is a pressing need to strengthen the security and resilience of the Health Care Information Infrastructure.

On the other hand, the healthcare sector is not exempt from aggression and threats posed by terrorists, criminals, and rogue states. Unfortunately, these entities could target healthcare facilities and providers as part of their agendas or for various reasons. Thus, it is crucial for healthcare organisations to be aware of these risks and take appropriate security measures to ensure the safety of their staff, patients, and infrastructure. This may include implementing security protocols, conducting risk assessments, and collaborating with law enforcement agencies to prevent and respond to potential threats effectively (Granhölm et al., 2022).

This paper has theoretical and practical implications in terms of analysing and visualising the scholarly output on healthcare resilience during critical events. The theoretical implications contribute to a better understanding of the patterns, relationships, and developments in the scientific literature on healthcare resilience during critical events, offering valuable insights

for researchers and identifying potential avenues for future research. On a practical level, the study offers guidance for scholars interested in conducting bibliometric analyses on scholarly output, including the performance of academics, institutions, and academic journals. The detailed instructions provided in the article can assist researchers in conducting similar analyses in different contexts.

Furthermore, the study presents opportunities for researchers to expand their current study directions by utilising the findings and insights generated through the bibliometric analysis. The study serves as a starting point for further exploration and research in the field of healthcare resilience.

However, it is important to note that the findings of this study are limited, as they solely consider data from the Scopus database. While Scopus provides a comprehensive overview of global research output, future studies should incorporate a wider range of data sources to ensure a more comprehensive and robust analysis. Expanding the data range would enhance the validity and generalisability of the findings, leading to a more comprehensive understanding of the topic.

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References

- EIU (2022). Healthcare outlook 2023. The Economist Intelligence Unit. Retrieved from: <https://cutt.ly/jwegBa5y> (accessed June 4 2023).
- Kirigia, J.M., Nganda, B.M., Mwikisa, C.N. et al. (2011), Effects of global financial crisis on funding for health development in nineteen countries of the WHO African Region. *BMC Int Health Hum Rights* 11, 4. DOI: 10.1186/1472-698X-11-4
- Klinger, C., Landeg, O., & Murray, V. (2014), Power outages, extreme events and health: a systematic review of the literature from 2011-2012. *PLoS currents*, 6, DOI: 10.1371/currents.dis.04eb1dc5e73dd1377e05a10e9edde673
- Murray, V., & Ebi, K. L. (2012), IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX). *Journal of epidemiology and community health*, 66(9), 759–760. DOI: 10.1136/jech-2012-201045
- Drożdż, W., Kinselki, G., Czarnecka, M., Wójcik-Jurkiewicz, M., Maroušková, A., Zych, G. (2021), Determinants of Decarbonization – How to Realize Sustainable and Low Carbon Cities? *Energies*, 14(9), 2640. DOI: 10.3390/en14092640.
- Kotowicz, J., Węcel, D., Kwilinski, A., Brzeczek, M. (2022). Efficiency of the power-to-gas-to-liquid-to-power system based on green methanol, *Applied Energy*, 314, 118933. <https://doi.org/10.1016/j.apenergy.2022.118933>.
- Ziabina, Y., Kwilinski, A., Lyulyov, O., Pimonenko, T., Us, Y. (2023), Convergence of Energy Policies between the EU and Ukraine under the Green Deal Policy, *Energies*, 16(2), 998. DOI: 10.3390/en16020998.
- Dzwigol, H., Kwilinski, A., Lyulyov, O., & Pimonenko, T. (2023). The Role of Environmental Regulations, Renewable Energy, and Energy Efficiency in Finding the Path to Green Economic Growth. *Energies*, 16, 3090. <https://doi.org/10.3390/en16073090>
- Ziabina, Y., Pimonenko, T., Lyulyov, O., Us, Y., & Proshkin, D. (2021). Evolutionary development of energy efficiency in the context of the national carbon-free economic development. In *E3S Web of Conferences* (Vol. 307, p. 09002). EDP Sciences. <https://doi.org/10.1051/e3sconf/202130709002>
- Coban, H.H., Lewicki, W., Miśkiewicz, R., Drożdż, W. (2023), The Economic Dimension of Using the Integration of Highway Sound Screens with Solar Panels in the Process of Generating Green Energy, *Energies*, 16, 178. DOI: 10.3390/en16010178.

- Lyulyov, O., Pimonenko, T., Kwilinski, A., & Us, Y. (2021). The heterogeneous effect of democracy, economic and political globalisation on renewable energy. In *E3S Web of Conferences* (Vol. 250, 03006). EDP Sciences. <https://doi.org/10.1051/e3sconf/202125003006>
- Us, Y., Pimonenko, T., Lyulyov, O. (2021). Energy efficiency profiles in developing the free-carbon economy: on the example of Ukraine and the V4 countries. *Polityka Energetyczna – Energy Policy Journal*, 23(4), 49–66. <https://doi.org/10.33223/epj/127397>
- Polcyn, J., Us, Y., Lyulyov, O., Pimonenko, T., Kwilinski, A. (2022), Factors Influencing the Renewable Energy Consumption in Selected European Countries, *Energies*, 15(1), 108. DOI: 10.3390/en15010108.
- Kharazishvili, Y., Kwilinski, A., Sukhodolia, O., Dzwigol, H., Bobro, D., Kotowicz, J. (2021). The systemic approach for estimating and strategizing energy security: The case of Ukraine, *Energies*, 14(8), 2126. <https://doi.org/10.3390/en14082126>.
- Gavkalova, N., Lola, Y., Prokopovych, S., Akimov, O., Smalskys, V., Akimova, L. (2022), Innovative Development of Renewable Energy During the Crisis Period and Its Impact on the Environment, *Virtual Economics*, 5(1), 65–77. DOI: 10.34021/ve.2022.05.01(4).
- Pimonenko, T., Prokopenko, O., Cebula, J., Chayen, S. (2017). Wind energy in Israel, Poland and Ukraine: Features and opportunities. *International Journal of Ecology and Development*, 32(1), 98–107.
- Durand-Moreau Q. (2022). The hidden occupational health burden of COVID: work-related cardiovascular diseases related to long working hours. *Canadian journal of public health = Revue canadienne de sante publique*, 113(3), 405–406. <https://doi.org/10.17269/s41997-022-00645-5>
- Zhang, M., Chen, Y., Lyulyov, O., and Pimonenko, T. (2023). Interactions between Economic Growth and Environmental Degradation toward Sustainable Development. *Systems*, 11, 13. <https://doi.org/10.3390/systems11010013>
- Kwilinski, A., Lyulyov, O., & Pimonenko, T. (2023). The Effects of Urbanisation on Green Growth within Sustainable Development Goals. *Land*, 12, 511. <https://doi.org/10.3390/land12020511>
- Kuzior, A., Grebski, W., Kwilinski, A., Krawczyk, D., Grebski, M. E. (2022). Revitalization of Post-Industrial Facilities in Economic and Socio-Cultural Perspectives – A Comparative Study between Poland and the USA, *Sustainability*, 14(17), 11011. DOI: 10.3390/su141711011.
- Tih, S., Wong, K.-K., Lynn, G.S., Reilly, R.R. (2016). Prototyping, Customer Involvement, and Speed of Information Dissemination in New Product Success, *Journal of Business and Industrial Marketing*, 31(4), 437–448. DOI: 10.1108/JBIM-09-2014-0182.
- Kwilinski, A., Lyulyov, O., Pimonenko, T. (2023). The Effects of Urbanisation on Green Growth within Sustainable Development Goals, *Land*, 12(2), 511. DOI: 10.3390/land12020511.
- Kwilinski, A., Lyulyov, O., & Pimonenko, T. (2023). Environmental Sustainability within Attaining Sustainable Development Goals: The Role of Digitalization and the Transport Sector. *Sustainability*, 15, 11282. <https://doi.org/10.3390/su151411282>
- Kwilinski, A., Lyulyov, O., Pimonenko, T. (2023). Environmental Sustainability within Attaining Sustainable Development Goals: The Role of Digitalization and the Transport Sector, *Sustainability*, 15(14), 11282. DOI: 10.3390/su151411282.
- Pimonenko, T., Lyulyov, O., Chortok, Y., Borovik, O. (2015). Ecological and Economic Evaluation of Transport System Functioning According To the Territory Sustainable Development. *International Journal of Ecology & Development™* 30 (3), 1–10.
- Hussain, H.I., Haseeb, M., Kamarudin, F., Dacko-Pikiewicz, Z., Szczepańska-Woszczyna, K. (2021). The role of globalization, economic growth and natural resources on the ecological footprint in Thailand: Evidence from nonlinear causal estimations, *Processes*, 9(7), 1103. DOI: 10.3390/pr9071103.

- Lyulyov, O., & Moskalenko, B. (2020). Institutional Quality and Shadow Economy: An Investment Potential Evaluation Model. *Virtual Economics*, 3(4), 131-146. [https://doi.org/10.34021/ve.2020.03.04\(7\)](https://doi.org/10.34021/ve.2020.03.04(7))
- Smilianov, V., Lyulyov, O., Pimonenko, T., Andrushchenko, T., Sova, S., Grechkovskaya, N. (2020). The impact of the pandemic lockdown on air pollution, health and economic growth: system dynamics analysis. *Wiadomości Lekarskie*, LXXIII (11), 2332-2338. <https://doi.org/10.36740/WLek2020111102>
- Miśkiewicz, R. (2021). Knowledge and innovation 4.0 in today's electromobility, in: Z. Makiela, M.M. Stuss, and R. Borowiecki (Eds.), *Sustainability, Technology and Innovation 4.0* (pp. 256-275), London, UK: Routledge.
- Arefieva, O., Polous, O., Arefiev, S., Tytykalo, V., Kwilinski, A. (2021), Managing sustainable development by human capital reproduction in the system of company's organizational behaviour, *IOP Conference Series: Earth and Environmental Science*, 628, 012039. DOI: 10.1088/1755-1315/628/1/012039.
- Kharazishvili, Y., Kwilinski, A. (2022). Methodology for Determining the Limit Values of National Security Indicators Using Artificial Intelligence Methods, *Virtual Economics*, 5(4), 7-26. DOI: 10.34021/ve.2022.05.04(1).
- Guan, H., Li, S., Wang, Q., Lyulyov, O. & Pimonenko, T. (2022). Financial Fraud Identification of the Companies Based on the Logistic Regression Model. *Journal of Competitiveness*, 14(4), 155-171. <https://doi.org/10.7441/joc.2022.04.09>
- Dzwigol, H. (2020). Methodological and Empirical Platform of Triangulation in Strategic Management. *Academy of Strategic Management Journal*, 19(4), 1-8.
- Dong, Z., Wu, L., Chen, Y., Lyulyov, O., & Pimonenko, T. (2022). Intergenerational Transmission of Obesity: Role of Education and Income. *International Journal of Environmental Research and Public Health*, 19, 15931. <https://doi.org/10.3390/ijerph192315931>
- Kuzior, A., Lyulyov, O., Pimonenko, T., Kwilinski, A., Krawczyk, D. (2021). Post-Industrial Tourism as a Driver of Sustainable Development. *Sustainability*, 13, 8145. <https://doi.org/10.3390/su13158145>
- Abazov, R. (2021), Engaging in the internationalization of education and SDGs: Case study on the global hub of UNA1 on sustainability, *E3S Web of Conferences*, 307, 06001. DOI: 10.1051/e3sconf/202130706001.
- Chen Q., Chi Q., Chen Y., Lyulyov O., Pimonenko T. (2022). Does Population Aging Impact China's Economic Growth? *International Journal of Environmental Research and Public Health*, 19(19),12171. <https://doi.org/10.3390/ijerph191912171>
- Stępień, S., Smędzik-Ambroży, K., Polcyn, J., Kwiliński, A., Maican, I. (2023), Are small farms sustainable and technologically smart? Evidence from Poland, Romania, and Lithuania, *Central European Economic Journal*, 10(57), 116-132. DOI: 10.2478/ceej-2023-0007.
- Wang, Z., Lin, S., Chen, Y., Lyulyov, O., Pimonenko, T. (2023). Digitalization Effect on Business Performance: Role of Business Model Innovation. *Sustainability*, 15, 9020. <https://doi.org/10.3390/su15119020>
- Tambovceva, T., Ivanov, I. H., Lyulyov, O., Pimonenko, T., Stoyanets, N., & Yanishevska, K. (2020). Food security and green economy: Impact of institutional drivers. *International Journal of Global Environmental Issues*, 19(1-3), 158-176.
- Szczepańska-Woszczyna, K., Gedvilaitė, D., Nazarko, J., Stasiukynas, A., Rubina, A. (2022). Assessment of Economic Convergence among Countries in the European Union, *Technological and Economic Development of Economy*, 28(5), 1572-1588. DOI: 10.3846/tede.2022.17518.
- Su, H., Lu, Y., Lyulyov, O., & Pimonenko, T. (2023). Good Governance within Public Participation and National Audit for Reducing Corruption. *Sustainability*, 15, 7030. <https://doi.org/10.3390/su15097030>

- Sokolovska, A., Zatonatska, T., Stavtysky, A., Lyulyov, O., & Giedraitis, V. (2020). The impact of globalization and international tax competition on tax policies. *Research in World Economy*, 11(4), 1-15. doi:10.5430/rwe.v11n4p
- Pimonenko, T. & Cebula, J. (2015). Comparison Financing Conditions of The Development Biogas Sector in Poland and Ukraine. *International Journal of Ecology & Development™* 30 (2), 220–30.
- Kwilinski, A., Dzwigol, H., Dementyev, V. (2020). Model of entrepreneurship financial activity of the transnational company based on intellectual technology, *International Journal of Entrepreneurship*, 24(1), 1-5.
- Kharazishvili, Y., Kwilinski, A., Grishnova, O., Dzwigol, H. (2020). Social safety of society for developing countries to meet sustainable development standards: Indicators, level, strategic benchmarks (with calculations based on the case study of Ukraine), *Sustainability*, 12(21), 8953. <https://doi.org/10.3390/su12218953>.
- Kianpour, M., Kowalski, S.J., Øverby, H. (2021). Systematically Understanding Cybersecurity Economics: A Survey, *Sustainability*, 13, 13677. DOI: 10.3390/su132413677.
- Kuzior, A., Kwilinski, A. (2022). Cognitive Technologies and Artificial Intelligence in Social Perception, *Management Systems in Production Engineering*, 30(2), 109-115. DOI: 10.2478/mspe-2022-0014.
- Kwilinski, A., Dielini, M., Mazuryk, O., Filippov, V., Kitseliuk, V. (2020). System Constructs for the Investment Security of a Country, *Journal of Security and Sustainability Issues*, 10(1), 345-358.
- Chen, Y., Lyulyov, O., Pimonenko, T., & Kwilinski, A. (2023). Green development of the country: Role of macroeconomic stability. *Energy & Environment*. <https://doi.org/10.1177/0958305X231151679>
- Kwilinski, A., Dalevska, N., Dementyev, V. V. (2022). Metatheoretical Issues of the Evolution of the International Political Economy, *Journal of Risk and Financial Management*, 15(3), 124. DOI: 10.3390/jrfm15030124.
- Vaníčková, R., Szczepańska-Woszczyna, K. (2020). Innovation of business and marketing plan of growth strategy and competitive advantage in exhibition industry, *Polish Journal of Management Studies*, 21(2), 425-445. DOI: 10.17512/pjms.2020.21.2.30.
- Nawawi, M., Samsudin, H., Saputra, J., Szczepańska-Woszczyna, K., Kot, S. (2022). The Effect of Formal and Informal Regulations on Industrial Effluents and Firm Compliance Behavior in Malaysia, *Production Engineering Archives*, 28(2), 193-200. DOI: 10.30657/pea.2022.28.23.
- Moskalenko B., Lyulyov O., Pimonenko T., Kwilinski A. & Dzwigol H. (2022). Investment attractiveness of the country: social, ecological, economic dimension. *International Journal of Environment and Pollution*, 69 (1/2), 80-98.
- Panchenko, O., Domashenko, M., Lyulyov, O., Dalevska, N., Pimonenko, T. & Letunovska, N. (2021). Objectivation of the Ecological and Economic Losses from Solid Domestic Waste at the Heating Enterprises. *Management Systems in Production Engineering*, 29(3), 235-241. <https://doi.org/10.2478/mspe-2021-0029>
- Pimonenko, T., Bilan, Y., Horák, J., Starchenko, L., & Gajda, W. (2020). Green Brand of Companies and Greenwashing under Sustainable Development Goals. *Sustainability*, 12(4), 1679 <https://doi.org/10.3390/su12041679>
- Rui, L., Sineviciene, L., Melnyk, L., Kubatko, O., Karintseva, O., & Lyulyov, O. (2019). Economic and environmental convergence of transformation economy: The case of China. *Problems and Perspectives in Management*, 17(3), 233-241. doi:10.21511/ppm.17(3).2019.19
- Wang, Q., Chen, Y., Guan, H., Lyulyov, O., & Pimonenko, T. (2022). Technological Innovation Efficiency in China: Dynamic Evaluation and Driving Factors. *Sustainability*, 14, 8321. <https://doi.org/10.3390/su14148321>
- Moskalenko, B., Lyulyov, O., Pimonenko, T., & Kobushko, I. (2022). Institutions' Effect on a Country's Investment Attractiveness within Sustainable Development. *Virtual Economics*, 5(4), 50–64. [https://doi.org/10.34021/ve.2022.05.04\(3\)](https://doi.org/10.34021/ve.2022.05.04(3))

- Chen, Y., Kwilinski, A., Chygryn, O., Lyulyov, O., Pimonenko, T. (2021), The Green Competitiveness of Enterprises: Justifying the Quality Criteria of Digital Marketing Communication Channels, *Sustainability*, 13(24), 13679. DOI: 10.3390/su132413679.
- Kwilinski, A., Lyulyov, O., Pimonenko, T., Dzwigol, H., Abazov, R., & Pudryk, D. (2022). International Migration Drivers: Economic, Environmental, Social, and Political Effects. *Sustainability*, 14(11), 6413. <https://doi.org/10.3390/su14116413>
- Pimonenko, T., Prokopenko, O., Dado J. (2017). Net Zero House: EU Experience in Ukrainian Conditions. *International Journal of Ecological Economics & Statistics*, 38(4), 46–57.
- Xu, S., Chen, Y., Lyulyov, O., Pimonenko, T. (2023). Green technology innovation and high-quality economic development: spatial spillover effect. *Prague Economic Papers*, 32 (3), 292–319, <https://doi.org/10.18267/j.pep.833>
- Miśkiewicz, R., Matan, K., Karnowski, J. (2022). The Role of Crypto Trading in the Economy, Renewable Energy Consumption and Ecological Degradation, *Energies*, 15(10), 3805. DOI: 10.3390/en15103805.
- Pimonenko, T., Lyulyov, O., Us, Y. (2021). Cointegration between Economic, Ecological and Tourism Development. *Journal of Tourism and Services*, 23(12), 169–180. doi: 10.29036/jots.v12i23.293
- Kwilinski, A., Slatvitskaya, I., Dugar, T., Khodakivska, L., Derevyanko, B. (2020). Main effects of mergers and acquisitions in international enterprise activities, *International Journal of Entrepreneurship*, 24(1), 1–8.
- Petroye, O., Lyulyov, O., Lytvynchuk, I., Paid, Y., Pakhomov, V. (2020). Effects of information security and innovations on country's image: Governance aspect. *International Journal of Safety and Security Engineering*, Vol. 10, No. 4, pp. 459–466. <https://doi.org/10.18280/ijss.100404>
- Kwilinski, A., Zaliznova, Y., Trushkina, N., Rynkevych, N. (2020). Organizational and methodological support for Ukrainian coal enterprises marketing activity improvement, *E3S Web of Conferences*, 168, 00031. DOI: 10.1051/e3sconf/20201680003.
- Lyulyov, O., Pimonenko, T., Stoyanets, N., & Letunovska, N. (2019). Sustainable development of agricultural sector: Democratic profile impact among developing countries. *Research in World Economy*, 10(4), 97–105. doi:10.5430/rwe.v10n4p97
- Kwilinski, A., Litvin, V., Kamchatova, E., Polusmiak, J., Mironova, D. (2021). Information support of the entrepreneurship model complex with the application of cloud technologies, *International Journal of Entrepreneurship*, 25(1), 1–8.
- Prokopenko, O., Miśkiewicz, R. (2020), Perception of “green shipping” in the contemporary conditions, *Entrepreneurship and Sustainability Issues*, 8(2), 269–284. DOI: 10.9770/jesi.2020.8.2(16).
- Us, Y., Pimonenko, T., Lyulyov, O., Chen, Y., Tambovceva, T. (2022), Promoting Green Brand of University in Social Media: Text Mining and Sentiment Analysis, *Virtual Economics*, 5(1), 24–42. DOI: 10.34021/ve.2022.05.01(2).
- Szczepańska-Woszczyna, K., Gatnar, S. (2022). Key Competences of Research and Development Project Managers in High Technology Sector, *Forum Scientiae Oeconomia*, 10(3), 107–130. DOI: 10.23762/FSO_VOL10_NO3_6.
- Dzwigol, H. (2022). Research Methodology in Management Science: Triangulation. *Virtual Economics*, 5(1), 78–93. DOI: 10.34021/ve.2022.05.01(5).
- Xiao, N., Sharman, R., Rao, H. R., & Dutta, S. (2012). A simulation-based study for managing hospital emergency department's capacity in extreme events. *International Journal of Business Excellence*, 5(1/2), 140. doi:10.1504/ijbex.2012.044578
- Elsevier (2022). Scopus. Retrieved from: https://www.elsevier.com/__data/assets/pdf_file/0017/114533/Scopus-fact-sheet-2022_WEB.pdf

- Berg, S.H. and Aase, K. (2019), "Resilient characteristics as described in empirical studies on health care", in Wiig, S. and Fahlbruch, B. (Eds), *Exploring Resilience - A Scientific Journey from Practice to Theory*, Springer Open, Cham, pp. 79-87.
- Achour, N., Pascale, F., Price, A. D. F., Polverino, F., Aciksari, K., Miyajima, M., ... Yoshida, M. (2016). Learning lessons from the 2011 Van Earthquake to enhance healthcare surge capacity in Turkey. *Environmental Hazards*, 15(1), 74-94. doi:10.1080/17477891.2016.1139539
- CDC. (2010). Interim planning guidance for preparedness and response to a mass casualty event resulting from terrorist use of explosives. Atlanta, GA: Centre for Disease Control and Prevention Department of Health and Human Services.
- Zhong, S., Clark, M., Hou, X. Y., Zang, A., & Fitzgerald, G. (2014). Proposing and developing a definition and conceptual framework for health care resilience to cope with disasters [Resiliencia: Propuesta y desarrollo de la definicion y del marco conceptual en relacion a los desastres en el ambito sanitario]. *Emergencias*, 26(1), 69-77.
- Werner, E.E., Smith, R.S., 1977. *Kauai's Children Come of Age*. University of Hawaii Press, Honolulu.
- Holling, C.S., 1973. Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics* 4, 1-23.
- Adger, W. N. (2000). Social and ecological resilience: Are they related? *Progress in Human Geography*, 24(3), 347-364. doi:10.1191/030913200701540465
- Google Books Ngram Viewer (2023). Available at: https://books.google.com/ngrams/graph?content=resilience&year_start=1500&year_end=2019&corpus=en-2019&smoothing=3&case_insensitive=true
- Google Trends (2023). Available at: <https://trends.google.com/trends/explore?cat=45&date=all&q=resilience&hl=ru>
- OECD (2023). Health Systems Resilience. Available at: <https://www.oecd.org/health/health-systems-resilience.htm#:~:text=Health%20system%20resilience%20is%20the,better%20performing%20and%20more%20prepared>.
- European Observatory on Health Systems and Policies (2023). Health systems resilience. Available at: <https://eurohealthobservatory.who.int/covid-19/policy-responses-to-covid-19/resilience>
- Henriksen, K., Battles, J. B., Keyes, M. A., & Grady, M. L. (2008). Advances in patient safety: new directions and alternative approaches. AHRQ Publication, (08-0034).
- Cutter, S. L., Ahearn, J. A., Amadei, B., Crawford, P., Eide, E. A., Galloway, G. E., ... & Zoback, M. L. (2013). Disaster resilience: A national imperative. *Environment: Science and Policy for Sustainable Development*, 55(2), 25-29.
- Aase, K., Guise, V., Billett, S., Sollid, S. J. M., Njå, O., Røise, O., ... & Wiig, S. (2020). Resilience in healthcare (RiH): a longitudinal research programme protocol. *BMJ open*, 10(10), e038779.
- Woloshynowych, M., Rogers, S., Taylor-Adams, S., & Vincent, C. (2005). The investigation and analysis of critical incidents and adverse events in healthcare. *Health Technology Assessment*, Vol. 9: No. 19, pp.1-143.
- Yazdani, M., Mojtahedi, M., Loosemore, M., & Sanderson, D. (2022). A modelling framework to design an evacuation support system for healthcare infrastructures in response to major flood events. *Progress in disaster science*, 13, 100218.
- Lloyd-Smith, M. (2020). The COVID-19 pandemic: resilient organisational response to a low-chance, high-impact event. *BMJ Leader*, leader-2020-000245. doi:10.1136/leader-2020-000245.
- Achour, N., Miyajima, M., Pascale, F., & D.F. Price, A. (2014). Hospital resilience to natural hazards: classification and performance of utilities. *Disaster Prevention and Management: An International Journal*, 23(1), 40-52. doi:10.1108/dpm-03-2013-0057

- Kunzler, A. M., Helmreich, I., Chmitorz, A., König, J., Binder, H., Wessa, M., & Lieb, K. (2020). Psychological interventions to foster resilience in healthcare professionals. *Cochrane Database of Systematic Reviews*. doi:10.1002/14651858.cd012527.pub2
- Cimellaro, G. P., Reinhorn, A. M., & Bruneau, M. (2010). Seismic resilience of a hospital system. *Structure and Infrastructure Engineering*, 6(1-2), 127–144. doi:10.1080/15732470802663847
- Humphrey, K. & Dresser, C. (2023). Natural disasters strike everywhere: Ways to help protect your health. Harvard Health Publishing. Harvard Medical School. Available at: <https://www.health.harvard.edu/blog/natural-disasters-strike-everywhere-ways-to-help-protect-your-health-202301202878>
- Bi, P., Williams, S., Loughnan, M., Lloyd, G., Hansen, A., Kjellstrom, T., ... Saniotis, A. (2011). The effects of extreme heat on human mortality and morbidity in australia: Implications for public health. *Asia-Pacific Journal of Public Health*, 23(2 SUPPL.), 27S-36S. doi:10.1177/1010539510391644
- Ebi, K. L. (2011). Resilience to the health risks of extreme weather events in a changing climate in the united states. *International Journal of Environmental Research and Public Health*, 8(12), 4582-4595. doi:10.3390/ijerph8124582
- Thomas, M., King, D., Keogh, D. U., Apan, A., & Mushtaq, S. (2011). Resilience to climate change impacts: A review of flood mitigation policy in queensland, australia. *Australian Journal of Emergency Management*, 26(1), 8-17.
- Meadows, M. P., Shreffler, K. M., & Mullins-Sweatt, S. N. (2011). Occupational stressors and resilience in critical occupations: The role of personality doi:10.1108/S1479-3555(2011)0000009006 Retrieved from www.scopus.com
- Costello, A., Abbas, M., Allen, A., Ball, S., Bell, S., Bellamy, R., ... Patterson, C. (2009). Managing the health effects of climate change. *Lancet and university college London institute for global health commission. The Lancet*, 373(9676), 1693-1733. doi:10.1016/S0140-6736(09)60935-1
- Soliman, M., Lyulyov, O., Shvindina, H., Figueiredo, R., & Pimonenko, T. (2021). Scientific output of the european journal of tourism research: A bibliometric overview and visualisation. *European Journal of Tourism Research*, 28
- Dubina, O., Us, Y., Pimonenko, T., & Lyulyov, O. (2020). Customer Loyalty to Bank Services: The Bibliometric Analysis. *Virtual Economics*, 3(3), 53-66. [https://doi.org/10.34021/ve.2020.03.03\(3\)](https://doi.org/10.34021/ve.2020.03.03(3))
- Pimonenko, T., Us, Y., Lyulyova, L., & Kotenko, N. (2021). The impact of the macroeconomic stability on the energy-efficiency of the European countries: A bibliometric analysis. In *E3S Web of Conferences* (Vol. 234, p. 00013). EDP Sciences. <https://doi.org/10.1051/e3sconf/202123400013>
- Letunovska, N., Lyulyov, O., Pimonenko, T., & Aleksandrov, V. (2021). Environmental management and social marketing: a bibliometric analysis. In *E3S Web of Conferences* (Vol. 234, p. 00008). EDP Sciences. <https://doi.org/10.1051/e3sconf/202123400008>
- Us, Y. O., Bilan, S., Pimonenko, T. V., Seliga, R., & Ostasz, G. Green Brand for Sustainable Business: Bibliometric Analysis. *Proceedings of the 35th International Business Information Management Association (IBIMA)*, ISBN: 978-0-9998551-4-0, 1-12 April 2020, Seville, Spain, p. 8456-8470.
- Soliman, M., Gulvady, S., Lyulyov O., Pimonenko T. (2023) Research trends and themes in the top-tier tourism, leisure and hospitality journals: A bibliometric and network analysis before and during the COVID-19 era. *International Journal Hospitality and Tourism Systems*, 16 (1), 58-73.
- Ziabina, Y., & Pimonenko, T. (2020). The Green Deal Policy for Renewable Energy: A Bibliometric Analysis. *Virtual Economics*, 3(4), 137-145. [https://doi.org/10.34021/ve.2020.03.04\(8\)](https://doi.org/10.34021/ve.2020.03.04(8))
- Bilan, Y., Pimonenko, T., & Starchenko, L. (2020). Sustainable business models for innovation and success: Bibliometric analysis. Paper presented at the *E3S Web of Conferences*, 159 doi:10.1051/e3sconf/202015904037
- Masten, A. S. (2011). Resilience in children threatened by extreme adversity: Frameworks for research, practice, and translational synergy. *Development and psychopathology*, 23(2), 493-506.

- Cicchetti, D. (2010). Resilience under conditions of extreme stress: a multilevel perspective. *World psychiatry*, 9(3), 145.
- Keim, M. E. (2008). Building human resilience: the role of public health preparedness and response as an adaptation to climate change. *American journal of preventive medicine*, 35(5), 508-516.
- Gillespie, C. F., Phifer, J., Bradley, B., & Ressler, K. J. (2009). Risk and resilience: genetic and environmental influences on development of the stress response. *Depression and anxiety*, 26(11), 984-992.
- Miskiewicz, R. (2020). Efficiency of electricity production technology from post-process gas heat: Ecological, economic and social benefits, *Energies*, 13(22), 6106. DOI: 10.3390/en13226106.
- Kwilinski, A., Lyulyov, O., Pimonenko, T. (2023). Inclusive Economic Growth: Relationship between Energy and Governance Efficiency. *Energies*, 16, 2511. <https://doi.org/10.3390/en16062511>
- Melnichenko, O. (2021). Energy Losses Due to Imperfect Payment Infrastructure and Payment Instruments, *Energies*, 14, 8213. DOI: 10.3390/en14248213.
- Dzwigol, H., Kwilinski, A., Lyulyov, O., Pimonenko, T. (2023) Renewable Energy, Knowledge Spillover, and Innovation: Capacity of Environmental Regulation. *Energies*, 16, 1117. <https://doi.org/10.3390/en16031117>
- Lyulyov O., Pimonenko T., Kwilinski A., Dzwigol H., Dzwigol-Barosz M., Pavlyk V., Barosz P. (2021). The Impact of the Government Policy on the Energy Efficient Gap: The Evidence from Ukraine. *Energies*, 14(2):373. <https://doi.org/10.3390/en14020373>
- Miśkiewicz, R., Rzepka, A., Borowiecki, R., Olesiński, Z. (2021). Energy Efficiency in the Industry 4.0 Era: Attributes of Teal Organisations, *Energies*, 14(20), 6776. DOI: 10.3390/en14206776.
- Kostyrko, R., Kosova, T., Kostyrko, L., Zaitseva, L., Melnichenko, O. (2021). Ukrainian Market of Electrical Energy: Reforming, Financing, Innovative Investment, Efficiency Analysis, and Audit, *Energies*, 14(16), 5080. DOI: 10.3390/en14165080.
- Miśkiewicz, R. (2018). The importance of knowledge transfer on the energy market. *Polityka Energetyczna*, 21(2), 49–62. DOI: 10.24425/122774.
- Kwilinski, A., Lyulyov, O., Pimonenko, T. (2023). Greenfield Investment as a Catalyst of Green Economic Growth, *Energies*, 16(5), 2372. DOI: 10.3390/en16052372.
- Miskiewicz, R. (2022). Clean and Affordable Energy within Sustainable Development Goals: The Role of Governance Digitalization, *Energies*, 15, 9571. DOI: 10.3390/en15249571.
- Kuzior, A., Kwilinski, A., & Hroznyi, I. (2021). The Factorial-Reflexive Approach to Diagnosing the Executors' and Contractors' Attitude to Achieving the Objectives by Energy Supplying Companies, *Energies*, 14(9), 2572. DOI: 10.3390/en14092572.
- Dukart, H., Lanoue, L., Rezende, M., and Rutten, P. (2022). To maintain profitable and resilient operations, CEOs and COOs of pharma companies may need to make bold changes to their operations strategy as the industry navigates new challenges. McKinsey & Company. Accessed on May 2, 2023.
- Vakulenko, I., Saher, L., Lyulyov, O., & Pimonenko, T. (2021). A systematic literature review of smart grids. Paper presented at the E3S Web of Conferences, 250 doi:10.1051/e3sconf/202125008006
- Falagas, M., Pitsouni, E., Malietzis, G., Pappas, G. (2008). Comparison of PubMed, scopus, web of science, and google scholar: Strengths and weaknesses. *FASEB Journal*, 22(2), 338-342. doi:10.1096/fj.07-9492LSF
- Corte, D., Gaudio, G., Sepe, F., & Sciarelli, F. (2019). Sustainable tourism in the open innovation realm: A bibliometric analysis. *Sustainability*, 11(21), 6114.
- Shi, G., Liu, N., Yu, X., Zhang, H., Li, S., Wu, S., ... Li, C. (2019). Bibliometric analysis of medical malpractice literature in legal medicine from 1975 to 2018: Web of science review. *Journal of Forensic and Legal Medicine*, 66, 167-183. doi:10.1016/j.jflm.2019.07.002

- Sfantou, D. F., Laliotis, A., Patelarou, A. E., Sifaki-Pistolla, D., Matalliotakis, M., & Patelarou, E. (2017). Importance of Leadership Style towards Quality of Care Measures in Healthcare Settings: A Systematic Review. *Healthcare (Basel, Switzerland)*, 5(4), 73. <https://doi.org/10.3390/healthcare5040073>
- Sahuga, P.W., Szczepańska-Woszczyna, K., Miśkiewicz, R., Chład, M. (2020), Cost of equity of coal-fired power generation projects in Poland: Its importance for the management of decision-making process. *Energies*, 13(18), 4833. DOI: 10.3390/en13184833.
- Lyulyov, O., & Shvindina, H. (2017). Stabilization Pentagon Model: application in the management at macro-and micro-levels. *Problems and Perspectives in Management*, 15(3), 42-52. doi:10.21511/ppm.15(3).2017.04
- Trzeciak, M., Kopec, T.P., Kwilinski, A. (2022). Constructs of Project Programme Management Supporting Open Innovation at the Strategic Level of the Organisation, *Journal of Open Innovation: Technology, Market, and Complexity*, 8(1), 58. DOI: 10.3390/joitmc8010058.
- Yevdokimov, Y., Melnyk, L., Lyulyov, O., Panchenko, O., Kubatko, V. (2018). Economic freedom and democracy: determinant factors in increasing macroeconomic stability. *Problems and Perspectives in Management*, 16(2), 279-290. doi:10.21511/ppm.16(2).2018.26
- Acheampong, S., Pimonenko, T., & Lyulyov, O. (2023). Sustainable Marketing Performance of Banks in the Digital Economy: The Role of Customer Relationship Management. *Virtual Economics*, 6(1), 19–37. [https://doi.org/10.34021/ve.2023.06.01\(2\)](https://doi.org/10.34021/ve.2023.06.01(2))
- Dzwigol-Barosz, M., Dzwigol, H. (2021), Managing Family Businesses in Light of Methodological Assumptions for Higher Education, *E3S Web of Conferences*, 307, 06003. DOI: 10.1051/e3sconf/202130706003.
- Dzwigol, H. (2021), Methodological Approach in Management and Quality Sciences, *E3S Web of Conferences*, 307, 01002. DOI: 10.1051/e3sconf/202130701002.
- Kwilinski, A., Kuzior, A. (2020). Cognitive Technologies in the Management and Formation of Directions of the Priority Development of Industrial Enterprises, *Management Systems in Production Engineering*, 28(2), 133-138. DOI: 10.2478/mspe-2020-0020
- Ree, E., Ellis, L.A. and Wiig, S. (2021). Managers' role in supporting resilience in healthcare: a proposed model of how managers contribute to a healthcare system's overall resilience, *International Journal of Health Governance*, Vol. 26 No. 3, pp. 266-280.
- Talubo, J. P., Morse, S., & Saroj, D. (2022). Whose resilience matters? A socio-ecological systems approach to defining and assessing disaster resilience for small islands. *Environmental Challenges*, 7, 100511.
- Southwick, S. M., Bonanno, G. A., Masten, A. S., Panter-Brick, C., & Yehuda, R. (2014). Resilience definitions, theory, and challenges: interdisciplinary perspectives. *European journal of psychotraumatology*, 5(1), 25338.
- Pasquinelli, C., & Sjöholm, J. (2015). Art and resilience: The spatial practices of making a resilient artistic career in London. *City, Culture and Society*, 6(3), 75-81.
- Islam, S., Papastergiou, S., & Mouratidis, H. (2021). A dynamic cyber security situational awareness framework for healthcare ICT infrastructures. Paper presented at the *ACM International Conference Proceeding Series*, 334-339. doi:10.1145/3503823.3503885
- Soni, P., Pradhan, J., Pal, A. K., & Islam, S. K. H. (2023). Cybersecurity attack-resilience authentication mechanism for intelligent healthcare system. *IEEE Transactions on Industrial Informatics*, 19(1), 830-840. doi:10.1109/TII.2022.3179429
- Granholm, F., Tin, D., & Ciottoni, G. R. (2022). Not war, not terrorism, the impact of hybrid warfare on emergency medicine. *American Journal of Emergency Medicine*, 62, 96-100. doi:10.1016/j.ajem.2022.10.021

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Sustainable Strategic Management: Foreign Capital Participation in the Post-COVID-19 Era

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Abstract

There is a clear need to research the issue of planning processes within companies. Although there are many publications on individual planning processes, insight into the impact of foreign capital participation after the COVID-19 pandemic is lacking. The focus of the study is the determination of statistically significant differences in individual management planning processes, whilst identifying differences in the functioning of companies both with and without foreign capital participation. The method of data collection was an interview and questionnaire survey conducted into seven aspects of the planning process, namely setting goals, generating plans, marketing planning, production planning, personnel planning, financial and investment planning, and monitoring. The influencing factor “foreign capital participation” was selected for particular focus. As our results suggest, foreign capital participation in companies has a fundamental impact on a company’s planning processes, sustainability and efficiency. The conclusions drawn are that foreign capital participation has a fundamental impact on our understanding of the business environment, and that to sustain a high-quality business, the issue requires even more in-depth research.

Key words

Foreign capital, company operations, planning process, strategy, COVID-19

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Introduction

Since the early days of the COVID-19 pandemic, the scientific community has been striving to shed light on a range of issues, including planning processes. The question

that is often asked is: Why is planning important, especially in crisis situations such as the COVID-19 pandemic? According to Griffin (2013) and Khorasani and

Almasifard (2017), planning processes are incredibly important for companies because they provide a systematic approach to achieving their goals. These processes help to identify potential challenges and opportunities, develop strategies to capitalise on them, and ensure that resources are used efficiently. Unfortunately, to date there has been no wide-ranging research into strategic planning processes in Slovak companies. This critical area therefore warrants a better look, especially with regards to foreign capital participation. As Maylor and Turner (2017) state, increased investment, job creation, knowledge transfer, infrastructure development, access to international markets, and economic growth in the recipient nation are all advantages of foreign capital inflows. In other words, foreign capital participation in planning processes is a game changer. Planning can be especially helpful in hard times, such as during crises or periods of uncertainty. When faced with difficult circumstances, companies that have a solid plan in place are better equipped to navigate these challenges and emerge stronger on the other side.

1. Literature review

Planning processes are a crucial part of effective corporate strategies. These give organisations a road map for navigating the complicated and competitive world of contemporary commerce by creating clear goals and recognising potential impediments, as well as enabling the implementation of effective plans to attain goals. According to Armstrong and Taylor (2015), planning processes provide companies with several advantages. First, they aid in the clarification of corporate objectives, ensuring that all parties involved pursue the same goals. This fosters a feeling of cohesion and direction within the business, which enhances output, engagement, and motivation. Second, they aid in the identification of prospective issues

and difficulties before they materialise. This makes it possible for companies to create backup plans and reduce risks, which lowers the possibility of costly errors or setbacks. Third, they aid in the efficient allocation of resources and the setting of priorities. This guarantees that the most important goals are taken care of first, optimising impact and effectiveness. Companies can therefore avoid distractions and keep a laser-like focus on what matters most by concentrating on the most crucial objectives. Finally, they encourage responsibility and openness within a company, which was also acknowledged by Teece (2018). Companies may hold themselves and their staff accountable for their results by setting clear goals and objectives. As a result, creativity and growth are stimulated, fostering a culture of excellence and continual improvement. In a similar vein, Estrela & Vargas (2012) suggested that planning processes help companies to navigate uncertainty with greater confidence and accomplish their goals with the greatest effectiveness and efficiency by offering a framework for precise goal setting, risk reduction, resource allocation, and accountability.

The planning process involves several critical steps, including setting goals, generating plans, marketing planning, production planning, personnel planning, financial and investment planning, and monitoring. In this paper, we explore why these planning processes are important and how they contribute to the success of an organisation. For any company, setting clear and quantifiable goals is the first step towards success (O'Connor et al., 2023). Goals give direction and focus to employees' efforts to achieve them. They also act as a yardstick for performance assessment and correction to attain the desired results (Lančarič et al., 2014). This goes hand-in-hand with generating plans. Planning entails coming up with methods to help the company achieve its objectives. This involves determining the resources required, deadlines,

and particular steps needed to accomplish the goals. Plans ensure that resources are used effectively and efficiently and provide a roadmap to accomplishing goals (Griffin, 2013). To present a company to the world of business, marketing planning is needed. Planning marketing strategy is crucial to every business that wants to sell goods or services. This entails conducting market analysis, determining the target market, and generating a plan to reach and influence it. Organisations can boost sales and revenue, build brand awareness, and maintain competitiveness by utilising marketing strategy (Lančarič et al., 2014; Ruschak et al., 2023). With the appropriate goals and marketing planning in place, it is necessary to draw up a production plan. Choosing the procedures, resources, and delivery schedules needed to produce goods or provide services is known as production planning. Effective production planning guarantees that a company can satisfy customer demand, cut costs, and limit waste (Javed et al., 2022). Organising the labour force, or so-called personnel planning, is also a crucial part of doing business. Personnel planning involves determining an organisation's labour needs, not only in terms of numbers, but also skills and experience, as well as the development of plans for hiring, educating, and retaining staff. Organisations can increase productivity, reduce staff turnover rates, and establish competent workforces with the aid of effective personnel planning (Javed et al., 2022). Financial and investment planning helps a company to allocate its financial resources wisely. According to Koubek (2015), creating plans to efficiently manage an organisation's finances is a component of financial and investment planning. This involves investment planning, forecasting, and budgeting. Organisations can optimise revenues, cut costs, and make wise investment decisions with the aid of effective finance and investment planning. Last, but not least, it is necessary to monitor plans. The practice of

keeping tabs on and assessing how well an organisation is doing in terms of attaining its objectives is known as monitoring. This involves comparing actual outcomes with anticipated outcomes and making the appropriate adjustments. Monitoring enables businesses to identify and resolve difficulties before they escalate into bigger concerns.

Planning processes are essential to the success of every organisation. They provide focus and direction for achieving goals (Straková, 2019). Planning processes ensure that resources are used wisely, risks are reduced, and opportunities are maximised. Organisations can accomplish their objectives, maintain their competitiveness, and experience sustainable growth by putting various planning processes into practice (Gutierrez et al., 2009; Maylor and Turner, 2017; Pyszczyński et al., 2015; Daft and Albers, 2012). Within this context, foreign capital participation can create benefits, albeit not always. There are authors who point to the adverse effects thereof, for a company in terms of inefficiency, for example, but also for society in the forms of corruption and unfair business practices. It is therefore necessary to consider the personal interests of those who support foreign capital participation in planning processes. It is these interests that have radically changed in recent times, especially in the aftermath of the COVID-19 pandemic (Liu et al., 2019; Bahoo et al., 2020). This issue therefore informs the basis for the theoretical part of this paper on foreign capital participation in the post-COVID-19 era within Sustainable Strategic Management planning processes. It is in such situations that such processes need to be in place to help organisations navigate difficult times.

It is for this reason that, in order to investigate this issue, the decision was made to conduct interviews and a questionnaire survey into seven aspects of the planning process, namely setting goals, generating plans, marketing planning, production

planning, personnel planning, financial and investment planning, and monitoring. The data obtained were subjected to non-parametric tests and post hoc tests. The results of these tests were subsequently interpreted and used in the discussion and for drawing conclusions.

The role of foreign capital participation in planning processes

Foreign capital participation can open up new financial avenues for companies. This may be crucial for companies who have trouble accessing finance on their domestic market or need a great deal of money to grow and expand (Metais et al., 2022). By lowering the risk of an organisation becoming overly dependent on a small number of shareholders or domestic investors, foreign capital participation can help to diversify a company's ownership structure. Foreign investors frequently contribute new technology, management strategies, and competencies that can boost a company's efficiency and competitiveness (Du et al., 2022). By generating new jobs, raising the demand for local goods and services, and fostering economic growth, foreign capital participation can also have beneficial spillover effects on the local economy. A company's planning processes may be significantly impacted by foreign capital participation, benefiting in a variety of ways. Firstly, foreign investment can increase a company's financial resources. As a consequence, it may be able to expand its operations, invest in new projects, and pursue opportunities that were previously out of reach, which may require planning objectives to be modified (Stark, 2022; Ben-Daya et al., 2019; Kapferer, 2017; O'Connor et al., 2023). Secondly, foreign investors can contribute important skills to a company. They may have worked in several industries or markets, or may be familiar with cutting-edge technologies or business strategies. This could help a company to strengthen its planning processes and

find fresh prospects for expansion (Samset and Volden, 2016; Badewi, 2016). However, according to Cachón-Rodríguez et al. (2022), foreign capital participation can also pose problems. For instance, when interacting with international investors, a company may need to overcome language obstacles or adapt to new cultural or regulatory standards. In addition, Chang et al. (2010) suggested that disputes amongst stakeholders may arise as a result of a flood of foreign investment. Within this context, local shareholders or employees may perceive that the interests of foreign investors are prioritised over their own. Overall, while foreign capital participation can have a positive impact on companies, it is crucial for them to carefully assess how it may affect their stakeholder relationships and planning processes. By doing so, they can ensure that they maximise their chances of attracting foreign investment, whilst safeguarding their long-term interests. It goes without saying that some authors point to the negative consequences of foreign capital participation. Examples include Paramati et al. (2017) with regards to the impact on GDP, and Bena et al. (2017) with regards to the long-term implications for companies.

This paper highlights the value of planning processes for accomplishing organisational objectives, especially in times of crisis or uncertainty. Planning processes help to define a company's goals, identify possible problems, effectively allocate resources, and promote an open and accountable culture. Goal setting, generating plans, marketing planning, production planning, personnel planning, financial and investment planning, and monitoring are just a few of the crucial elements in the planning process. The issue of how foreign capital participation can diversify a company's ownership structure and provide new financial opportunities for business is also discussed herein. According to Amin and Viganola (2023), the COVID-19 era showed that better

access to finance reduces the likelihood of a decline in sales. Other challenges were, according to Song et al. (2020), that many companies changed their business practices just after the pandemic and focused on other areas of business, or moved production from one country to another. Within this context, Khanthavit (2020) pointed to abnormal behaviour, even irrational behaviour, when it comes to foreign capital participation, with investors trying to protect their capital, but doing so badly by withdrawing from large investments or not completing projects which are already underway.

Hypotheses resulting from factors that influence planning processes

As indicated in the literature review, several factors influence the planning process in companies. For the purposes of this study, the four main factors – legal form, number of employees, foreign capital participation, and field of activity – are addressed in further detail to provide a better understanding of the development of the formulated hypotheses.

The legal form of a business refers to the structure or entity under which it operates and is recognised by law. This is important in that it affects how a business is operated, regulated, and taxed. Bondarenko et al. (2017) pointed out how legal form requirements change the work of management in terms of strategy formulation in times of macroeconomic crises.

The number of employees reflects the size of a company. It is a factor that is considered important in many studies, such as those by Ainin et al. (2015) and Dahmash (2015). Even though it is not directly related to the issue at hand, it has been included here. On this basis, the respondents to the questionnaire survey can be divided into the following company size categories: 78 micro-enterprises, 105 small enterprises, 87 medium-sized enterprises, and 80 large enterprises.

Foreign capital participation in a company's capital structure determines the strength of influence of investors. Of the 350 respondents, the following applies: 190 exclusively Slovak (100% SK), 104 balanced (1–99% SK) and 56 exclusively foreign (0% SK).

The field of activity of a company is an important indicator of the structure and composition of an economy. It helps one to gain an understanding of how resources are being utilised and what types of goods and services are being produced and consumed.

In order to determine the degree to which planning processes depend on these factors in the companies surveyed, the following hypotheses were formulated:

- H1:** *There are differences in the planning processes of small, medium and large enterprises, with large enterprises employing more extensive and sophisticated planning processes compared to small and medium-sized enterprises.*
- H2:** *There are differences in planning processes between different legal forms of business. Specifically, limited liability companies and joint-stock companies are more likely to employ extensive and sophisticated planning processes compared to cooperatives.*
- H3:** *There are differences in planning processes between companies with and without foreign capital participation. Companies with foreign capital participation are more likely to employ extensive and sophisticated planning processes compared to companies without foreign capital participation.*
- H4:** *There are differences in planning processes between businesses operating in different fields, pointing to the need for specific processes in each field.*

2. Methodology

This paper evaluates the previously identified aspects of the planning process in companies operating in Slovakia. This includes the identification of the strengths and weaknesses of the planning process in specific companies, as well as proposals for rationalisation measures to improve their planning processes.

The research was conducted in the form of interviews and a questionnaire survey. Prior to sending out the questionnaire, pilot verification was carried out with the help of experts on the given subject and representatives from the private sector, with improvements made accordingly. As the presented study is based on previous research, which included a pilot study, pilot verification was considered sufficient. However, interviewers had to be familiar with the topic of interest and the questionnaire itself as part of the preparatory phase. Of the 400 companies addressed, 350 cooperated, representing a response rate of 87.50%. Following data adjustment (Teunissen, 2003), all 350 companies were included in the sample set. For this research, stratified randomisation was applied. The respondents were selected based on one criterion – the participating legal entity must be registered in the Slovak Commercial Register. The only additional prerequisite was that a company representative who was aware of the issues surrounding planning processes filled in the questionnaire. This inevitably meant addressing a director or top manager. For the purpose of this study, the main focus was direct foreign capital participation.

The questionnaire consisted of 69 questions divided into seven categories, i.e. the identified aspects of the planning process, namely setting goals, generating plans, marketing planning, production planning, personnel planning, financial and investment planning, and monitoring. For each response sought, a Likert scale of 1–7 was applied: 1 – completely agree; 4 – neutral; 7 – completely disagree. To analyse the differences in the application of planning processes, the following null hypothesis was formulated:

***H0** – the more correctly a company implements the individual planning processes, the more efficient the company is and the less critical the individual planning phases are.*

At the same time, in order to determine whether the planning process depends on the selected factors, the following research questions arose:

***RQ1** – Does the planning process in the company depend on foreign capital participation?*

***RQ2** – Are there differences in the planning processes in companies with and without foreign capital participation?*

For the purpose of this study, variable optimisation was applied for a better understanding of the individual factors (see Table 1 below).

Table 1. Variable optimisation

Variable	Operationalisation	Method of measurement
Foreign capital participation	To what degree is foreign capital represented in your company?	1 – 0%; 2 – 1 to 50%; 3 – 51 to 100%
Setting goals	Items 1-9	Likert scale 1-7: 1 – completely agree; 4 – neutral; 7 – completely disagree
Generating plans	Items 10-18	Likert scale 1-7: 1 – completely agree; 4 – neutral; 7 – completely disagree
Marketing planning	Items 19-26	Likert scale 1-7: 1 – completely agree; 4 – neutral; 7 – completely disagree
Production planning	Items 27-36	Likert scale 1-7: 1 – completely agree; 4 – neutral; 7 – completely disagree
Personnel planning	Items 37-48	Likert scale 1-7: 1 – completely agree; 4 – neutral; 7 – completely disagree
Financial and investment planning	Items 49-62	Likert scale 1-7: 1 – completely agree; 4 – neutral; 7 – completely disagree
Monitoring	Items 63-69	Likert scale 1-7: 1 – completely agree; 4 – neutral; 7 – completely disagree

Source: own elaboration

The methodological procedure for the analysis of the results of the questionnaire survey started with the calculation of Cronbach's alpha (Viladrich et al., 2017) for the tested model. This indicates the reliability of the test. The results showed a set value of 0.955, which is considered acceptable, implying that the test is therefore suitable for statistical investigation. In the tables in the results section, the mean values and standard deviations are given per item, i.e. question. The total number of observations for all items was 350. The next step was to run an autocorrelation test. This produced results between 1.5 and 2.5 for all factors, thereby not confirming autocorrelation. An intermediate step in the procedure was the application of the Shapiro-Wilk normality test (Shapiro and Francia, 1972), which demonstrated that the main factor is not normally distributed for each level of independent variables. For

the purpose of data distribution, we applied the non-parametric Mann-Whitney and Kruskal-Wallis tests. In relation to the latter, the Bonferroni post hoc test was subsequently applied to determine differences in individual factors. The results of the tests are summarised in the discussion and conclusion of this work. For the purposes of data analysis, IBM SPSS Statistics Subscription 1.0.0.1447 was used.

3. Research results

The presented results form part of a large-scale study into various aspects of planning processes within a selected group of companies in Slovakia. For clarification, a summary of the general model is presented here. The Durbin-Watson test is applied to compute a test statistic that measures the degree of autocorrelation in the residuals. In this case, the model summary value is

2.112. Subsequently, due to the non-normal distribution of the data, the non-parametric Kruskal-Wallis test (Kruskal and Wallis, 1952) was applied based on the assumption that statistically significant differences exist between our chosen factors and the individual variables. Here, only the results for the factor “foreign capital participation” are presented. The mean values for the items (questions I1-I9) are presented in Table 2, followed by the statistically significant differences in Table 3.

Table 2. Mean values per item for the “Setting goals” section

Foreign capital participation	I1	I2	I3	I4	I5	I6	I7	I8	I9
1 (0%)	5.49	4.52	5.20	5.65	5.85	5.78	6.05	6.28	6.28
2 (1–50%)	5.62	4.93	5.47	5.35	5.55	5.85	5.88	6.16	6.03
3 (51–100%)	5.96	5.53	6.04	5.85	6.00	5.96	6.20	6.27	6.27
Total	5.61	4.81	5.41	5.59	5.78	5.83	6.03	6.24	6.20

Source: own elaboration

Table 3. Statistically significant differences for the “Setting goals” section of foreign capital participation

	I1	I2	I3	I4	I5	I6	I7	I8	I9
Kruskal-Wallis H	6.883	10.926	12.554	3.825	5.720	1.054	.827	2.956	2.066
Asymp. sig.	0.032	0.004	0.002	0.148	0.057	0.590	0.661	0.228	0.356
Post hoc analyses	1–3	1–3	2–3 1–3						

Source: own elaboration

The test statistics show significant values for questions I1-I3. I1 examines whether the company has defined long-term goals, I2 whether long-term goals are set for a period of five years or more, and I3 whether medium-term goals follow long-term goals. We can attribute the differences to the different intentions of the individual companies, as foreign capital participation largely affects the very goals of the company. Only three out of the nine items generated statistically significant differences. Companies with more than 50% foreign capital participation and those without any foreign capital participation were found to differ from one another. According to the statistically significant

differences found, organisations with higher levels of foreign capital participation are more focused on defining long-term goals for the organisation and are better at understanding how to develop short- and medium-term goals.

The generation of plans refers to the process of developing a detailed strategy or roadmap for achieving a specific goal or objective. This involves identifying the steps or actions that need to be taken, allocating resources and timelines, and outlining potential obstacles and contingencies. The mean values for the items (questions I10-I18) are presented in Table 4, followed by the statistically significant differences in Table 5.

Table 4. Mean values per item for the “Generating plans” section

Foreign capital participation	I10	I11	I12	I13	I14	I15	I16	I17	I18
1(0%)	3.05	5.39	5.52	4.71	2.77	5.14	4.86	5.26	4.49
2 (1–50%)	4.07	5.18	4.97	5.39	4.74	5.47	4.71	5.09	5.02
3 (51–100%)	4.33	5.57	5.90	5.91	4.78	5.75	5.53	5.62	4.87
Total	3.56	5.36	5.41	5.11	3.66	5.34	4.92	5.27	4.70

Source: own elaboration

Table 5. Statistically significant differences for the “Generating plans” section of foreign capital participation

	I10	I11	I12	I13	I14	I15	I16	I17	I18
Kruskal-Wallis H	18.606	1.608	6.529	15.383	53.033	8.720	7.317	3.676	4.568
Asymp. sig.	0.000	0.447	0.038	0.000	0.000	0.013	0.026	0.159	0.102
Post hoc analyses	2–3 1–3		2–3	1–3	1–3 1–2	1–3	2–3 1–3		

Source: own elaboration

The test statistics show significant values for questions I10, I12, I13, I14, I15 and I16. I10 examines whether the company has developed plans for a period of five to eight years, I12 plans for a period of less than one year, I13 plans for functional areas (marketing, production, etc.), I14 the presence of a separate planning department, I15 whether planning precedes individual activities, and I16 the existence of plans in the internal environment. The responses to I14 suggest that some smaller companies do not possess the means to create such departments. The responses to I15 and I16 suggest these are critical points in the planning process. The resulting differences are evident, for instance, in the more precise creation of plans for both short-term and long-term periods (I10 and I12), as well as in the creation of plans according to individual functional areas

(I13), whereby it is clear that businesses with foreign capital participation pay more attention to this, which is reflected in the existence of personnel plans, marketing plans, production plans, and financial plans. Likewise, such companies are more likely to develop integrated plans (I16) based on the findings of analyses of the internal environment.

Marketing planning is the process of creating a detailed roadmap for all marketing activities that an organisation will undertake in a given period, typically a year. This involves setting marketing objectives, identifying target markets, developing marketing strategies, creating a budget, and determining the parameters that will be used to measure success. The mean values for the items (questions I19–I26) are presented in Table 6, followed by the statistically significant differences in Table 7.

Table 6. Mean values per items for the “Marketing planning” section

Foreign capital participation	I19	I20	I21	I22	I23	I24	I25	I26
1 (0%)	5.07	5.19	4.70	5.88	5.34	5.00	5.11	4.60
2 (1–50%)	5.34	5.39	4.97	5.69	5.43	5.17	5.43	4.87
3 (51–100%)	5.58	5.60	5.40	6.05	5.70	5.62	5.36	5.19
Total	5.23	5.32	4.89	5.85	5.43	5.15	5.25	4.78

Source: own elaboration

Table 7. Statistically significant differences for the “Marketing planning” section of foreign capital participation

	I19	I20	I21	I22	I23	I24	I25	I26
Kruskal-Wallis H	6.391	4.311	4.009	2.894	1.600	6.304	2.629	5.370
Asymp. sig.	0.041	0.116	0.135	0.235	0.449	0.043	0.269	0.068
Post hoc analyses	1 – 3					1 – 3		

Source: own elaboration

The test statistics show significant values for only two questions, namely I19 and I24, whereby the largest statistically significant difference is between companies with no foreign capital participation and those with more than 50% participation. In those companies with foreign capital participation, the marketing strategy is clearly stated (I19) and is based primarily on the findings of market research (I24). No other statistically significant differences were found (no significance values larger than 0.05).

Production planning is the process of preparing a detailed plan for manufacturing a product or providing a service. The goal of production planning is to optimise the use of resources to ensure that products are produced efficiently, cost-effectively, and are of high quality. The mean values for the items (questions I27–I36) are presented in Table 8, followed by the statistically significant differences in Table 9.

Table 8. Mean values per item for the “Production planning” section

Foreign capital participation	I27	I28	I29	I30	I31	I32	I33	I34	I35	I36
1 (0%)	4.82	5.44	5.46	5.38	4.95	4.29	3.70	3.97	5.07	5.35
2 (1–50%)	4.80	5.57	5.62	5.60	5.12	4.73	4.54	4.49	5.30	5.48
3 (51–100%)	5.29	6.06	6.29	6.11	5.63	5.71	5.15	5.15	6.21	5.84
Total	4.89	5.58	5.64	5.56	5.11	4.67	4.19	4.31	5.32	5.47

Source: own elaboration

Table 9. Statistically significant differences for the “Production planning” section of foreign capital participation

	I27	I28	I29	I30	I31	I32	I33	I34	I35	I36
Kruskal-Wallis H	2.474	4.327	7.801	6.423	3.252	18.632	16.511	13.498	13.843	1.723
Asymp. sig.	0.290	0.115	0.020	0.040	0.197	0.000	0.000	0.001	0.001	0.422
Post hoc analyses			2–3 1–3	1–3		2–3 1–3	1–2 1–3	1–3	2–3 1–3	

Source: own elaboration

Based on the findings, the “foreign capital participation” factor indicates statistically significant changes in the distribution of variables I29, I30, I32, I33, I34, and I35. There were no discernible variations in the evaluation of the remaining variables. The post hoc test was applied to determine the statistically significant differences between companies with up to 50% domestic capital and those with a greater share of foreign capital participation. Upon closer scrutiny, the incorporation of marketing strategies (I29) and environmental protection standards (I30) into production plans, the implementation of the JIT concept (I32), results of trend analyses (I33), the preparedness of

plans for changes in demand (I34), as well as the monitoring of these plans (I35) is more widespread among companies with more than 50% foreign capital participation. It is in these areas that the advantages of foreign know-how benefit companies and help them to gain ground.

Personnel planning is the process of ensuring that an organisation has the right people in the right roles at the right time to achieve its goals. This includes the basic work force, as well as all specialists and external workers. The mean values for the items (questions I37-I48) are presented in Table 10, followed by the statistically significant differences in Table 11.

Table 10. Mean values per item for the “Personnel planning” section

Foreign capital participation	I37	I38	I39	I40	I41	I42	I43	I44	I45	I46	I47	I48
1[0%]	5.49	4.56	4.06	5.87	5.84	1.98	5.68	5.74	4.35	5.05	4.98	5.15
2[1–50%]	5.81	3.62	4.68	5.88	6.00	3.44	4.79	5.77	4.77	4.77	4.79	5.45
3[51–100%]	5.80	3.10	4.90	5.76	5.73	4.35	5.30	5.98	5.09	5.42	4.57	5.45
Total	5.63	4.06	4.38	5.86	5.87	2.79	5.35	5.79	4.59	5.03	4.86	5.29

Source: own elaboration

Table 11. Statistically significant differences for the “Personnel planning” section re foreign capital participation

	I37	I38	I39	I40	I41	I42	I43	I44	I45	I46	I47.	I48
Kruskal-Wallis H	0.814	22.537	8.941	0.886	0.649	52.269	15.448	1.994	5.672	4.457	2.378	1.431
Asymp. sig.	0.666	0.000	0.011	0.642	0.723	0.000	0.000	0.369	0.059	0.108	0.305	0.489
Post hoc analyses		1–3 2–1	1–3			1–2 1–3	2–1					

Source: own elaboration

The test statistics show significant values for questions I38, I39, I42, and I43. I38 examines whether intuitive methods are used during the process of determining the needs of employees, I39 whether quantitative methods are used for the same, I42 the use of personnel agencies, and I43 the lack of workers in the company. I38 shows, at an asymptomatic significance value lower than 0.05, differences between companies without foreign capital participation and those with more than 50% foreign capital participation. This points to a greater use of intuitive methods (I38) in personnel planning in domestic companies and, on the contrary, a greater use of quantitative methods (I39) in companies with foreign capital participation. An understandable difference can be seen especially in the greater use of personnel agencies (I42) in the recruitment of employees in companies

with foreign capital participation, which is almost absent in domestic companies. A shortage of workers (I43) in a company can lead to decreased productivity, increased workload on existing employees, longer lead times, and difficulties in meeting customer demands, ultimately affecting a company’s bottom line. Surprisingly, we found differences between the companies surveyed.

Financial and investment planning is the process of developing strategies and actions to manage financial resources effectively to achieve specific goals. This process involves analysing an individual’s or an organisation’s current financial situation, identifying financial goals, and developing a plan to achieve those goals. The mean values for the items (questions I49-I62) are presented in Table 11, followed by the statistically significant differences in Table 12.

Table 12. Mean values per item for the “Financial and investment planning” section

Foreign capital participation	I49	I50	I51	I52	I53	I54	I55	I56	I57	I58	I59	I60	I61	I62
1(0%)	5.79	3.74	5.38	5.14	5.33	6.25	2.46	4.64	4.62	3.95	4.93	5.17	3.24	5.56
2(1–50%)	5.57	4.52	5.65	4.72	5.29	6.10	4.11	4.53	4.79	4.47	4.37	4.72	3.48	5.64
3(51–100%)	6.50	5.60	6.32	5.90	6.44	6.45	4.10	4.98	5.00	4.64	5.71	5.51	3.21	5.84
Total	5.84	4.29	5.62	5.14	5.50	6.24	3.19	4.66	4.73	4.20	4.90	5.10	3.31	5.63

Source: own elaboration

Table 13. Statistically significant differences in the “Financial and investment planning” section foreign capital participation

	I49	I50	I51	I52	I53	I54	I55	I56	I57	I58	I59	I60	I61	I62
Kruskal-Wallis H	12.422	29.117	16.488	12.455	25.129	3.789	37.016	1.650	1.802	4.932	14.902	8.378	1.116	1.199
Asymp. sig.	0.002	0.000	0.000	0.002	0.000	0.150	0.000	0.438	0.406	0.085	0.001	0.015	0.572	0.549
Post hoc analyses	2-3 1-3	1-3 1-2 2-3	1-3 2-3	1-3 2-3	1-3 2-3		1-3 1-2				2-3 1-3	2-3		

Source: own elaboration

According to our assumptions, the percentage of foreign capital participation in companies has an impact on financial planning. This is reflected in the results of the data subjected to the Kruskal-Wallis test, which shows eight asymptotically significant values less than 0.05. This applies to questions I49, I50, I51, I52, I53, I55, I59, and I60. A pairwise comparison and subsequent post hoc test showed statistically significant variations between the individual properties of the factor. The differences show that the level of financial and investment planning is higher in companies with foreign capital participation, and that this is mainly due to the fact that they have developed both short-term (I49) and long-term (I50) financial plans, for the development of which financial analyses are made (I51) and are subsequently reflected

in the companies’ budgets (I53). As for investments, the difference lies in the fact that these are assessed based on the pay-back period to a greater extent (I59). From the above, it can be concluded that foreign capital participation largely influences individual variables in the area of financial and investment planning.

Monitoring refers to the ongoing observation and evaluation of the effectiveness of plans to ensure that they are on track and producing the desired results. The monitoring process involves comparing actual results to the planned results, identifying any variances or deviations, and taking corrective action as necessary to keep the plans on track. The mean values for the items (questions I63-I69) are presented in Table 14, followed by the statistically significant differences in Table 15.

Table 14. Mean values per item for the “Monitoring” section

Foreign capital participation	I63	I64	I65	I66	I67	I68	I69
1[0%]	5.61	5.84	5.49	5.29	5.85	5.60	5.78
2[1-50%]	5.70	5.76	5.49	4.95	5.83	5.45	5.63
3[51-100%]	5.87	6.24	5.92	4.96	6.17	5.98	5.85
Total	5.68	5.89	5.56	5.14	5.89	5.62	5.75

Source: own elaboration

Table 15. Statistically significant differences for the “Monitoring” section re foreign capital participation

	I63	I64	I65	I66	I67	I68	I69
Kruskal-Wallis H	1.493	3.845	4.198	3.923	3.201	7.921	1.000
Asymp. sig.	0.474	0.146	0.123	0.141	0.202	0.019	0.607
Post hoc analyses	2 – 3						

Source: own elaboration

The percentage of foreign capital participation was investigated as a factor that influences monitoring within the surveyed companies. The application of the Kruskal-Wallis test produced a statistically significant difference for I68 only. This indicates that the effectiveness of corrective measures is continuously monitored and evaluated more in companies with foreign capital participation. This demonstrates that these companies apply their know-how and adopt management methods across their subsidiaries or branches around the world. Without good quality monitoring and subsequent appropriate measures, it would not be possible for them to ensure company development.

4. Discussion

Depending on the particulars of the company and the nation in which it operates, the effects of COVID-19 on foreign capital participation have varied. According to Weilu et al. (2022), the pandemic has generally produced a difficult economic environment that could endanger foreign investment in companies. The disruption of global supply chains and the lower demand for goods and services has resulted in many businesses seeing their sales and profitability fall. As a result of the potential risk of a variable return on their investment, international investors may therefore feel discouraged from investing in such companies. Planning in companies has also changed post-COVID-19, with the pandemic creating new challenges and

uncertainty that has required companies to adapt and innovate. The pandemic highlighted the importance of having contingency plans and being prepared for unexpected events, with all business factors having to be reconsidered (Pradip et al., 2023).

Foley and Manova (2015), for example, stated that for international trade, foreign capital participation is beneficial for a company’s structure. Planning processes and the correct implementation thereof are, according to Xu et al. (2018), a must for future business evolution. Planning processes should not only apply to human capital. In fact, according to Dwivedi et al. (2021), companies need to prepare their organisations for emerging AI technology and to plan accordingly. However, foreign capital participation does not always produce benefits. Within this context, Manda et al. (2020) pointed out the impact thereof on different policies and specific industry practices among agricultural companies in Zimbabwe. Ďaďo et al. (2015) discussed the different strategies that arise within companies with foreign capital participation in Poland. Since Polish companies have a similar approach to business as the other V4 countries, of which Slovakia is one, this can only be reflected likewise. Within this context, Amdam and Benito (2022) pointed to the time temporality of foreign capital participation.

As part of the research presented in this paper, the importance of goal setting and planning for companies is discussed. While some companies focus on short-term goals, others emphasise a longer-term horizon

for building the future. Unfortunately, it appears that many companies choose the former approach over the latter, as has been confirmed in many studies. This may be due to a lack of a dedicated planning department in these companies. Results suggest that further research is needed to understand the influence of a planning department on the planning process and the effectiveness thereof (see Manda et al. (2020) re: agriculture). Results also point to the importance of marketing planning and its role in a company's success. This was the conclusion reached by Milstein et al. (2022), who also stated that competition analysis must necessarily be implemented in marketing plans if a company wants to succeed in the competitive struggle. In a similar vein, our results suggest that marketing plans should be integrated with production and sales plans to ensure the success of the planning process. We discussed the importance of personnel planning, educational programmes, and incentive programmes in achieving high-quality organisational results. This is supported by Oehmichen et al. (2018). Research shows that although companies pay attention to personnel planning, they often forget to implement incentive programmes. In addition, companies often use limited financial resources to invest in the renewal and modernisation of production capacity. That said, the use of financial analysis as background information is widely used in financial planning. Dyck et al. (2019) emphasised the importance of clear criteria and monitoring standards for effective plan implementation, and suggested moving towards a model of self-assessment for achieving greater impacts on organisational goals. However, studies abroad show that it is important to pay attention to long-term financial planning and goals, which play a key role in achieving good business results (Huang et al., 2015). The planning process in different companies is influenced by various factors such as legal form, company

size, foreign capital participation, and the area of activity within the national economy. Companies with higher levels of foreign capital participation also tend to have better levels of planning, as confirmed by Mihai (2014), who pointed out that this fact is characteristic for the countries of Central and Eastern Europe.

The main limitation of the study is the size of the sample set and therefore its representativeness. Despite this, we believe the study accurately reflects the situation on the ground and that the factors identified as strategic in the field of planning for companies operating in Slovakia are also valid for companies operating in the other V4 countries due to the similarities in their geopolitical situations and economic histories. For further research, we therefore suggest creating a larger sample set that reflects these facts.

Conclusions

Our exploration of foreign capital participation in company operations shed light on the significant role it plays in shaping planning processes. These processes were proven to vary significantly across different companies in Slovakia, leading to diverse outcomes. The aforementioned variations may include differences in strategic decision-making, risk assessment, stakeholder involvement, and cultural factors. Our results also showed that changing financial planning processes, economic strategies, the willingness to be more effective, and the ability to adapt faster to market changes also differs widely. Companies were not ready for such a situation before COVID-19, which is why many companies found themselves struggling. Although they had ideas, they had no plans. We also found supportive arguments and research conducted in the V4 countries on similar issues. Our findings highlight the importance of understanding and addressing these differences in the

planning process when dealing with foreign capital participation in companies. This knowledge can assist stakeholders, including company managers, investors, policy-makers, and international business professionals, in making informed decisions and formulating effective strategies to optimise foreign capital participation outcomes. The result is high-quality strategic planning that also takes into account the possibility of crises, such as COVID-19. Further research in this area could delve deeper into specific planning process variations in different countries, industries, and company sizes, and explore how these variations impact foreign capital participation and related outcomes. In addition, studying the role of regulatory frameworks, legal structures, and institutional factors in shaping planning processes and foreign capital participation dynamics would provide valuable insights for both academics and practitioners.

The limitations of the presented research relate to the use of data only on companies operating in Slovakia and the size of the sample set. If a larger sample set were to be established, there would be opportunities to investigate the impact of a wider range of factors. In addition, it is not possible to guarantee that the respondents expressed their answers in the most honest manner. However, we believe that we have brought attention to the importance of monitoring planning processes in companies, including within the context of foreign capital participation. We also see opportunities for expanding this research to other countries in the future and attempting to examine specific planning processes in more detail. It is also important here to point out the influence of other factors on planning processes, and therefore the strategic direction of companies as well.

References

- Ainin, S., Parveen, F., Moghavvemi, S., Jaafar, N. I., & Mohd Shuib, N. L. (2015). Factors influencing the use of social media by SMEs and its performance outcomes. *Industrial Management & Data Systems*, 115(3), 570-588.
- Amdam, R. P., & Benito, G. R. G. (2022). Temporality and the first foreign direct investment. *Journal of World Business*, 57(5) doi:10.1016/j.jwb.2022.101363
- Amin, Mohammad & Viganola, Domenico. (2023). Does better access to finance help firms deal with the COVID-19 pandemic? Evidence from firm-level survey data. *Journal of International Development*. 10.1002/jid.3787.
- Armstrong, Michael. – Taylor, Stephen. 2015. Řízení lidských zdrojů. Praha: Grada Publishing a.s, 2015. 928 s. ISBN 978-80-247-5258-7.
- Badewi, A. (2016). The impact of project management (PM) and benefits management (BM) practices on project success: Towards developing a project benefits governance framework. *International Journal of Project Management*, 34(4), 761-778.
- Bahoo, S., Alon, I., & Paltrinieri, A. (2020). Corruption in international business: A review and research agenda. *International Business Review*, 29(4), 101660. <https://doi.org/10.1016/j.ibusrev.2019.101660>
- Bena, J., Ferreira, M. A., Matos, P., & Pires, P. (2017). Are foreign investors locusts? The long-term effects of foreign institutional ownership. *Journal of Financial Economics*, 126(1), 122-146. DOI: 10.1016/j.jfineco.2017.07.005
- Ben-Daya, M., Hassini, E., & Bahroun, Z. (2019). Internet of things and supply chain management: a literature review. *International Journal of Production Research*, 57(15-16), 4719-4742.
- Bondarenko, T. G., Isaeva, E. A., Orekhov, S. A., & Soltakhanov, A. U. (2017). Optimization of the company strategic management system in the context of economic instability. *European Research Studies Journal*, 20(2), 3-24.

- Cachón-rodríguez, G., Blanco-gonzález, A., Pradoromán, C., & Del-castillo-feito, C. (2022). How sustainable human resources management helps in the evaluation and planning of employee loyalty and retention: Can social capital make a difference?. *Evaluation and Program Planning*, 95, 102171.
- Chang, V., Wills, G., & De roure, D. (2010, July). A review of cloud business models and sustainability. In *2010 IEEE 3rd International Conference on Cloud Computing* (pp. 43-50). IEEE. DOI: 10.1109/CLOUD.2010.69
- Đađo, J., Wiktor, J. W., & Źbikowska, A. (2015). Foreign markets entry motives and strategies of polish exporters. *E a M: Ekonomie a Management*, 18(2), 135-150. doi:10.15240/tul/001/2015-2-010
- Daft, J., & Albers, S. (2012). A profitability analysis of low-cost long-haul flight operations. *Journal of Air Transport Management*, 19, 49-54. DOI: 10.1016/j.jairtraman.2012.01.010
- Dahmash, F. N. (2015). Size effect on company profitability: Evidence from Jordan. *International Journal of Business and Management*, 10(2), 58. DOI: 10.5539/ijbm.v10n2p58
- Du, D., Watkins, T., Ladbury, C., Qing, K., Han, C., Vora, N., ... & Liu, A. (2022). Automatic organ contour check: One essential step in autonomous treatment planning. *Medical Dosimetry*, 47(2), 197-201.
- Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., ... Williams, M. D. (2021). Artificial intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management*, 57 doi:10.1016/j.ijinfomgt.2019.08.002
- Dyck, A., Lins, K. V., Roth, L., & Wagner, H. F. (2019). Do institutional investors drive corporate social responsibility? International evidence. *Journal of financial economics*, 131(3), 693-714.
- Estrela, T., & Vargas, E. (2012). Drought management plans in the European Union. The case of Spain. *Water resources management*, 26(6), 1537-1553, DOI: 10.1007/s11269-011-9971-2
- Foley, C. F., & Manova, K. (2015). International trade, multinational activity, and corporate finance. *Annual Review of Economics*, 7(1), 119-146. doi: 10.1146/annurev-economics-080614-1
- Xu, L. D., Xu, E. L., & Li, L. (2018). Industry 4.0: State of the art and future trends. *International Journal of Production Research*, 56(8), 2941-2962. doi:10.1080/00207543.2018.1444806
- Griffin, Ricky. 2013. *Fundamentals of Management*. 7th ed, Cengage South-Western. 512 p. ISBN-13: 978 1133627494.
- Huang, Guofang; KHWAJA, Ahmed; SUDHIR, K. Short-run needs and long-term goals: A dynamic model of thirst management. *Marketing Science*, 2015, 34.5: 702-721.
- Javed, A. R., Shahzad, F., ur Rehman, S., Zikria, Y. B., Razzak, I., Jalil, Z., & Xu, G. (2022). Future smart cities requirements, emerging technologies, applications, challenges, and future aspects. *Cities*, 129, 103794. <https://doi.org/10.1016/j.cities.2022.103794>
- Kapferer, J. N. (2017). Managing luxury brands. *Advances in luxury brand management*, 235-249. DOI: 10.1007/978-3-319-51127-6_11
- Khanthavit, A. (2020). Foreign investors' abnormal trading behavior in the time of COVID-19. *Journal of Asian Finance, Economics and Business*, 7(9), 63-74. doi: 10.13106/jafeb.2020.vol7.no9.063
- Khorasani, S. T., & Almasifard, M. (2017). Evolution of management theory within 20 century: A systemic overview of paradigm shifts in management. *International Review of Management and Marketing*, 7(3), 134-137.
- Koubek, Josef. 2015. *Řízení lidských zdrojů: základy moderní personalistiky*. 5. rozš. a doplň. vyd. Praha: Management Press, 2015. 400 s. ISBN 978-80-7261-288-8.
- Lančarič, Drahoslav. – Savov, Radovan. – Kozáková J. 2014. *Firemné plánovanie*. Prvé vydanie. Nitra: Slovenská poľnohospodárska univerzita v Nitre, 2014. 231 s. ISBN 978-80-552-1263-0.
- Liu, B., Siyuan, Y., & Donaldson, J. (2019). Exploring the causes of immiserizing growth: a comparison of pathways. *Immiserizing Growth: When Growth Fails the Poor*, 106-135. doi: 10.1093/oso/9780198832317.003.0005

- Manda, S., Tallontire, A., & Dougill, A. J. (2020). Business 'power of presence': Foreign capital, industry practices, and politics of sustainable development in Zambian agriculture. *The Journal of Development Studies*, 56(1), 186-204.
- Maylor, H. and Turner, N. (2017), "Understand, reduce, respond: project complexity management theory and practice", *International Journal of Operations & Production Management*, Vol. 37 No. 8, pp. 1076-1093. <https://doi.org/10.1108/IJOPM-05-2016-0263>
- Metais, M.O. & Jouini, O. & Perez, Y. & Berrada, J. & Suomalainen, E., 2022. "Too much or not enough? Planning electric vehicle charging infrastructure: A review of modeling options," *Renewable and Sustainable Energy Reviews*, Elsevier, vol. 153(C).
- Mihai, Iuliana Oana. A Literature Review of Foreign Ownership and Company Performance. *Annals of the University Dunarea de Jos of Galati: Fascicle: I, Economics & Applied Informatics*, 2014, 20.2.
- Milstein, Nir, et al. Rivalry and performance: A systematic review and meta-analysis. *Organizational Psychology Review*, 2022, 12.3: 332-361.
- O'Connor, E., Evers, N., & Vega, A. (2023). Port capacity planning—A strategic management perspective. *Marine Policy*, 150, 105537.
- Oehmichen, J., Wolff, M., & Zschoche, U. (2018). Employee participation in employee stock ownership plans: Cross-level interaction effects of institutions and workgroup behavior. *Human Resource Management*, 57(5), 1023-1037. DOI: 10.1002/hrm.21885
- Paramati, S. R., Apergis, N., & Ummalla, M. (2017). Financing clean energy projects through domestic and foreign capital: The role of political cooperation among the EU, the G20 and OECD countries. *Energy economics*, 61, 62-71.
- Pradip Banerjee, Sandip Dhole, Sagarika Mishra. (2023). Operating performance during the COVID-19 pandemic: Is there a business group advantage?, *Pacific-Basin Finance Journal*, Volume 79. 2023. 102031. ISSN 0927-538X. <https://doi.org/10.1016/j.pacfin.2023.102031>.
- Pyszczyński, T., Solomon, S., & Greenberg, J. (2015). Thirty years of terror management theory: From genesis to revelation. In *Advances in experimental social psychology* (Vol. 52, pp. 1-70). Academic Press.
- Ruschak, M., Caha, Z., Talíř, M., & Konečný, M. (2023). The application of CSR in marketing communication and its potential impact on customer perceived value. *Entrepreneurship and Sustainability Issues*, 10(4), 223. doi: 10.9770/jesi.2023.10.4(14)
- Samset, K., & Volden, G. H. (2016). Front-end definition of projects: Ten paradoxes and some reflections regarding project management and project governance. *International journal of project management*, 34(2), 297-313. DOI: 10.1016/j.ijproman.2015.01.014
- Song, C., Zhuang, Y., Liu, Z., Zhang, H., & Ding, Y. (2022). Emerging trend on international capital flows and global value chains reconstruction under post COVID-19: a review. *Transnational Corporations Review*, 14(3), 271-285. doi: 10.1080/19186444.2021.2019551
- Stark, J. (2022). Product lifecycle management (PLM). In *Product Lifecycle Management (Volume 1) 21st Century Paradigm for Product Realisation* (pp. 1-32). Cham: Springer International Publishing. ISBN- 978-3030985776
- Straková, Jarmila. 2019. Podnikové prostředí Základ pro strategické řízení a rozhodování. Plzeň: Aleš Čeněk, 2019. 220 s. ISBN 978-80-7380-755-9.
- Teece, D. J. (2018). Business models and dynamic capabilities. *Long Range Planning*, 51(1), 40-49. doi:10.1016/j.lrp.2017.06.007
- Teunissen, P. J. (2003). Adjustment theory. VSSD.
- Viladrich, C., Angulo-Brunet, A., & Doval, E. (2017). A journey around alpha and omega to estimate internal consistency reliability. [Un viaje alrededor de alfa y omega para estimar la fiabilidad de consistencia interna] *Anales De Psicología*, 33(3), 755-782. doi:10.6018/analesps.33.3.268401

Weilu Hou, Qin Shi, Liquan Guo. (2022). Impacts of COVID-19 pandemic on foreign trade intermodal transport accessibility: Evidence from the Yangtze River Delta region of mainland China, *Transportation Research Part A: Policy and Practice*, Volume 165, 2022, p. 419-438, ISSN 0965-8564, <https://doi.org/10.1016/j.tra.2022.09.019>.

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