

Volume 11 (2023)

ISSN: 2300-5947

No. 1

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Cover Design:

Wojciech Cigłło Studio DTP, www.dtp-studio.pl

Technical editor and typesetting:

Wojciech Cigłło Studio DTP, www.dtp-studio.pl

Printed by:

totem.com.pl

ISSN 2300-5947

The printed version of the journal **Security Forum** is the original one.

The electronic version of the journal is available as a copy of the original printed version.

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Scientific Publishing of WSB University, Ciepłaka 1c, 41-300 Dąbrowa Górnicza, Poland

WSB University

FORUM

Scientiae Oeconomia

Vol. 11 (2023) • No. 1

Published by WSB University

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In memory of Professor Włodzimierz Sroka



Professor Włodzimierz Krzysztof Sroka

(15 August 1967 – 21 January 2023)

Editor-in-Chief of *Forum Scientiae Oeconomia*. Polish economist, manager, associate professor (doctor habilitatus) of economic sciences within the scope of management and quality sciences, and scholar associated with WSB University.

Włodzimierz Sroka was a renowned academic specialising in the areas of strategic management, strategic alliances, innovation and entrepreneurship, and corporate social responsibility. His career was highly dynamic, and his activities were wide-ranging and multifaceted.

He graduated from the University of Economics in Katowice, where he defended his doctoral thesis in management sciences in 1999. In 2012, he was awarded the title of Doctor Habilitatus of Economic Sciences at the University of Žilina on the basis of his dissertation entitled *Management as the Key Success Factor of Alliance Networks*.

For the past 24 years, Professor Sroka was associated with WSB University, where he held the positions of Professor, Vice-Rector for Science, Deputy Head of the Department of Management, and Editor-in-Chief of *Forum Scientiae Oeconomia*. At his Alma Mater, Professor Sroka fulfilled numerous organisational and scientific tasks, e.g. as a supervisor of doctoral theses, reviewer in promotion proceedings, manager of research grants, mentor and academic tutor, and chairman of university committees.

A special role in Professor Sroka's achievements was played by activities carried out internationally: he was an animator, initiator and great promoter of the internationalisation of research as well as broad academic cooperation. His important work was a series of international scientific conferences under the common title "New trends in management and production engineering – regional, cross-border and global perspective", which have taken place continuously at WSB University since 2014. Those events (as well as post-conference materials published in renowned scientific periodicals) have attracted the attention of world-class researchers from six continents each year.

Professor Sroka constantly sought to strengthen cooperation with foreign academic centres. He lectured and conducted research at universities in Lithuania (Vilnius Gediminas Technical University, Aleksandras Stulginskis University and Kaunas University of Technology); Slovakia (the University of Žilina); Spain (CESTE International Business School in Zaragoza and the University of Huelva); and the Czech Republic (Mendel University in Brno and the Silesian University in Opava). Two periodic international projects directed by Professor Sroka have had a great scientific impact in particular, namely "Problems of contemporary management", on which he collaborated with the University of Žilina, and "Trends of business ethics and corporate social responsibility in central European Economics", which were implemented in cooperation with Corvinus University of Budapest and Mendel University in Brno.

Professor Sroka's scientific achievements include over 180 publications with a citation index reaching 2,400. He was the author and co-author of publications that have already become canonical in the represented discipline, including monographs and academic textbooks (published by e.g. Springer, Shaker Verlag and Cambridge International Publishing), as well as articles and scientific dissertations (indexed e.g. in Scopus and WoS databases). He held the positions of Editor-in-Chief

of the international journal “Forum Scientiae Oeconomia” and Deputy Editor-in-Chief of the “European Journal of International Management”. He formed part of the editorial teams of respected journals, including the “International Journal of Emerging Markets”, “Amfiteatru Economic”, “Cogent Business & Management” and “Organizacija”, and also served on the scientific advisory boards of numerous periodicals, including: “Sustainability”, “Engineering Management in Production and Services”, “Central European Business Review”, “Administrative Sciences”, “Marketing and Management of Innovations”, “Central European Journal of Public Policy”, “Journal of Tourism and Services”, “Journal of Eastern European and Central Asian Research”, “Marketing Instytucji Badawczych i Naukowych”, and “Cultural Management: Science and Education”.

Professor Sroka successfully combined science with his managerial activities, and held strategic positions in the corporate sector throughout his career. At Huta Katowice SA, he served as Deputy General Manager for Restructuring and Development (1992–2002). Afterwards, he held the positions of Vice-President of the Management Board at HK Stal Service Sp. z o.o. (2003–2006), Vice-President of the Management Board and Managing Director at KEM Profil sp. z o.o. (2006–2007), and Vice-President and later President of the Management Board at RAPZ sp. z o.o. (since 2008). He also served as a member of the supervisory boards at corporations including Huta Bankowa sp. z o.o., HK Grupa Kapitałowo-Inwestycyjna SA, Sentel sp. z o.o., GZNF “Fosfory” sp. z o.o. and WRA Sp. z o.o.

As a recognised scientist, teacher and expert, Włodzimierz Sroka was the holder of numerous awards and distinctions, of which perhaps the most prestigious was the Medal of the Commission of National Education from the Minister of National Education in recognition of his tireless, lifelong services to education.

We have lost an outstanding, wonderful and sensitive human being, an extraordinary teacher and researcher, and a renowned and respected expert. He made a great contribution to the development of science, the discipline of economics, intercollegiate and international cooperation, and his Alma Mater – WSB University. Professor Sroka’s scientific achievements will remain a legacy and a source of inspiration for future generations.

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Assessing the business models of Ukrainian IT companies

NESTOR SHPAK, ANASTASIYA KARPYAK, OLGA RYBYTSKA,
MARYANA GVOZD, WŁODZIMIERZ SROKA

Abstract

The characteristic features of Ukrainian IT companies are identified and analysed in the article. These characteristics are considered in the context of the application of business model elements from the point of view of creating value for customers of digital services and products. Data clustering was carried out in order to distinguish similar groups of IT companies. The principles of evaluating the value of IT enterprise products and the effectiveness of the applied business models were developed based on cluster analysis. Using the k-means method, clustering according to the following groups of indicators was carried out: the share of the various types of industry of customers of the company's services/products in relation to the total volume; the share of types of services provided by the enterprise in relation to the total volume; the number of IT specialists at a given enterprise, taking into account the share comprising those registered in Ukraine; and the share in the client base of enterprises of certain categories (based on annual turnover). The calculation of the optimal number of clusters was carried out using the elbow method and the simplified silhouette estimation method. In the homogeneous groups formed by the applied business models, an analysis of the connections between these elements was carried out. It has been shown that the main factors in the creation of the value of IT products on the global market are the ability to provide high-quality services (a spectrum of services provided); the ability to provide services to certain types of industries; as well as the ability to form a national or transnational team of specialists that work towards the previous two factors. To evaluate the effectiveness of the applied business models, the value of the average declared cost of an hour of project implementation work, as well as the spectrum of the client base by categories of financial turnover (small, medium-sized or large businesses) are proposed. Given the state of the national economy and the prevailing transnational activity of a large share of Ukrainian IT companies, the propor-

DOI: 10.23762/FSO_VOL11_N01_2

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tion of employees registered in Ukraine is an equally important factor in assessing the effectiveness of the business model. It has been shown that the most effective business models of IT enterprises are those that ensure the involvement of professionals in a team, capable of providing high quality of a sufficiently narrow range of services to a medium range of industry types, and also create the possibility of a permanent improvement in employee qualifications in order to provide unique services. Business models that ensure the involvement of highly qualified managers from countries with developed economies in order to attract the client base of large and medium-sized businesses are also effective. The results of the research can be useful for adjusting the business models of IT enterprises in order to increase their efficiency by ensuring the possibility of providing services which cost above the average global market level and optimising the client base.

Key words

business model, clustering, IT company, IT product, product value, human capital, company management.

Introduction

The IT sector in today's digital world is an important factor in increasing the competitiveness of countries, as it is a driver of social and economic progress (Halkiv et al., 2021). This gives grounds for directing the main attention of the global scientific community and practitioners to the rapid global development of the information society. In this situation, conditioned by the accelerated development of digitalisation, priority strategic tasks for the development of the information society throughout the world and in Ukraine, in particular, are the accelerated implementation of modern information technologies in all spheres of the economy and public life, the development of the digital and sustainable economy, the development of the national information infrastructure, strengthening the integration of Ukraine into the global information space and improving cyber security (Melnyk et al., 2018).

In recent years the global IT industry has been characterised by active development,

in particular the creation of IT clusters based on new forms of cooperation in the IT sphere, conditioned by the integration of joint efforts of IT companies, educational institutions, public organisations and other business entities.

It can be stated that the IT industry is a priority driver of economic development at both the national and global levels, because it provides opportunities for the emergence of new types of economic activity and the development of those areas of activity where business models are built on the use of an IT product (Shpak et al., 2020). This is confirmed, for example, by global trends in the development of electronic commerce (Ohinok et al., 2022; Pyroh & Horyachka, 2019). The accelerated development of digitalisation affects all processes within enterprises – reengineering of business processes (Shpak et al., 2018), automation of production processes, analysis of Big Data, the Internet of Things, distance learning, and so on (Chukhray & Shcherbata (2016),

etc.). Nowadays enterprises and industries are increasingly utilising IT products in order to ensure their competitive advantages. It is the products and services of IT companies that make it possible to optimise processes, reduce work time and costs, diversify their activities (Kuzmin, 2015), optimise production processes, etc. With the development of the IT industry, new risks arise, in the context of which it is important to evaluate the capabilities of human resources in the conditions of rapid technological changes to ensure the stability of the state security system (Yemelyanov et al., 2018).

The fact that the development of the IT industry is a generator of the progress of all phenomena and processes creates the fundamental foundations for the development of the global economy, forming a growing interest in the activities of IT companies as separate elements of the IT sector. In particular, attention is mainly directed to the study of models of functioning, tactics of activity, and strategies of the development thereof; whereas with the development of IT industries, business models of IT companies also develop and differentiate. In view of this, everything described above actualises the problems of researching the business models of Ukrainian IT enterprises.

However, assessing the effectiveness of the functioning model of a modern enterprise, in particular in the field of information technologies, is becoming an increasingly difficult task. This is due to a number of objective reasons, among them the globalisation of production processes, the possibility of teams of specialists from different countries performing certain subtasks in the global development process of a digital product, the absence of boundaries between customers and service providers, the existence of various forms of labour relations, the lack of information pertaining to the income of companies, etc. There is also the problem of identifying the components of companies-brands, since a fairly large

number of individual companies registered in different cities in Ukraine, as well as abroad, are often united under the name of a Ukrainian IT company. Common indicators of the management efficiency of a company such as the amount of capital turnover and profit, the amount of taxes paid, the number of full-time employees, etc. become blurred and ambiguous, which complicates the process of analysis.

The IT companies of today are required to quickly reorganise and respond flexibly to the needs of the modern market, to organise work ahead of schedule, to attract highly qualified and creative employees, and to organise continuous training for them. All of the above gives reason to state that the main capital which an IT company possesses is high-quality professionals. Accordingly, the term 'human capital' is becoming increasingly materialised, because in the field of information technologies it is the main source of profit growth, a key link in the value creation chains. Therefore, we consider the scale of human capital, which is measured by the number of employees, to be one of the main indicators characterising the effectiveness of the business models of IT enterprises. Since a large proportion of Ukrainian IT companies are transnational, it is important to research the share of their employees registered in Ukraine.

Nowadays, a concept such as the value of the enterprise's product to individual consumers (B2C) or other businesses (B2B) comes to the forefront of the description of the efficiency of the enterprise's business model in the scientific literature. It is the permanent growth of value for the consumer, which the company creates or can create, that is becoming a key indicator of the effectiveness of a certain business model. However, it is quite difficult to single out effective business models which are the foundation of successful IT enterprises, because factors such as the possibility of temporary work, or the wide use of a popular form

of employment in Ukrainian IT companies – namely, the sole tradership – are increasingly blurring the notion of the staff of IT companies, making it impossible to apply established approaches to evaluating the effectiveness of management. Diverse and often individual business models underlying the activities of IT enterprises greatly complicate the comparative analysis and classification thereof according to specific characteristics. However, from the point of view of the value of the product to consumers, inclusion in chains of the creation of added value, as well as earning profits, the authors suggest a comparative analysis to investigate characteristics such as the types of services provided by the IT company, the types of industries to which the company provides services, the size of customer companies and the average declared cost per hour of employees' work.

The purpose of the study is to analyse the business models of IT enterprises and evaluate the value of the elements therein, identified by means of cluster analysis.

To achieve the goal, the following tasks are defined in the article: analysis of the elements of business models of Ukrainian IT enterprises using cluster analysis; scientific substantiation of the influence of interrelationships between the factors that shape the value of the products of Ukrainian IT enterprises, taking into account the range of services and industries to which these services are provided; investigation of the relationships between the scale of companies (determined by the criterion of the number of employees) and the percentage of employees registered in Ukraine, the scale of enterprises-clients, the average cost of an hour of work and the product value creation system: target client base (industry focus) and types of services (service focus).

The article is structured as follows. Firstly, the authors present the theoretical foundations of the research, focused on studying the features of business models of

IT enterprises and evaluating the elements therein, as identified by the clustering method. Next, the researchers present the practical significance of the methodology used. The subsequent part of the paper presents the results, followed by the conclusions, recommendations and limitations of the study.

1. Literature review

In modern conditions, considerable attention is paid to the development of the IT sphere, since it contributes to the optimisation of the management of economic processes through the introduction and use of information technologies, and also creates opportunities for the formation of powerful integrated IT clusters with high economic capacity, which is necessary for the development of the national economy (Melnyk et al., 2018). The growth of the IT industry depends directly on the development of IT enterprises as separate industry elements. In this context, special attention needs to be paid to the functioning of the IT enterprise, which directly depends on the business models that form the basis of their management. In view of this, the issue of studying theoretical and practical aspects of evaluating individual elements of the business models of IT enterprises, which are formed and analysed on the basis of cluster analysis, is becoming increasingly relevant.

The results of scientific research on this issue indicate the growing interest of scientists and practitioners in the functioning and development of IT companies, the analysis of their business models, the use of the cluster analysis method, etc. Such research demonstrates the diversity of views and concentration on the analysis of certain aspects of the problem. Thus, we have singled out the following key areas of scientific research: the interpretation of the economic essence of the term 'business model', the analysis of the features of business models of IT companies, the analysis of the clustering method

and the areas (examples) of its application. Below we will consider research/scientific works in these identified scientific directions in more detail.

1.1. Interpretation of the economic essence of the term 'business model'

Numerous scientists have provided definitions of the term 'business model', as well as the classification of the structural elements thereof. Zott (2010) describes it as a set of the ways and rules of conducting business in a company, which is analysed through a prism of its structure, products, methods of delivering products and services, increasing market value, which are the basis of the strategy by means of which the company creates value to customers and profits.

Ukrainian economists (Bublyk et al., 2018; Kuzmin et al., 2020; Pyrog & Poritska, 2020; Shpak et al., 2018) have conducted research on the conceptual foundations of the business model; models of functioning and administration of companies, in particular, in the IT sphere; and the factors which form value for consumers. Thus, Kuzmin et al. (2020) noted that a business model logically describes how an organisation creates products or services, delivers them to customers, and acquires various forms of value – economic, social, and others. Pyrog & Poritska (2020) revealed the economic essence of the business model as a description of the value that enterprises offer to various customers, which reflects the capabilities of the enterprise necessary to create, promote and supply this value to customers, as well as the capital relations necessary to receive sustainable revenues. Shpak et al. (2019) presented a set of related model elements defining the internal and external environment of the company within a single system, describing described diversification models of sales activity for the steady development of an enterprise.

Spieth et al. (2014) justified the practical feasibility of building business models based

on innovation. According to scientists, this will ensure the successful integration of companies into the business environment in modern conditions and their effective response to future challenges. Scientists argue that effective business models should be based on three goals: business explanation, business management, and business development. This view is shared by other scientists (Villi & Picard, 2019), who describe the need to transform business models through the prism of innovation. The authors postulate that with the development of information technologies, models of the functioning of companies must also change in order to ensure the adaptability of the latter to new business challenges such as increased competition, rapid changes in consumer needs/requests, and so on.

Thus, in the scientific literature, the concept of the business model is used to describe the principles, methods, rules, tools, and strategies that underlie the management of an enterprise, to ensure its effective functioning in modern market conditions of business, as well as its adaptation to new challenges of the business environment, with the aim of creating value, increasing competitiveness and making a profit.

1.2. Analysis of the features of the business model of IT companies

Bonaccorsi et al. (2006) analysed business models of IT companies which are based on entry strategies in the IT industry. The authors proposed a new definition of the business model and conducted a survey of 146 Italian software development firms. The results of the study showed that firms have adapted to an environment dominated by existing standards, combining open source software and proprietary software. The authors investigated determinants of business models and substantiated the practical significance of hybrid business models of IT enterprises in the context of the evolution of this industry.

Ansong & Boateng (2019) investigated business models of IT companies in the context of developing tactics and strategies for the survival of enterprises in modern conditions. Harmash (2021) analysed modern business models of managing enterprises in the IT sector. After all, in order to adapt to rapidly changing conditions in the business environment of the IT industry, it is necessary to change the business model of IT companies. Pech & Vrchota (2020) scientifically justified the need to classify IT companies into small and medium-sized enterprises according to the level of implementation of Industry 4.0, which directly affects the choice of the appropriate business model to ensure the maximum efficiency of the company's activities.

Research into the practical aspects of IT company activity showed that, in general, companies can be conditionally divided according to their functional focus into service companies that operate according to the principle of outsourcing and/or outstaffing, and product companies. According to this, the basis of company management should be appropriate models of functioning of IT companies, which provide the possibility of managing them as efficiently as possible, taking their functional orientation into account.

1.3. Content of the clustering method and analysis of the spheres (examples) of its application

The cluster analysis method was proposed in 1932 (Driver & Kroeber, 1932), and since then has been actively developed and used in various sciences and fields of activity. Shortly after its origination, scientists noted that it works even when there is little data and the requirements of the normality of distribution of random variables and other requirements of classical methods of statistical analysis are not met, and it is also useful when it is necessary to classify large amounts of information (Hartigan, 1975).

Research has shown that there are many different definitions of this term; however, we would keep to the following: "cluster analysis is a set of statistical methods for discovering new group/class structure when examining data sets" (Flynt & Dean, 2016). In this article, the authors consider popular libraries/commands for various types of cluster analysis, which expand the possibilities of its practical use and increase the value of the obtained results. The packages/functions analysed by the authors cover various methods of cluster analysis for continuous data, categorical data, or the combination thereof.

Antonenko et al. (2012) consider cluster analysis to be a group of statistical methods that have great potential for analysing huge amounts of data. The authors provide examples to illustrate the use of the hierarchical and non-hierarchical clustering method. Jain & Dubes (1988) thoroughly described the data clustering algorithm. Jasiński et al. (2021) presented the cluster analysis algorithm as a type of data intelligence technique, substantiating the feasibility of the k-means algorithm for long-term data and presenting methods for obtaining the optimal number of clusters. Finally, Zhang (2019) proposed an improvement of the k-means method, which makes it possible to significantly reduce the sensitivity of the clustering result to the selection of the initial centroid.

It is difficult to overestimate the practical significance of cluster analysis, as has been confirmed by numerous scientific works where completely different tasks are solved using this method. After all, cluster analysis is used in various spheres and industries, in particular the following: medicine – for the classification of diseases or the symptoms thereof, taxonomy of patients, drugs, etc.; psychiatry – for the correct diagnosis of symptoms such as paranoia, schizophrenia, etc., which is a decisive factor in successful therapy; marketing – for the segmentation of competitors and consumers, the

analysis of consumer behaviour, the grouping of consumers into homogeneous classes to assess the behaviour of the client from each group and the factors affecting it; management – for the division of personnel into different groups, clustering of consumers and suppliers, and the identification of similar production situations that cause shortages; sociology – to divide respondents into homogeneous groups; geoinformatics – for data visualisation, image segmentation, and intelligent searching; economics – for the analysis of markets and financial flows, and the derivation of regularities on stock exchanges; astronomy – for the selection of groups of stars and galaxies, etc. (Hartigan, 1975).

Garuso et al. (2021) propose a methodology based on mixed data clustering techniques that is appropriate for credit risk assessment. Chen (2007) describes the risk assessment of knowledge sharing in virtual enterprises based on grey cluster analysis. Choudhury et al. (2016) applied rainfall cluster analysis to establish a drought insurance index. Flath et al. (2012) conducted a cluster analysis of smart metering data. Dumuid et al. (2017) investigated the academic performance and lifestyle of Australian school students. Using cluster analysis, Franco (2021) investigated the influence of the external and internal environment of multinational enterprises on the sustainability of their subsidiaries. Jasiński et al. (2021) carried out a cluster analysis of power quality measurements and substantiated the problem of choosing the optimal number of clusters. In the work of Hitka et al. (2017), cluster analysis was used as a strategic advantage of human resource management in small and medium-sized enterprises in the woodworking industry. Hosseini et al. (2010) describe cluster analysis using data analysis to develop a CRM methodology for assessing customer loyalty. Scutariu et al. (2021) conducted a cluster analysis of e-commerce business behaviour in the context of the COVID-19 pandemic. IT market

researchers Rybyska & Karpyak (2022) used cluster analysis as a tool for researching the motivational component of business models of IT companies in Ukraine.

In general, the results of the research on this topic can have significant practical value, because they can form the basis of the development strategy of existing IT companies and ensure an improvement in their operational efficiency in the conditions of a dynamic business environment and political and economic instability in Ukraine. The latter is due to the treacherous invasion by Russia, which has brought about the large-scale destruction of infrastructure, in particular in education, and the loss of a significant number of qualified personnel (due to military service and forced emigration). The abovementioned factors, destructive as they are to the economy and social development, have led to a decrease in the number of employees of IT enterprises, a decrease in the cost of an hour of work, and may have a negative impact on the scale and results of the activities of Ukrainian IT enterprises in the near future.

For this reason, the study of the influence of factors shaping the value of the products of Ukrainian IT companies on the development of the Ukrainian IT industry requires special attention from scientists today. The results of such studies may have a great deal of practical significance, as they can be a reference point in adjusting the business models of IT enterprises in order to increase their efficiency.

A thorough analysis of scientific sources and statistical information from available sources made it possible to formulate the following research hypotheses.

Hypothesis 1:

Understanding of the relationships among the factors that shape the value of the products of Ukrainian IT enterprises, given the range of services provided and of industries to which these services/products are provided, positively affects

the development of the Ukrainian IT industry.

Hypothesis 2:

There is a relationship between the scale of the IT companies (based on the criterion of the number of employees) and the percentage of employees registered in Ukraine, the scale of enterprises-clients, the average cost of an hour of work and the value creation system: the target client base (industry focus) and types of services (service focus).

2. Methodology

To substantiate the proposed hypotheses and achieve the research goal, the research methodology used in this article includes the following stages:

Stage 1. Collection of data on elements of the business models of Ukrainian IT companies from available open sources.

Stage 2. Justification of data use.

Stage 3. Clustering of the IT enterprises according to individual indicators.

Stage 4. Description of centroid companies of the resulting clusters.

Stage 5. Grouping of the IT enterprises according to the similarity of their model elements.

Stage 6. Selection of the scale of enterprises that form the client base and determine the average cost per hour of work of employees as key success factors of the selected model.

In order to identify the common features of groups of IT enterprises from the point of view of the similarity of business models, which are attributed to the characteristics of product value, the authors propose to apply clustering methods.

Clustering is the division of a set of objects into non-intersecting subsets (clusters) with the aim of grouping the most similar objects into separate groups. Objects that differ significantly due to clustering belong to different clusters.

Caruso et al. (2021) describe the advantages of using the clustering method in the case of a large amount of mixed data, which is a characteristic feature of the activity of IT companies.

The task of clustering can be formulated as follows: a given set of n vectors, each of which has dimension d , must be divided into subsets (according to a given optimisation criterion). Usually, the optimisation criterion is the minimisation of distortion, that is, the total deviation from the centroids, due to the distribution of data between subsets (areas) that do not intersect and are represented by the centroid element and the “distance” of the rest of the cluster elements from the centroid. The main advantages of using this method are simplicity and guaranteed convergence during several iterations.

In this paper, the method of averages is used for clustering (Zhang, 2020; Syvogolovko, 2011). The term ‘k-means’ was first used by J. McQueen in 1967, although its idea was first described by H. Steinhaus in 1957, while the standard algorithm was first proposed by A. Lloyd in 1957.

K-means clustering divides the input set of n vectors into k clusters S^j ($j = 1, 2, \dots, k$), each of which has a centroid associated with it $c_j = (c_{1j}, c_{2j}, \dots, c_{dj})$. Let us mark as $S = \{x\}$ a set of power n of input vectors $x = (x_1, x_2, \dots, x_d)$. Let $D(x, c)$ be the distance between the vector X and the centroid c . This article uses the unweighted Euclidean distance:

$$D^2(x, c) = \sum_{i=1}^d (x_i - c_i)^2. \quad (1)$$

Let us denote the set of centroids obtained at iteration t as follows: $Sc^{jt} = \{c^{jt}\}$.

The traditional version of the k-means clustering algorithm is described as follows:

1. We set $t = 0$ and set the initial location of the centroids Sc^{j0} .
2. For a given set of centroids Sc^{jt} we perform the actions indicated in stages

$$S^j = \{x: D(x, c^r) \leq D(x, c^s) \quad r \neq s\}$$

2.2. We calculate the centroid c^{jt} for each cluster S^j ($j = 1, 2, \dots, k$), to obtain a new set of centroids Sc^{jt+1} :

$$c_s^j = \frac{1}{m_j} \sum_{i=1}^{m_j} x_{si}^j, s = 1, \dots, d,$$

where m_j – the number of vectors belonging to the cluster S^j .

3. We calculate the total distortion $E^2 = \sum_{x \in S} D^2(x, c)$ for Sc^t . If it differs from the one obtained in the previous iteration by a sufficiently small amount, we bring the process to a halt. Otherwise, we assign $t \rightarrow t + 1$ and return to step 2.

The clustering error and number of iterations depends on the initial choice of centroids, so it is common practice to run k-means multiple times with different initial candidate centroids.

In this paper, the selection of the number of clusters was made based on the comparison of the results obtained by the elbow and silhouette methods. The main idea of the elbow method is to select a number of clusters such that the total variation between clusters (the total variation within the cluster) is minimised. There are several algorithms for this method, and the algorithm used in the paper defines the total variation within the cluster as the sum of the squared Euclidean distances between the elements and the corresponding centroid:

$$W(C_k) = \sum_{x_j \in C_k} (x_j - \mu_k)^2.$$

2.1 and 2.2 and obtain an improved set of centroids Sc^{jt+1} :

2.1. We find the following partition S^j , which distributes the original set of n input vectors into k clusters S^j ($j = 1, 2, \dots, k$) and satisfies the condition:

To determine the optimal number of clusters by means of groups of all the described indicators, the parallel use of two methods is proposed: the elbow method and the simplified silhouette estimation method. The advantages of the elbow method are its simplicity and illustrative informativeness. The possibility of choosing the number of clusters is shown by the curve, which at these points (abscissa – the number of clusters) has a refraction in the direction of growth or slows down the rate of decline.

Since there is a high probability that the input data will not be clearly distributed between clusters and, as a result, the division obtained by using the elbow method will not correspond to a high level of the partition quality (Syvogolovko, 2011), the suggestion was made to combine the elbow method with the simplified silhouette estimation method, which allows one to clarify the results obtained by the elbow method, based on the results of the analysis of the elements set, which differ significantly from the centroids.

Therefore, in order to evaluate the effectiveness of selected business models of Ukrainian IT enterprises, the suggestion was made to divide the investigated IT companies

into clusters based on individual elements of the business model. The group of elements that create a product value system includes the range of types of services provided, the range of industries in which the recipients of services/products operate, and the scale of the enterprise, taking the percentage of employees registered in Ukraine into account. The formation of groups of similarity (homogeneity) according to the elements that create the product value system, and a comparative analysis of companies that have been allocated to homogeneous groups according to the scale of their client base and the average cost of an hour of work, allows for the evaluation of the selected business model.

3. Research results

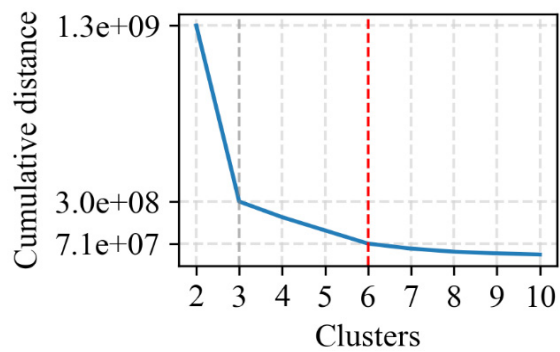
Due to the lack of official statistical data on the number of employees, the types of

services provided, client base, profits, wages, etc., data published by online platforms were used as the main source, namely the DOU website (Trendy Jobs.dou.ua 2019–2022); Clutch, an international platform for ratings and reviews of IT, marketing and business providers (clutch.co); and LinkedIn, the world’s largest social network (company profiles on linkedin.com).

3.1. Clustering of collected data

Due to the lack of complete data on all IT enterprises registered in Ukraine, the authors focused the research on 242 (based on the scale of enterprises) and 255 (other elements) companies, about whose activities it was possible to collect full information regarding the investigated indicators from personal profiles on the abovementioned platforms.

Figure 1. Determination of the number of clusters according to the scale of Ukrainian IT enterprises using the elbow method



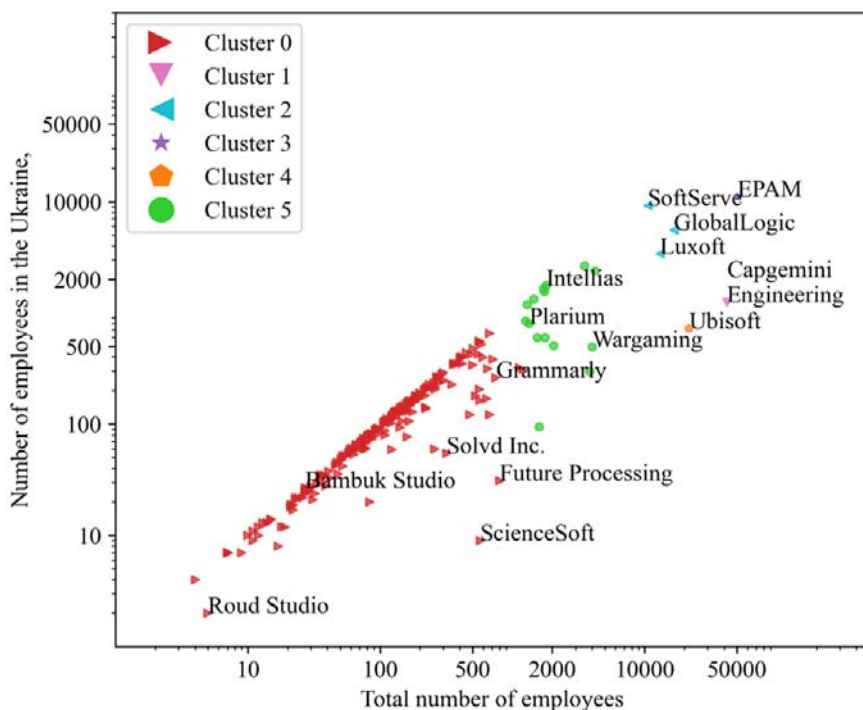
Source: own elaboration

3.2. Clustering according to the scale of enterprises

Clustering according to the scale of the IT companies that position themselves as Ukrainian brands and have offices in Ukraine made it possible to investigate the relationship between the total number of employees and the share of specialists

registered in Ukraine (clustering was carried out by means of two indicators: the total number of employees and the number of employees registered in Ukraine, using data from LinkedIn). Using the elbow method, results pertaining to the optimality of the division into six clusters were obtained (Fig. 1).

Figure 2. Results of clustering of Ukrainian IT enterprises according to scale indicators



Axis: OX – total number of employees, OY – number of employees registered in Ukraine

Source: own elaboration

The results of clustering of IT enterprises are as follows:

Cluster 0 is the most numerous, consisting of small and medium-sized enterprises (4-1,211 employees). This cluster includes 223 companies, 18 of which have 100% of employees registered in Ukraine, 125 companies in which the share of Ukrainian employees is 90-99%, 46 companies with 75-90% Ukrainian staff, 15 companies with 50-74%, 17 companies with 10-50%, as well as two international companies at which the percentage of Ukrainian specialists as a share of the total is less than 10%. In all the following clusters, which include larger companies, there is not a single company that is comprised of 100% Ukrainian specialists.

Cluster 1 – the international giant Capgemini Engineering (42,000 employees), where the percentage of Ukrainian specialists as a share of the total is only 2.9%.

Cluster 2 – giant enterprises with a significant share of Ukrainian employees. The cluster includes three companies – SoftServe (10,500 employees) with 87% of specialists being Ukrainian, GlobalLogic (16,500 employees) with 33% Ukrainian specialists and Luxoft (13,000 employees) with 26%.

Cluster 3 – the international giant EPAM (50,300 employees) with more than 11,000 Ukrainian specialists, which is 22% of the company's total workforce.

Cluster 4 – the international giant Ubisoft (21,600 employees), where the share of Ukrainian specialists at the company is only 3.3%.

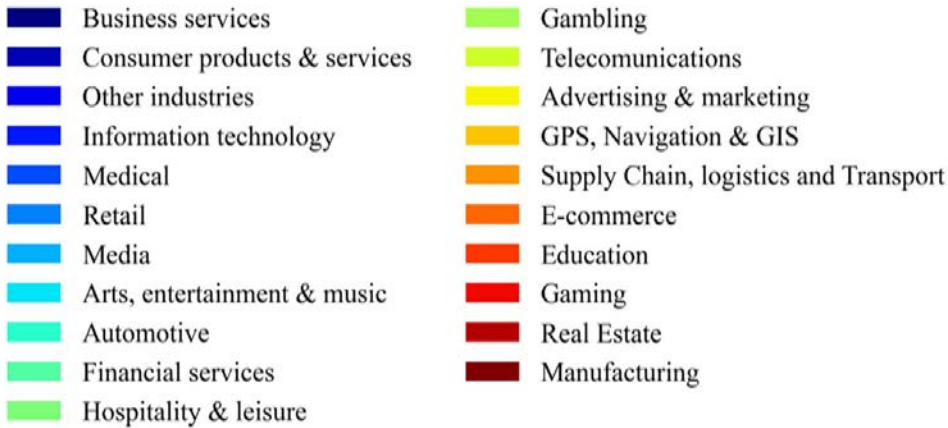
Cluster 5 – large enterprises (1,200–4,200 employees). The cluster included 13 companies, of which four companies (among them Intellias and N-iX) have more than 90% Ukrainian employees, three companies (Plarium, Ciklum, DataArt) with 50–90%, three companies (among them Grid Dynamics) with 20-50%, as well as three international companies (Itransition, Valtech, and Wargaming) where the share of Ukrainian employees is only 6-15% of the total.

Despite the fact that the majority of companies under investigation are concentrated in cluster 0, the main employers and customers of services of individual entrepreneurs in the field of IT are large companies from clusters 2-4. However, four giant companies – EPAM, SoftServe, GlobalLogic and Luxoft – have more IT specialists than all 223 companies belonging to cluster 0. This gives reason to believe that it is such giant companies that shape the trends, regularities, and rules of functioning of the IT market in Ukraine. It is also important to note that enterprises that are 100% composed of

employees registered in Ukraine are small companies, the largest of which is Anadea, which has only 129 employees. Enterprises based in Ukraine which enter international markets, in addition to registering and physically locating the vast majority of their employees in Ukraine, continue to register companies and hire employees in other countries where customers are registered, as this allows them to comply with the legislation of future business partners.

Distribution of Ukrainian IT companies by industry based on clustering (255 companies whose profiles are presented on Clutch were studied):

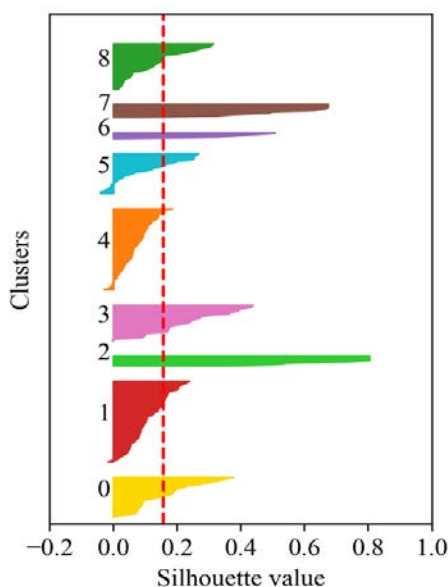
According to data posted on personal profiles on Clutch (clutch.co), Ukrainian IT companies provide services and products for the following main sectors of the economy (a total of 20 sectors plus a further catch-all category of “other industries”): financial services, medicine, information technology, business services, e-commerce, education, retail, gaming, etc. In Figures 5-13, the share of the respective industries is depicted in the corresponding colours:



Calculation of the number of clusters by industries serviced (industry orientation, as a percentage of the entire client base) was carried out using the elbow method (Fig. 3) and the silhouette method (Fig. 4). The

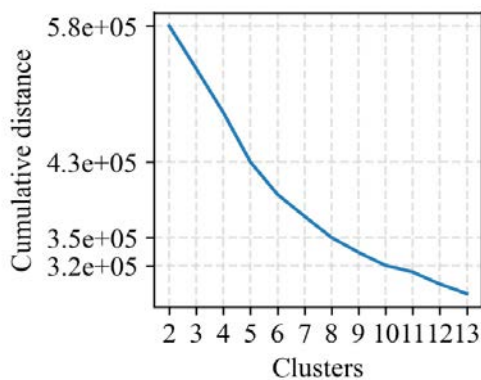
results obtained show that the division of IT companies into nine clusters is most effective. Below is a description of the IT companies included in each cluster.

Figure 3. Determining the number of clusters by industry orientation using the elbow method



Source: own elaboration

Figure 4. Determining the number of clusters by industry orientation using the silhouette method

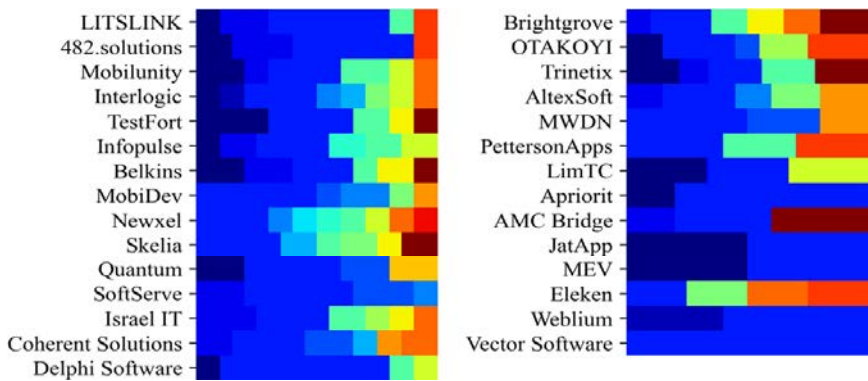


Source: own elaboration

Cluster 0 – companies serving the information technology (centroid 41.89) and business services industry groups (centroid 11.55). The cluster includes 29 companies

(Fig. 5). The companies closest to the centroid of the cluster are LITSLINK, 482.solutions and Mobilunity.

Figure 5. Enterprises belonging to cluster 0 by industry orientation

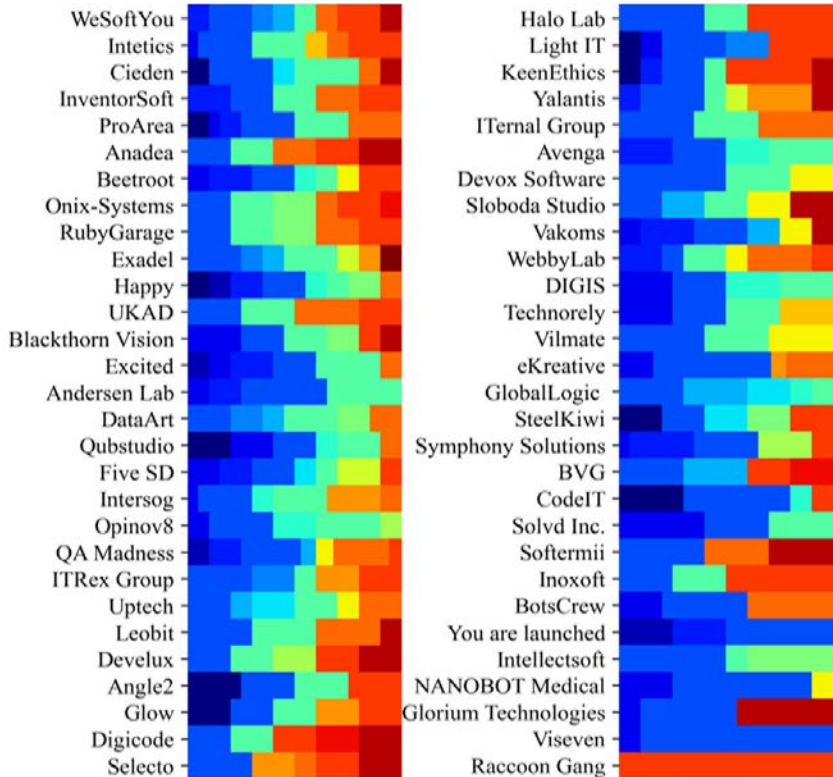


Source: own elaboration

Cluster 1 – companies that provide services mainly for the medical (centroid 29.53), education (centroid 11.13) and e-commerce (centroid 7.81) industries. The

cluster includes 57 companies (Fig. 6). The companies closest to the centroid of the cluster are WeSoftYou, Intetics, Cieden and InventorSoft.

Figure 6. Enterprises belonging to cluster 1 based on industry orientation



Source: own elaboration

Cluster 2 – companies that mainly provide products/services to the gaming industry (centroid 86.25). The cluster included eight companies (Fig. 8), of which Wargaming and Plarium are the closest to the centroid.

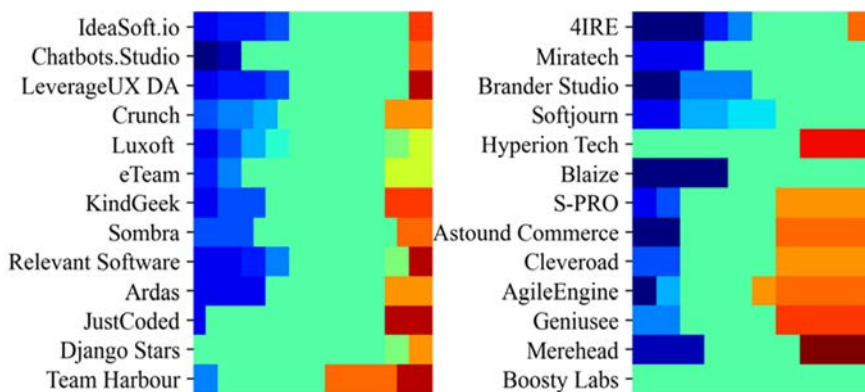
Cluster 3 – companies specialising in services for the financial services (centroid 52.88) and e-commerce (centroid 5.57) sectors. The cluster includes 26 companies (Fig. 7), of which the companies closest to the centroid are IdeaSoft.io, Chatbots.Studio, LeverageUX Design Agency and Crunch.

Figure 7. Enterprises belonging to cluster 2 based on industry orientation



Source: own elaboration

Figure 8. Enterprises belonging to cluster 3 based on industry orientation

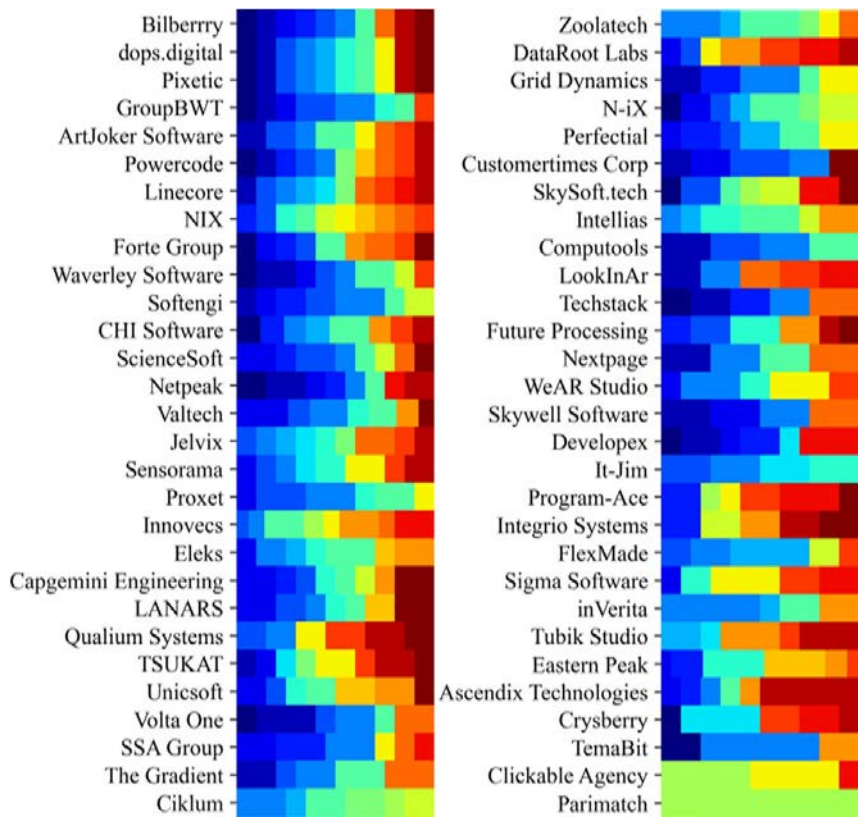


Source: own elaboration

Cluster 4 – companies specialising in providing services to a wide range of industries, mainly retail (centroid 12.89), financial services (centroid 9.12), medical (centroid 7.7), consumer products & services (centroid 6.12), the aforementioned catch-all “others”

category (centroid 5.96) and advertising & marketing (centroid 5.22). This cluster includes 58 companies (Fig. 9). The companies closest to the centroid are Bilberry, dops, digital high-end visual, Pixetic, GroupBWT and ArtJoker Software.

Figure 9. Enterprises belonging to cluster 4 based on industry orientation

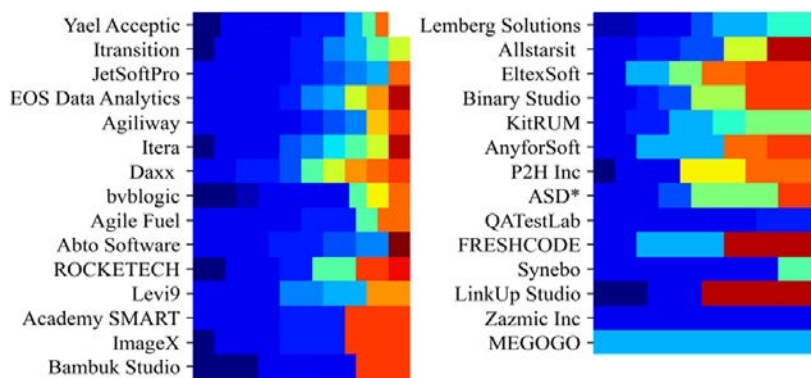


Source: own elaboration

Cluster 5 – companies specialising in providing services for other industries (centroid 36), media (centroid 10.44) and education (centroid 7.41) (Fig. 10). The

cluster includes 29 companies, of which the companies closest to the centroid are Yael Acceptic, Itransition, JetSoftPro and EOS Data Analytics.

Figure 10. Enterprises belonging to cluster 5 based on industry orientation

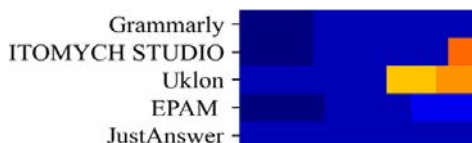


Source: own elaboration

Cluster 6 – companies specialising in consumer products & services (centroid 64) and business services (centroid 19). The cluster includes five companies (Fig. 11), of which the closest to the centroid is Grammarly.

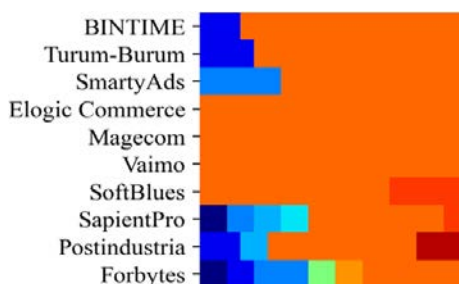
Cluster 7 – companies specialising in e-commerce (centroid 75) and other industries (centroid 6). The cluster includes 10 companies (Fig. 12). The companies closest to the centroid are BINTIME and Turum-Burum.

Figure 11. Enterprises belonging to cluster 6 based on industry orientation



Source: own elaboration

Figure 12. Enterprises belonging to cluster 7 based on industry orientation

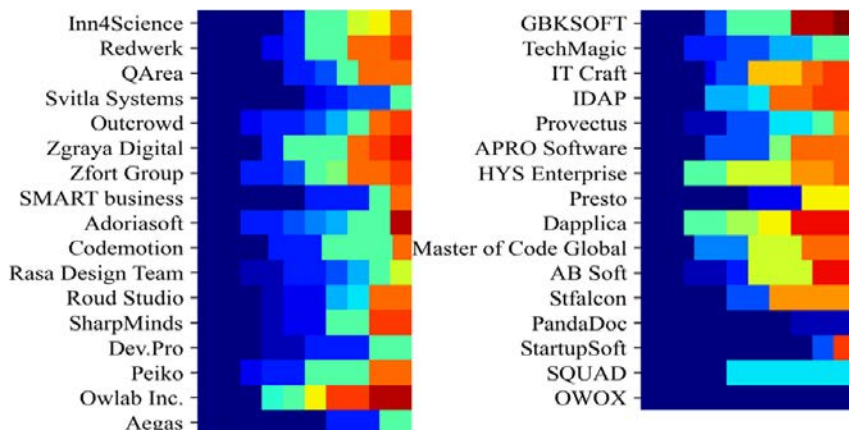


Source: own elaboration

Cluster 8 – companies specialising in providing services for the business services (centroid 35.69), financial services (centroid 11.45), information technology (centroid

8.93) and e-commerce (centroid 7.54) sectors. 33 companies belong to the cluster (Fig. 13). The companies closest to the centroid are Inn4Science, Redwerk and Qarea.

Figure 13. Enterprises belonging to cluster 8 based on industry orientation



Source: own elaboration

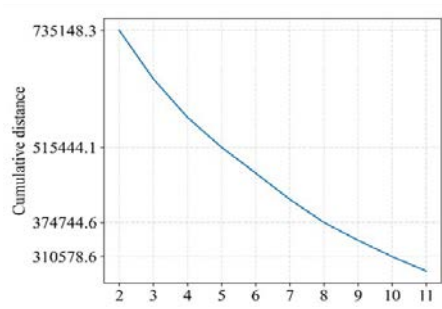
The range of services provided by the company (service focus) (255 companies whose profiles are presented on Clutch were studied).

The clustering of the IT companies in terms of service focus (as a percentage of the total number of services provided by the company) is based on data collected on the Clutch platform. Companies submit this data about themselves by registering on the

platform. ‘Service focus’ reflects the services in which the company specialises (a total of 29 types of services and a similar catch-all category combining the remaining ones under the name “other types of services”).

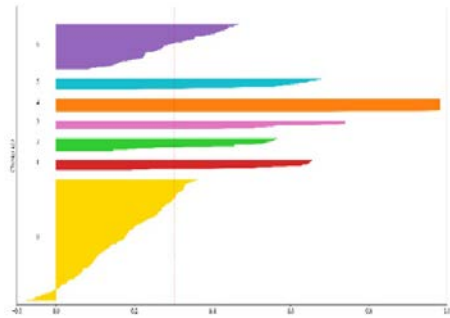
According to the elbow (Fig. 14) and silhouette (Fig. 15) methods, the division into seven clusters is optimal for service focus data.

Figure 14. Determination of the optimal number of clusters for the range of services provided by the company based on the elbow method



Source: own elaboration

Figure 15. Determination of the optimal number of clusters for the range of services provided by the company based on the silhouette method



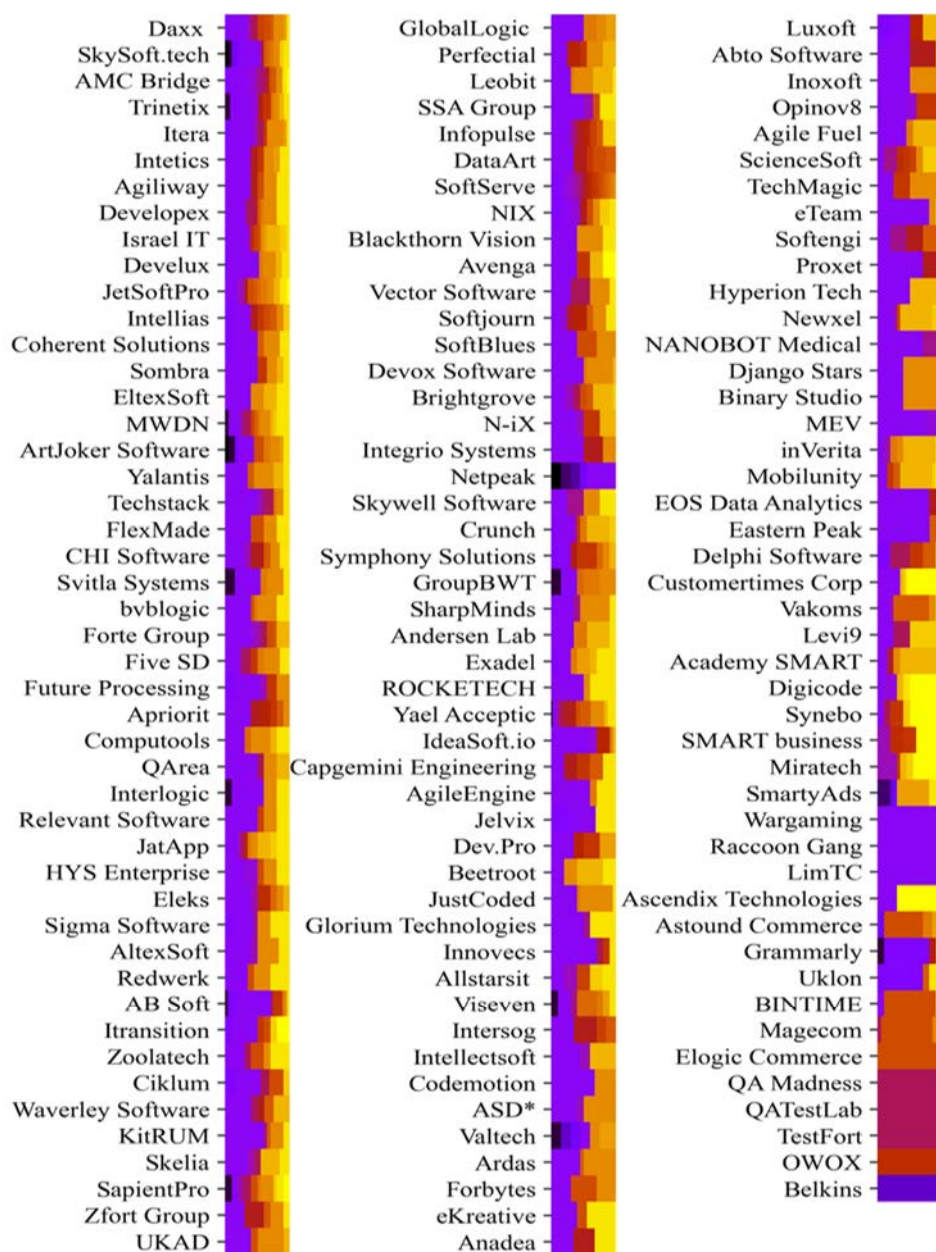
Source: own elaboration

In Figures 16-22, the share of the services is depicted in the corresponding colours:

- | | | |
|---------------------------------|---------------------------|------------------------------|
| ■ Search Engine Optimisation | ■ IT strategy consulting | ■ IoT development |
| ■ Web Design | ■ AR/VR Development | ■ Product design |
| ■ Advertising | ■ Application testing | ■ UX/UI Design |
| ■ Branding | ■ Artificial Intelligence | ■ Web development |
| ■ Content marketing | ■ Blockchain | ■ Digital Strategy |
| ■ Public Relations | ■ Business consulting | ■ IT Staff Augmentation |
| ■ Social Media Marketing | ■ Cloud Consulting | ■ IT managed services |
| ■ BI & Big Data Consulting & SI | ■ Cybersecurity | ■ Mobile app Development |
| ■ Custom Software Development | ■ E-commerce development | ■ CRM, ERP consulting and SI |
| ■ Enterprise App Modernization | | |

Cluster 0 – companies in which the following types of services are dominant: custom software development (centroid 34.01), web development (centroid 12.32)

and mobile app development (centroid 8.12). This cluster includes 139 companies (Fig. 16), among which the closest to the centroid are Daxx, SkySoft.tech and AMC Bridge.

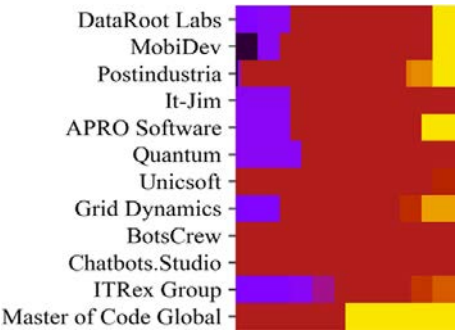
Figure 16. Enterprises belonging to cluster 0 based on the range of services provided

Source: own elaboration

Cluster 1 – companies focused on providing services in artificial intelligence (centroid 70.41), mobile app development (centroid 7.91) and business intelligence & Big Data consulting (centroid 4.58). The

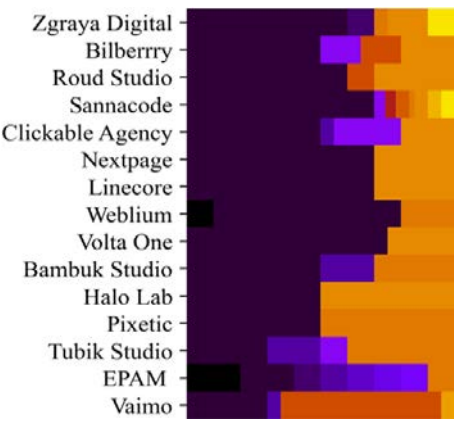
group includes 12 companies (Fig. 17). Among them, the companies closest to the centroid are DataRoot Labs, MobiDev and Postindustria.

Figure 17. Enterprises belonging to cluster 1 based on the range of services provided



Source: own elaboration

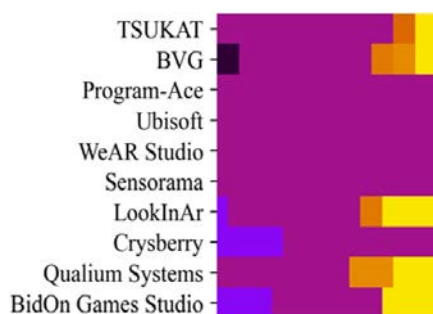
Figure 18. Enterprises belonging to cluster 2 based on the range of services provided



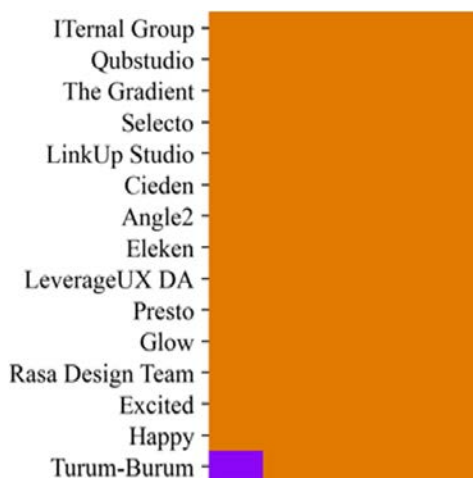
Source: own elaboration

Cluster 2 – companies specialising in web design (centroid 53.66), UX/UI design (centroid 10.46) and e-commerce development (centroid 5.66). The group includes 15 companies (Fig. 18). The companies closest to the centroid are Zgraya Digital, Bilberry and Roud Studio.

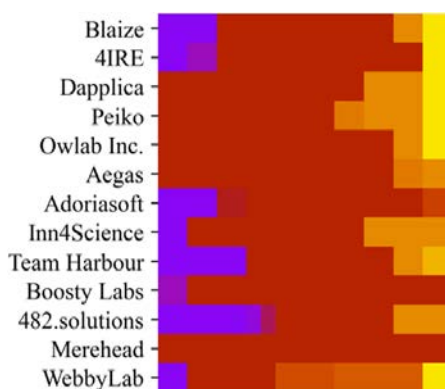
Cluster 3 – companies specialising in AR/VR development (centroid 78) and mobile app development (centroid 9). The cluster includes 10 companies (Fig. 19). The companies closest to the centroid are TSUKAT and BVG Software Group.

Figure 19. Enterprises belonging to cluster 3 based on the range of services provided

Source: own elaboration

Figure 20. Enterprises belonging to cluster 4 based on the range of services provided

Source: own elaboration

Figure 21. Enterprises belonging to cluster 5 based on the range of services provided

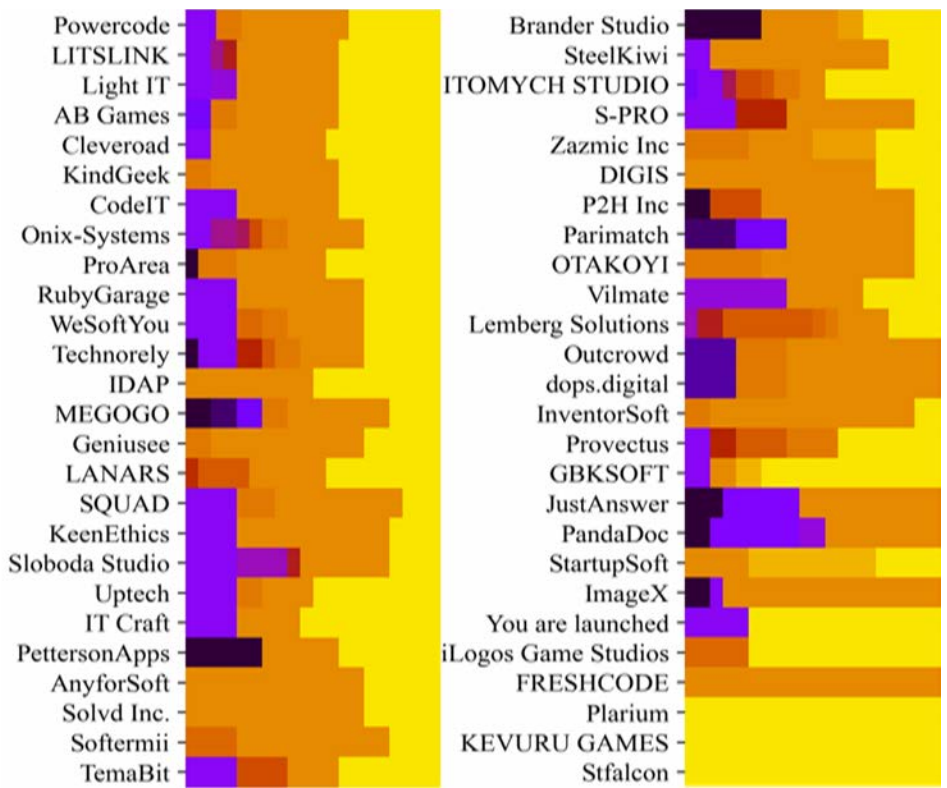
Source: own elaboration

Cluster 4 – companies specialising exclusively or almost exclusively (Turum-Burum company) in UX/UI design (centroid 98.66). 15 companies belong to the cluster (Fig. 20).

Cluster 5 – companies specialising in blockchain technologies (centroid 65.38) and mobile app development (centroid 4.61). The cluster includes 13 companies (Fig. 21), of which the closest to the centroid are Blaize and 4IRE.

Cluster 6 – companies specialising in web development (centroid 40.13), mobile app development (centroid 33.48) and custom software development (centroid 6.48). 52 companies belong to the cluster (Fig. 22), of which the companies closest to the centroid are Powercode, Powercode, Light IT, AB Games and Cleveroad.

Figure 22. Enterprises belonging to cluster 6 based on the range of services provided



Source: own elaboration

3.3. Grouping of companies with homogeneous business models according to the elements that form IT product value: industry orientation and the range of services provided

As mentioned earlier, for the assessment of the effectiveness of the business model chosen by the company based on the factors of value formation (industry orientation and

range of services provided), the following indicators were chosen: the declared cost of an hour of work for the implementation of projects, as well as the scale of the client base (small, medium-sized or large business). Statistical information on these indicators was obtained from the profiles of companies presented on the Clutch platform.

Companies are considered homogeneous if they simultaneously belong to the same cluster, in terms of both industry orientation and the range of services provided. As a result of such a grouping, 27 groups were obtained, which include 239 companies; 17 companies under investigation do not belong to any group. In each group, the calculation of the average cost of an hour of work revealed the following (Table 1):

- the highest declared average cost of an hour of work of \$81.25 is in group 2-3. Companies in this group provide services for the Gaming industry. These companies specialise in providing AR/VR development and mobile app development services;
- an average cost of \$78.13 per hour of work was declared by members of group 4-1, comprised of companies that provide services to a wide range of industries, mainly retail, financial services, medical, consumer products & services, other industries and advertising & marketing, specialising in artificial intelligence, mobile app development and business intelligence & Big Data consulting;
- Companies from groups 1-1, 6-0, 6-6 and 8-2 have an average hourly rate of \$75.00. They provide both a fairly narrow and a wide range of services and their client base consists of companies from various branches, namely medical, education and e-commerce, consumer products & services, business services, financial services, and to a lesser extent information technology. These companies specialise in the following services: artificial intelligence, mobile app development and business intelligence & Big Data consulting, web development, custom software development, web design, UX/UI design and e-commerce development.

Table 1. The average cost of an hour of work in homogeneous groups

The cluster to which IT companies belong based on the range of services provided, cluster №								
The cluster to which IT companies belong based on industry orientation, cluster №		0	1	2	3	4	5	6
	0	55.5	56.25					50
	1	54.02	75			60.93		44.12
	2				81.25			56.25
	3	55.68					45	45
	4	55.47	78.13	62.5	48.21			46.88
	5	43.75						64.58
	6	75						75
	7	56.25						
	8	46.86	56.25	75		37.5	50	51.56

Source: own development

The most numerous are groups 4-0 (34 companies) with an average cost of \$55.50; 1-0 (28 companies) with a cost of \$54.00; 0-0

(21 companies) with an average cost of \$55.50 and 5-0 (20 companies) with a cost of \$43.75. The lowest cost per hour of work (\$37.50) is

in group 8-4 specialising in business services (centroid 35.69), financial services (centroid 11.45), information technology (centroid 8.93) and e-commerce (centroid 7.54) and exclusively in UX/UI design (centroid 98.66).

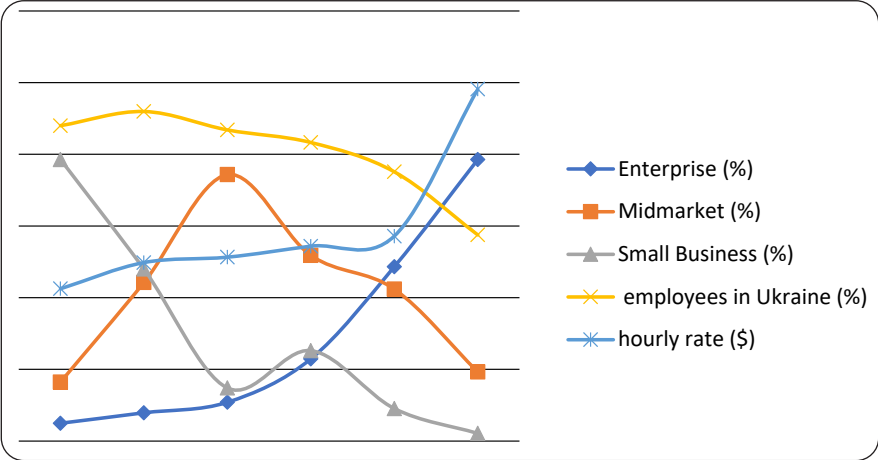
Therefore, the cost of an hour of work does not significantly depend on the industry, but to a greater extent on the uniqueness of the services provided. The services provided by the sixth cluster of companies – specialising in consumer products & services (centroid 64) and business services – turned out to be consistently quite highly paid. Also, an hour of work at companies from the first cluster is remunerated at an above-average rate. These companies focus on providing services in artificial intelligence (centroid 70.41), mobile app development (centroid 7.91), and business intelligence & Big Data consulting (centroid 4.58). Enterprises that exclusively provide application testing services for business services or with a significant share of service types such as e-commerce development, CRM, ERP consulting and SI, and cloud consulting also declared a high cost of one hour of work.

3.4. Manifestation of product value according to the size of companies- customers of IT services

An important factor in the success of the business model is the inclusion of companies with significant financial turnover in the client base. Based on the information provided on the Clutch platform in the Client Focus section, data on the financial turnover of IT enterprises' client companies was obtained. According to the Clutch methodology, all clients that use the services of IT enterprises are divided by annual turnover into the Enterprise (>\$1B), Midmarket (\$10M – \$1B) and Small Business (<\$10M) categories.

The existence of certain interrelationships between the scale of the IT company (belonging to cluster 0-5 based on the number of employees and the percentage of staff registered in Ukraine), the average cost of an hour of work and the respective percentages of companies from the Enterprise, Midmarket or Small Business categories in the client base is illustrated in Fig. 23.

Figure 23. The relationship between the average cost of an hour of work, the percentage of the client base in each category (Enterprise, Midmarket, Small Business), the average percentage of employees registered in Ukraine, and the scale of the enterprise



Source: own elaboration

However, the use of clustering methods provides a more accurate scientific justification of the relationships described above.

Data on the share of projects for customers of different scales was clustered, based on which the results indicated the most effective division into six clusters.

The numbering of clusters from 0 to 5 is carried out according to the following principle: cluster 0 denotes enterprises with almost no large businesses in the client base,

and then a higher cluster number corresponds to the growth of the corresponding percentage. Table 2 shows the values of the centroids of the corresponding indicators for the IT enterprises belonging to six resulting clusters – the percentage in the customer base of Enterprise, Midmarket, and Small Business companies, respectively, as well as the average indicators of declared hourly labour costs and the percentage of employees registered in Ukraine.

Table 2. Values of the centroids of indicators of the percentage composition of the scale of client enterprises, averaged indicators of the declared cost of an hour of work and the share of employees registered in Ukraine

	Enterprise, %	Midmarket, %	Small Business, %	Hourly rate, \$	Employees in Ukraine, %
cluster 0	4.964286	16.46429	78.57143	42.52	88.01344
cluster 1	7.884058	44.24638	48	49.80952	91.97136
cluster 2	10.82609	74.34783	14.82609	51.31579	86.81032
cluster 3	22.95	51.81667	25.23333	54.38596	83.32944
cluster 4	48.64865	42.40541	9.081081	57.19697	75.15178
cluster 5	78.57143	19.28571	2.142857	98.21429	57.5214

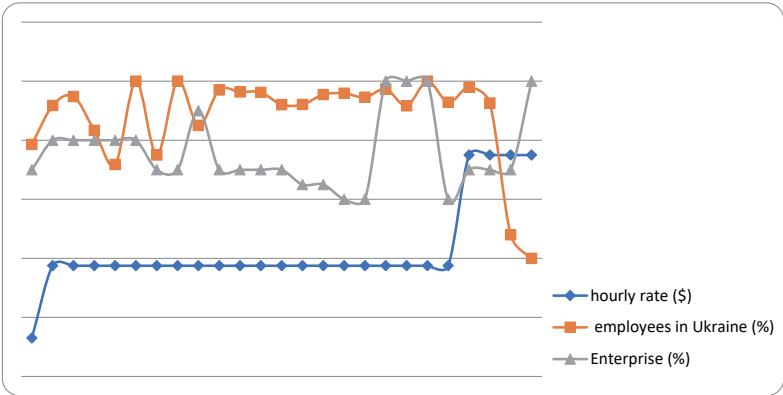
Source: calculated by authors

Thus, the formation of a client base by SMEs is typical for enterprises of cluster 0 (Fig. 24). The values of the centroid coordinates are: Small Business – 78.57, Midmarket – 16.46, and Enterprise – 4.69. The average hourly cost of labour in this cluster (\$42.14) is the lowest among all clusters. The average share of Ukrainian employees in the cluster is 88%. This indicator is higher (91.97) only in companies that form cluster 1 (Fig. 25). The average cost of an hour of work in this cluster is higher

(\$49.81) compared to cluster 0, due to larger shares in the client base of companies of the Midmarket (centroid 44.25) and Enterprise (centroid 7.88) segments.

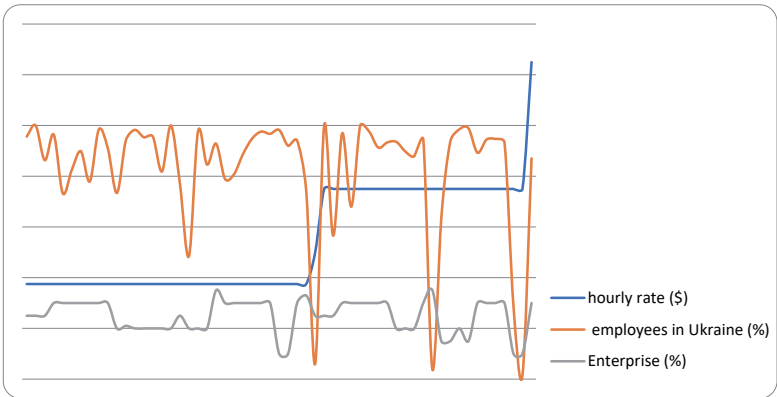
With the growth in the share of enterprises of the Enterprise segment (centroids 10.83; 22.95; 48.65, respectively) and the decline in the share of Ukrainian employees (centroids 86.81; 83.33; 75.15), the average rate declared per hour of work continues to increase (centroids 51.32; 54.39; 57.20) (Fig. 26-28).

Figure 24. Indicators of companies of cluster 0 based on the annual turnover of client companies



(% of large and medium-sized businesses)
Source: own elaboration

Figure 25. Indicators of companies of cluster 1 based on the amount of annual turnover of client companies

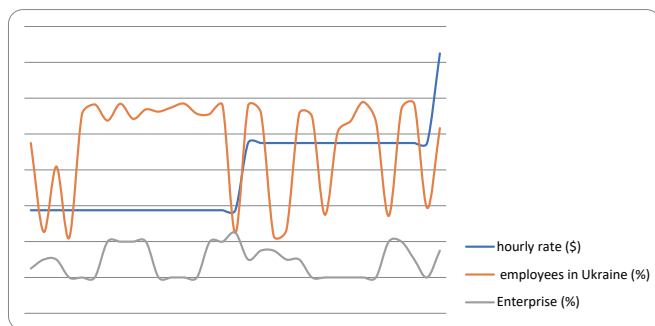


(% of large and medium-sized businesses)
Source: own elaboration

The highest (98.21) average cost of an hour of labour is recorded in the fifth cluster (seven companies) (fig. 29). These are

businesses that focus on the Enterprise segment (centroid 78.57), while the Small Business share (centroid 2.14) is the lowest.

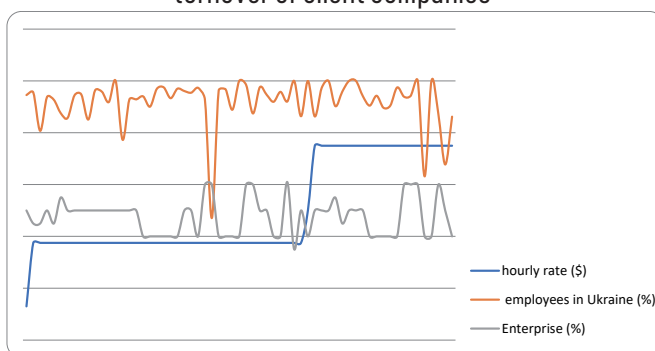
Figure 26. Indicators of companies of cluster 0 based on the amount of annual turnover of client companies



(% of large and medium-sized businesses)

Source: own elaboration

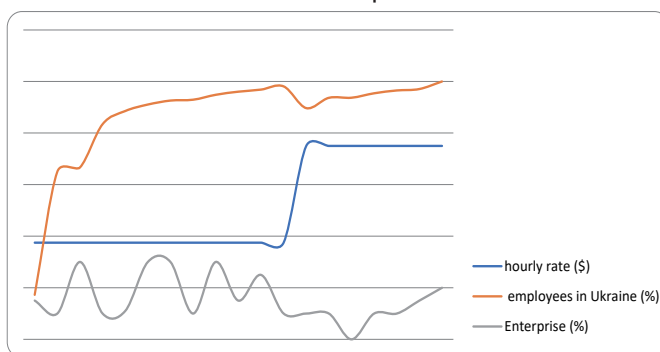
Figure 27. Indicators of companies of cluster 1 based on the amount of annual turnover of client companies



(% of large and medium-sized businesses)

Source: own elaboration

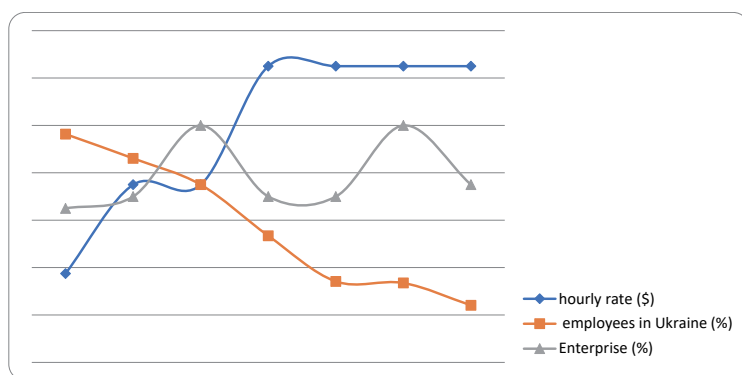
Figure 28. Indicators of companies of cluster 1 based on the annual turnover of client companies



(% of large and medium-sized businesses)

Source: own elaboration

Figure 29. Indicators of companies of cluster 5 based on the annual turnover of client companies



(% of large and medium-sized businesses)

Source: own elaboration

The most important factor in the hourly cost of labour was the percentage of Enterprise scale companies (correlation coefficient 0.921). An even closer relationship was found between the percentage in the client base of companies of this segment and the share of employees registered in Ukraine (correlation coefficient -0.982).

The correlation between the share of medium-sized and small businesses in the client base is insignificant (correlation coefficients -0.367) or medium (correlation coefficients -0.657), respectively. An exception is the small company BINTIME (79 specialists) with 65% of enterprise-scale client companies, 80% of e-commerce services, and 85% of the sector of the economy of the same name. The low average cost of its services (\$26-49 per hour) correlates with a high (96%) percentage of Ukrainian employees.

4. Discussion

According to the results of the research (clusters of enterprises designated according to the share of the client base of the corresponding segments and comparison with the cost of an hour of work based on data published by the companies on the Clutch

platform), the authors came to the conclusion that enterprises focusing on customers from the Enterprise segment have the highest average cost of an hour of work. These are the majority of companies included in the fifth cluster, namely ImageX, Customertimes Corp, Grid Dynamics, and GlobalLogic, in which the share of Ukrainian employees is 34.2% on average.

This cost is somewhat lower for companies from cluster 2, which focus equally on the Enterprise and Midmarket segments of clients. The share of Ukrainian employees in these companies is 75% on average, which is significantly higher than in the fifth cluster.

This indicator is the lowest for enterprises that focus on customers in the Small Business segment. These companies belong to cluster 0, and their share of Ukrainian workers is 92% on average. This cluster of companies is the largest. Unfortunately, there is a visible trend at play whereby, in order to enter the Enterprise segment, companies with a high proportion of Ukrainian employees need to reduce the prices of their products/services. However, significantly lower prices for the production of a digital product by Ukrainian specialists, due to the lower cost of living and the liberal

taxation system of the individual entrepreneur, make the IT industry the highest paid and one that has resources available for development and growth.

Companies which predominantly deal in services such as custom software development, web development, artificial intelligence, mobile App development or which focus entirely on UX/UI design manage to maintain the average cost of an hour of work. As for the client base, companies at which an hour of work costs approximately the average rate tend to be those which focus on providing services to industries such as financial services, medical, e-commerce, information technology, business services and retail. No dependence between the dispersion of industry branches and the cost per hour of services was found.

Unfortunately, in contrast to the level of digital literacy of the population and the level of digitalisation of state structures, the Ukrainian economy as a whole is developing at an extremely slow pace. With the beginning of Russia's unprovoked full-scale aggression against Ukraine, the situation became even more complicated. Therefore, when promoting their products and services, IT companies must focus more on clients from countries with developed economies and, first of all, on large companies. For this purpose, it is necessary to attract specialists from those countries, involving them in the top management of companies. For companies with a low percentage of Ukrainian employees, it is advisable to focus on increasing this figure, as such a strategy will allow them to provide a high-quality product/service at a lower cost.

SoftServe is a unique company on the Ukrainian IT market, as it is the only company with more than 10,500 employees, 87% of whom are specialists registered in Ukraine. In the remaining three companies of this scale, the percentage of Ukrainian employees does not exceed 34%. However, the top management of the company

manages to maintain a high level both in terms of the declared cost of an hour of work (\$100-149) and the minimum cost of a project (\$50,000). The company's reputation as a reliable partner has been formed over three decades, which of course constitutes a significant success factor. This company provides 12 types of services to four industries, including a group of specific industries under the catch-all category "other industries" (20%). The distribution of the remainder of the industries is as follows: information technology – 45%, medical – 25%, and retail – 10%. The secret of this company's success, in our opinion, is the thorough and total implementation of the slogan "Start your journey with us". The company has followed a unique strategy of attracting the best specialists to the team through close cooperation with universities in the region. Also, as one of the founders of the Lviv IT cluster, SoftServe provides staff with the opportunity to continuously learn and improve their qualifications. However, the satisfaction index in the context of salary and career growth opportunities in the company is somewhat lower than in smaller companies with a similar percentage of Ukrainian employees. We believe that for the further rapid development of the company, more customers from the Enterprise sector should be attracted to the client base (today this share is only 25%).

EPAM also occupies a special place on the Ukrainian IT market. The company has the largest number (11,115) of IT specialists registered in Ukraine (of whom there are 50,304 in total). The top management of these two companies – the largest employers of Ukrainian specialists in the industry – chose the right strategy, occupying non-competing niches providing value both in the range of services and in the range of client industries. However, a higher percentage of the client base in the Enterprise sector does not provide EPAM with a high declared cost per hour of work (\$25-49), as well

as a minimum project cost (\$10,000). At the same time, smaller projects provide a higher index of satisfaction with career growth. In our opinion, this company should more actively attract specialists with competencies that will allow for the expansion of the range

of services provided, creating competition for SoftServe and other companies.

Recommendations for the improvement of business model efficiency for the rest of the IT companies, as assigned to homogeneous groups, are presented in Table 3.

Table 3. Recommendations regarding measures aimed at improving the efficiency of the business model of IT companies categorised in groups of homogeneity

a-b* **	Main services provided (the value of the centroid as a percentage of the entire spectrum)	Industries (the value of the centroid as a percentage of the entire spectrum)	Recommendations
0-0 55.5	IT (41.89), BS (11.55)	CSD (34.01), WD (12.32), MaD (8.12)	Establishing cooperation with the Re, MI, and CPS industries
0-1 56.3		AI (70.41), MaD (7.91), BIBD (4.58)	Establishing cooperation with the Re, MI, and CPS industries and increasing the share of BIBD
0-6 50.0		WD (40.13), MaD (33.48),CSD (6.48)	Involvement in the client base of the Ma industry, as well as specific industries
1-0 54.0	MI (29.53), Ed (11.13), E-c (7.81).	CSD (34.01), WD (12.32), MaD (8.12)	Establishing cooperation with the CPS and BS industries
1-1 75.0		AI (70.41), MaD (7.91), BI&BD (4.58)	Establishing cooperation with the Enterprise segment
1-4 60.9		UX/UI (98.66)	Establishing cooperation with the Enterprise segment
1-6 44.1		WD(40.13), MaD (33.48), CSD (6.48)	Expansion of the client base to include the FS, CPS, and BS industries
2-3 81.3	Gaming (86.25)	AR/VR (78), MaD (9)	The optimal combination
2-6 56.2		WD(40.13), MaD (33.48), CSD (6.48)	Adding AR/VR specialists to the team or training one's own specialists
3-0 55.7	FS (52.88), E-c (5.57)	CSD (34.01), WD (12.32), MaD (8.12)	CSD services are the best remunerated in terms of client industries, and so should constitute an increased focus
3-5 45.0		BC (65.38), MaD (4.61)	Establishing cooperation with the Enterprise segment
3-6 45.0		WD (40.13), MaD (33.48), CSD (6.48)	Increasing the share of CSD services

a-b* **	Main services provided (the value of the centroid as a percentage of the entire spectrum)	Industries (the value of the centroid as a percentage of the entire spectrum)	Recommendations
4-0 55.5	Re (12.89), FS (9.12), MI (7.7), CPS (6.12)	CSD (34.01), WD (12.32), MaD (8.12)	These select industries pay more for AI services. It is necessary to attract these specialists to the team or to increase the share of CPS clients
4-1 78.1		AI (70.41), MaD (7.91), BIBD (4.58)	Entering the gaming market, as well as increasing the share of AI and BIBD in services
4-2 62.5		WDS (53.66), UX/UI (10.46), E-cD (5.66)	BS, IT industries pay more for similar services. Therefore, attract customers from these industries
4-3 48.2		AR/VR (78), MaD (9)	It is necessary to work at least partially with the gaming industry
4-6 46.9		WD (40.13), MaD (33.48), CSD (6.48)	Attracting the BS industry as well as specific OI industries to the client base
5-0 43.8	OI (36), Ma (10.44), Ed (7.41).	CSD (34.01), WD (12.32), MaD (8.12)	Expand the client base in the FS, BS and CPS industries and attract WD specialists to the team
5-6 64.6		WD (40.13), MaD (33.48), CSD (6.48)	Expand the client base in the FS, BS industries
6-0 75.0	CPS (64), BS (19)	CSD (34.01), WD (12.32), MaD (8.12)	Expand the client base to include FS branches
6-6 75.0		WD (40.13), MaD (33.48), CSD (6.48)	Expand the client base to include FS branches
7-0 56.3	E-c (75) OI (6)	CSD (34.01), WD (12.32), MaD (8.12)	Expand the client base in the fields of FS, CPS, and BS
8-0 46.9	BS (35.69), FS (11.45), IT (8.93), E-c (7.54)	CSD (34.01), WD (12.32), MaD (8.12)	WD services are better remunerated by customers of the same industries. Increasing the share of WD services
8-1 56.3		AI (70.41), MaD (7.91), BIBD (4.58)	Establishing cooperation with the Re, MI, and CPS industries
8-2 75.0		WDS (53.66), UX/UI (10.46), E-cD (5.66)	Establishing cooperation with the Enterprise segment
8-4 37.5		UX/UI (98.66)	Establishing cooperation with the Re and MI industries
8-5 50.0		BC (65.38), MaD (4.61)	The range of services provided is suboptimal, it is necessary to change the emphasis
8-6 51.5		WD (40.13), MaD (33.48), CSD (6.48)	Establishing cooperation with the CPS industry

*a-b – a – cluster number according to industries that form the client base, b – cluster number according to the range of services provided;

** – the average declared cost of an hour of work by the homogeneity groups

Source: calculated by authors

The abbreviations used in Table 3 for industry sectors are as follows: information technology (IT), business services (BS), medical (MI), education (Ed), e-commerce (E-c), gaming (Ga), financial services (FS), retail (Re), consumer products & services (CPS), other industries (OI), and the media (Ma).

The abbreviations used for the types of services provided: custom software development (CSD), web development (WD), mobile app development (MaD), Artificial Intelligence (AI), business intelligence & Big Data consulting (BIBD), web design (WDS), UX/UI design (UX/UI), e-commerce development (E-cD), AR/VR development (AR/VR), and blockchain technologies (BC).

According to the research, the best remunerated services are artificial intelligence, business intelligence & Big Data consulting, e-commerce development, CRM, ERP consulting and SI, and cloud consulting. These services can only be provided by highly qualified specialists. Therefore, the top management of companies should cooperate closely with universities to create educational programmes, providing technical means of education, as well as promoting the improvement of teaching staff qualifications and setting applied tasks; that is, establishing the process of attracting the best students even in the process of their so-called formal education.

Conclusions

The applied clustering method made it possible to group a large share of Ukrainian IT enterprises according to the similarity of elements of their business models from the point of view of the value creation system. The main indicators that characterise the value of an IT product on the global market are the ability to provide high-quality services (spectrum of provided services); the ability to provide services to certain industries, as well as the ability to form a national

or transnational team of specialists that ensure the first two indicators.

The proposed measure of the effectiveness of the applied business models was the average declared cost of an hour of work for the implementation of the project, as well as the spectrum of the scale of the client base (small, medium-sized or large businesses).

The results of the study allowed us to confirm the hypothesis. The study showed that the main factor in the formation of IT product value is the number and quality of employees. Given the present state of the national economy and the predominant transnational nature of a large share of Ukrainian IT companies, the share of employees registered in Ukraine is no less important. The selection of the average hourly cost of work for the assessment of the effectiveness of business models received scientific confirmation.

In the study, the authors found an inexpediency of wide dispersion of the range of services provided. An optimal solution would be to focus on a small number of services, especially custom software development, web development, artificial intelligence, mobile app development, or to devote oneself entirely to UX/UI Design. The breadth of the range of the sectors in which consumers of the services provided operate is insignificant in view of the cost of an hour of work at a given company, but to a certain extent preference should be given to industries such as financial services, medicine, e-commerce, information technology, business services and retail.

Further research can be connected with internal elements of business models, aimed at ensuring the growth of the product value of Ukrainian IT enterprises for external customers, as well as with external factors with the aim of building a vague business model (Zaiats et al., 2019) based on the effects of legislation and the educational environment on the Ukrainian IT industry.

The results of the publication will be useful for the top management of IT companies in order to identify the optimal directions of possible development in relation to more expensive services on the global market. Also, the results of the study can be useful for teaching staff and top management of universities who train budding IT specialists in order to adjust curricula and programmes as well as intensifying cooperation with IT companies and IT clusters.

The results of the study have certain limitations; in particular, only factors influencing the value of an IT product in the context of the client base and the range of services provided were analysed.

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Entrepreneurship Education, Personality Traits and University Environment as Predictors of Venture Creation Among Undergraduates in Nigeria

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Abstract

National entrepreneurship activities define economic growth, development and national competitiveness. Creating a pool of entrepreneurs becomes a viable strategy for developing countries to improve employment and livelihoods therein. While entrepreneurship education, personality traits and the university entrepreneurship environment matter in terms of the stimulation of entrepreneurial intention, little is known about the relationship in the Nigerian context. This study therefore examines the influence of entrepreneurship education (EE), students' personality traits (PECs), and the perception of the university entrepreneurship environment on students' entrepreneurial interest (EI) and practice (EP). The study further explores how EE influences their entrepreneurial capabilities. Primary data were collected from 3,848 students across the science, engineering and social science disciplines at six Nigerian universities. The results show that about 81.8% of the students are interested in entrepreneurship, while about 39.1% of them are currently practicing entrepreneurship. Regression analysis shows that EE, PECs and parents' entrepreneurial experience have a positive and significant relationship with students' EI and EP. Interestingly, students' perception of the university entrepreneurship environment shows a positive and significant relationship to EI, especially in terms of inspiring them to become entrepreneurs. EE was found to equip students with the ability to notice and develop business ideas, networks, practical managerial skills, an understanding of entrepreneurship in general and the attitude, values and motivation necessary for venture creation. The study provides novel empirical insights into the relevance of the university context to the EI and EP of students at Nigerian universities. It further confirms the influence of EE and

DOI: 10.23762/FSO_VOL11_N01_3

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PECs on EI and EP. The study concludes with important policy suggestions by means of which to stimulate and sustain students' interest and confidence in venture creation.

Key words

university, entrepreneurship interest, entrepreneurial practice, personal entrepreneurial characteristics, undergraduates.

Introduction

One of the critical challenges confronting African countries, and Nigeria in particular, is the persistent increase in the unemployment rate leading to unrest and insecurity. Unemployment has escalated in recent years due to the economic slowdown occasioned by the COVID-19 pandemic (Ilevbare et al., 2022). Recent statistics from the national database showed that the country has an unemployment rate of 33.3%, with the majority in the youth category (42.5%) (NBS, 2022). With a low business birth rate and a poor business climate in the country, it does not seem as though the problem of unemployment will disappear anytime soon. Therefore, promoting and stimulating entrepreneurship among the youth becomes a viable option for overcoming poverty and unemployment (Drucker, 2014; Ilevbare et al., 2022). Successive governments in Nigeria had devised several programmes and policies to tackle the problem of unemployment and macroeconomic challenges in the past, including the industrial revolution plan, economic recovery and growth plan, economic sustainability plan and the current national development plan (2021-2025) (FMFBNP, 2021). Major programmes that cut across the national development plans are those designed to reduce poverty, unemployment and provide critical infrastructure to stimulate new venture creation while sustaining the existing ones. In fact, the 2022 budget, which was meant to finance the National Development Plan (2021-25), hinged on achieving accelerated growth, deepening initiatives for diversified growth

and fostering sustainable development. To achieve these laudable goals, four key strategic objectives and two cross-cutting enablers were identified to lay the groundwork. Among these strategic objectives are the need to establish a strong foundation for a diversified economy, invest in critical infrastructure (such as finance, physical, digital and innovation), build a solid framework for building capacity and strengthening security, and enable a vibrant, educated and healthy populace. In addition, investment in social infrastructure for the alleviation of poverty and the promotion of development opportunities across the country and regions have become key enablers in the NDP (FMFBNP, 2021). As earlier noted, the nucleus of any economy lies in the ability to provide an enabling environment for business and innovation in a sustainable way, including a wide array of social and infrastructural services. This gave credence to the argument espoused by Mazzucato (2016) that nations have to be appropriately equipped with entrepreneurial mindsets and leadership, deploying policies and making decisions that allow for the exploitation of opportunities in order to foster economic development.

Overreliance on oil revenue since the 1970s has been a major drawback for the Nigerian economy. The agricultural sector, which previously served as the mainstay, is now dominated by subsistence practices, resulting in huge food deficits and subsequent imports (NBS, 2020; 2022). The service sector now contributes more than other sectors to the economy, although its full potential is not

being explored as a result of weak ICT infrastructure, which is one of the key types of infrastructure needed to bolster innovation and entrepreneurship ecosystems in the country.

Moreover, the knowledge institutions within the ecosystems need to provide education and training in entrepreneurship to equip students and faculty members with entrepreneurship competencies and skills to positively impact society. There is burgeoning literature on how entrepreneurship education and training can stimulate students' career options in venture creation and self-employment (Olofinyehun et al., 2018; Adelowo et al., 2021). In addition to entrepreneurship education, there is a general perception in the country that most curricula taught in schools merely prepares students for careers in white-collar jobs, thereby pushing them to become job-seekers after graduation rather than job creators. To effectively prepare students for venture creation, all actors in the entrepreneurship and innovation ecosystems have to play active roles providing policy incentives, critical entrepreneurship infrastructure, financial incentives such as venture/innovation funds, clear guidelines on training, R&D investment, university-industry collaborations and human capital development. In addition, some of the key indicators that have emerged for monitoring and evaluating entrepreneurship ecosystems recently included national and entrepreneurship framework conditions, societal values and individual attributes (GEM, 2022). The Global Entrepreneurship Development Institute also designed indicators for measuring the quality and dynamics of entrepreneurship ecosystems at the national and regional levels, paying particular attention to attitudes, ability and aspirations as the core structure of entrepreneurship indices (Acs et al., 2018). In shaping the ecosystems, the indicators take cognisance of the framework conditions advanced in the GEM reports including the market structure

of the economy, infrastructure, R&D system, the financial sector, the corporate sector, government and the education system. Furthermore, Acs et al. (2018) devised 14 components of entrepreneurship ecosystems ranging from opportunity recognition to the availability of risk capital within the system. Entrepreneurship begins with the ability to perceive and exploit opportunities using the available resources, yet adequate support in the ecosystems are required. The performance of Nigeria as measured in existing entrepreneurship data indices has always been low principally because of its weak institutions, infrastructure and policy incentives, among other things (Siyanbola, 2019). This is also demonstrated in the consistent decline of the country's ranking on the WIPO Global Innovation Index (WIPO, 2021) and the Global Competitiveness Index (GCI, 2021) by the World Economic Forum.

In recent times, a consortium of three universities in Europe have emerged to regularly map the university entrepreneurial spirit of students at the national and global levels (Sieger, 2021). The datasets generated by the consortium provide insights into the entrepreneurial intention and its key determinants among university students in various countries around the world. The participation of Nigerian universities in this survey is limited to 2010, with few responses. However, recent studies have shown that the National Centre for Technology Management in Nigeria has been conducting a large-scale survey on students' entrepreneurial intentions since 2007 (Olofinyehun et al., 2022). The dataset has now been published and is freely available for public use as well (Olofinyehun et al., 2022). This dataset is useful to policymakers and interested stakeholders for mapping the relevance of entrepreneurship education and identifying key correlates of entrepreneurship interest and practice among undergraduates in the country. For the purpose of this study, we specifically examine the important roles played by the university entrepreneurship

environment, students' personality traits and entrepreneurship education as important variables that jointly influence the propensity for entrepreneurship among students. As parts of the effort to transform universities into hubs of innovation and entrepreneurship in Nigeria, it is critically important to map the level of preparedness that could match students' readiness for venture creation. This study shines a light on students' perception of the university entrepreneurship environment at universities and also scrutinises how entrepreneurship education has impacted their entrepreneurship capabilities. The uniqueness of this study is twofold; it uses a large-scale dataset and represents the first case of including the university entrepreneurship environment as a variable that influences EI and EP, in addition to personality traits and entrepreneurship education. Theoretically, the study provides empirical implications of the university entrepreneurship environment and entrepreneurship education on the intention of undergraduates to become entrepreneurs (Ajzen, 1991; 2011). The remaining sections are structured as follows: section 2 contains the literature review; section 3 articulates the methodology, variables and measurement and how the data was analysed; section 4 presents the results and discussion; while the last section highlights the conclusions and policy recommendations.

1. Literature review

Studies have consistently demonstrated that entrepreneurship education (EE) has the potential to instil entrepreneurial mindsets and skills, particularly in young people (Gerry et al., 2008; European Commission, 2012; Valerio et al., 2014; Liñán & Fayolle, 2015; Olofinyehun et al., 2018). The findings also show that exposure to entrepreneurship education indeed improves the propensity for entrepreneurship among undergraduates (Siyanbola, 2019; Olofinyehun et al., 2018). However, direct links between EE and actual

engagement in entrepreneurial activities is yet to be established, given that a number of other factors mediate start-up formation, including finance, infrastructure, regulations and other players in the ecosystem. Besides these other factors, the entrepreneurship education curriculum also matters, including the delivery system, class size and availability of mentoring services. From the perspectives of Ajzen (1991) as laid out in his theory of planned behaviour, entrepreneurial behaviour is driven by three important psychological properties, namely attitude towards behaviour, subjective norms and perceived behavioural control. The attitude towards entrepreneurial behaviour is defined by the degree to which an individual considers entrepreneurship a favourable outcome after evaluation. Here, the benefits and motivations for engaging in entrepreneurship are considered holistically by individuals before actual engagement in entrepreneurial ventures. Second, the subjective norms relate to the acceptability of the behaviours in society. For instance, if an individual believes that an entrepreneurial undertaking is acceptable in a particular setting, most likely among one's peers, friends and society, there is a high chance of engaging in it than would otherwise be the case. The third component, perceived behavioural control, relates to the capability of an individual to actually exercise the behaviour. In this case, competence matters. The overarching role of entrepreneurship education as a mediator of attitude, subjective norms and perceived behavioural control towards start-up creation has been well documented in the literature (Ndfirepi, 2020). By exposing an individual to EE or ET, their attitude, perception and aspirations regarding entrepreneurship receive a boost (Linan, 2008; Regele & Neck, 2012; Rauch & Hulsink, 2015; Boldureanu et al., 2020). This notion is also confirmed by the human capital theory, where education is believed to imbue skills and knowledge into an individual to enhance competence and capability for independent

or collective actions. EE tends to increase participants' awareness of entrepreneurial opportunities both prior to and after graduation, thereby enabling skills development for new venture creation (Morland et al., 2021). They further claimed that EE allows participants to self-discover their entrepreneurial potential, with the possibility of engaging in entrepreneurship in the future. To Morland et al. (2021), experiential entrepreneurship education is important for individuals interested in starting business ventures, as it fills the gaps between knowledge acquisition and tacit appreciation of what it takes to be entrepreneurial. Therefore, to promote entrepreneurship among university students, it is imperative to understand their initial drive and motivation for participation in entrepreneurship courses so as to provide suitable programmes that will be more likely to lead to positive business outcomes. It should be noted that EE is most effective where favourable entrepreneurial ecosystems exist and suitable training develops skills, perceptions and intentions which can easily be translated into actions (Martinez et al., 2010).

In a quasi-experimental study among Spanish students at the University of Castilla-La Mancha, Díaz-García et al. (2015) found empirical evidence for the contention that EE improves entrepreneurial intentions and sustains the self-efficacy of those who participated in the entrepreneurship programme. This suggests that EE has the potential to ignite passion for entrepreneurship in students, but a different strategy may be required to sustain it, particularly the establishment of entrepreneurship facilities such as incubators, science parks and technology parks, among others. A more recent study also confirms that the university context and entrepreneurship training are important parameters that influence students' attitudes towards entrepreneurship in 10 Colombian universities (Valencia-Arias et al., 2021). The authors later emphasise the need to align the entrepreneurship

curriculum with industry needs and equip students with an experiential entrepreneurship education that helps them create business ventures or make them readily employable in the industry. Solesvik (2019) also affirmed that participation in university entrepreneurship programmes develops stronger entrepreneurship skills among students who participate than those who do not. Della Volpe (2020) argued that entrepreneurship education that will equip 21st century entrepreneurs with the skills and mindsets necessary for business creation should go beyond traditional classroom teaching to incorporate knowledge that promotes innovation. Entrepreneurship education programmes may arouse the urge for entrepreneurship in students, but there are other factors that mediate between intention and actual action, particularly the configuration of the entrepreneurial ecosystems – access to finance, business space and other support infrastructure. Moreover, the curriculum and delivery process are key to the success of EE. For instance, Guerrero and Urbano (2012) suggest that for EE to be effective and achieve the intended purpose, seminars, business meetings and labs where students and experienced entrepreneurs can interact have to be incorporated into the training. Other authors have also suggested role modelling (Van Auker et al., 2006; Karimi et al., 2013), case studies (Byabashaija & Katono, 2011) and mentoring programmes (Karimi et al., 2013) as important components of entrepreneurship education and training.

In Nigeria, studies have examined and shown the influence of self-efficacy on entrepreneurship intention among students in technical and vocational education in Lagos State (Adeniyi, 2021; Adeniyi et al., 2022). However, the author did not consider the fact that self-efficacy of students is a function of their knowledge and understanding of entrepreneurship and other factors in the entrepreneurship ecosystems. As noted earlier, for students to improve self-efficacy,

entrepreneurship education is crucial. By factoring in the university entrepreneurship environment, we tend to increase the understanding of how its perception interacts with entrepreneurship intention and practice among undergraduates. Finally, the study evaluates the influence of entrepreneurship education, personality traits (PECs) and university context on EI and EP of the undergraduates in the country. The study also estimates the influence of entrepreneurship education on the entrepreneurship capacity of the students using regression analysis (OLS).

2. Methodology

The study utilises a cross-sectional study for which data were collected with the aid of a questionnaire to examine the effects of government entrepreneurship education policy on the entrepreneurial intention and practice of students in six selected universities across Nigeria (Adelowo et al., 2021; Olofinyehun et al., 2022). In Nigeria, research on entrepreneurial interest and practice among students of higher education institutions dates back to 2007, when the effect of entrepreneurship education policy in Nigeria was examined at NACETEM. In 2010-2011, a large scale cross-sectional survey was again designed to gain more insights into how entrepreneurship courses at Nigerian institutions have influenced EI and EP. In 2016 and 2020-2021 further rounds of datasets were collected from the same institutions to further unpack the dynamics of entrepreneurial activities in the universities. In the latter survey, however, certain variables were introduced to provide a better understanding of the influence of entrepreneurship education on the entrepreneurial skillsets acquired by the students. It also provided information on how students perceived the university entrepreneurship environment (ecosystems), and whether it is conducive to entrepreneurial ventures. Universities with entrepreneurship

infrastructure and incentives tend to boost students' interest and participation in venture creation. For instance, there are deliberate efforts currently ongoing in South Africa to improve the entrepreneurial climate in higher education institutions through the introduction of entrepreneurship development in higher education (EDHE). Such programmes target different segments of students and faculty with the sole aim of improving venture creation and research commercialisation, thereby reducing the rate of unemployment in the country. Nigeria has run compulsory entrepreneurship education as part of tertiary education for decades now, but the different approach that South Africa brought to their programmes makes them more likely to promote job creation. For instance, the introduction of competitive grants, innovation funds and other mechanisms to bridge university-industry gaps are germane to the promotion of entrepreneurship in the higher education system.

In the datasets used for this article, at least 700 or 800 students from the science, social science and engineering departments at six universities participated in the survey. A total of 3,848 survey instruments retrieved were usable for analysis. The datasets used represent those collected during the 2020-2021 sessions. It should be noted that data collection began in the first quarter of 2020 before the COVID-19 pandemic was reported in Nigeria. Data collection at one university was delayed until 2021 because the school could not resume the process as a result of the lockdown measures meant to stall the spread of COVID-19.

2.1. Variables and Measurement

The important variables of interest in this study include students' entrepreneurial intention, practice and their perception of the university entrepreneurship environment. From the theory of reasoned action (TRA) and planned behaviour (TPB), intention has been advanced as an important predictor of

behaviour, including entrepreneurial behaviour. TPB strongly advanced the hypothesis that behaviour is a function of interplays among three key variables, including attitude towards behaviour, subjective norms and perceived behavioural control (Ajzen, 1991; 2011). Students' intention to start or interest in starting a business was captured using the dichotomous variable 'Yes' or 'No' and coded as '1' and '0' respectively. Students who were interested in starting their own businesses answered in the affirmative, while their level of interest was captured on a five-point Likert rating scale ranging from very low (1) to very high (5). Quantifying their level of interest provided further insight into their level of seriousness with regard to the previous question of whether they were interested in entrepreneurship as a career option or not. Similarly, entrepreneurial practice (EP) was measured using the dichotomous variable of 'Yes' (1) or 'No' (0), indicating whether they were already undertaking business activities at the time of the survey. This is not an uncommon practice among young graduates in Nigeria, where some engage in petty trading to support themselves financially on campus (Olofinyehun et al., 2018). Information on whether their parents run or manage a business was elicited using the dichotomous response of 'Yes' (1) or 'No' (0). Parents' business experience has been established in the literature to influence entrepreneurial intention among students (Olofinyehun et al., 2018). Students' participation in entrepreneurship courses was captured using the dichotomous variable of 'Yes' (1) or 'No' (0).

For the personal entrepreneurship characteristics (PECs) of students, 55 validated items developed by Management Systems International in 2018 were adapted (Reyel et al., 2018; Adelowo et al., 2021). The items were measured on a five-point Likert scale of 'never' (0) to 'always' (4). Unlike how the PECs were grouped and analysed in our previous study, weighted means were computed and used in this article.

In terms of university entrepreneurship ecosystems, students were asked to rate the extent to which they perceived their university environment as supporting or promoting entrepreneurial inclinations on a five-point Likert scale from 'never' (0) to 'always' (4). Six items were used to capture this variable, adapting Sieger's (2021) framework (see Appendix 1). The items are as follows: 'the entrepreneurship environment at my university inspires me to develop new business ideas', 'a favourable environment for becoming an entrepreneur exists at my university', 'students are encouraged to engage in entrepreneurial activities at my university', 'there are suitable entrepreneurial laboratories and equipment for skills acquisition at my university', 'we were exposed to the practical approach of entrepreneurship or businesses in my department' and 'there are sufficient lecture halls for entrepreneurship education at my university'. These six items were reduced to two main factors using the Principal Component Analysis (PCA). The two factors explained 68.1% of the variance among the items that represents students' perception of the university entrepreneurship environment. The results further show that the Bartlett's test of sphericity was statistically significant ($X^2=6119$, $df=15$, $p<0.01$), the Keiser-Meyer-Olkin index of 0.773 was 'good' and the scree plot elbow suggests that the two components be retained. The two factors were renamed based on the items that load on each of them. The first factor was renamed 'EEEnv-Facilities' because the three items loading thereon are mainly related to those that captured the perception of students on the entrepreneurial laboratories or equipment, practical entrepreneurship workshops and lecture halls for teaching and learning at universities. The second factor was renamed 'EEEnv-Inspiration' because they are related to the degree to which they perceived the environment as providing inspiration, motivation and encouragement to the students. The two renamed factors are used in the regression

analysis to explore their influence on entrepreneurship interest and practice among the students. The results of the data analysis are presented and discussed in the next section of this article below.

3. Results and Discussion

The descriptive results presented in Table 1 show students’ responses to parents’ business experience, students’ personal business involvement and interest in starting ventures, perhaps after graduation. Students’ level of interest in starting a business and whether they have taken entrepreneurship education courses were adequately captured. The results show that most students (82.3%) affirmed that their parents had business experience. Most of them (81.8%) also signalled their interest in starting a business while approximately 39.1% of them were already running one form of business or another at the time of the survey. The latter result was expected, as the majority of them are currently expected to pay sufficient attention to their studies and limit any activities that may distract them. Interestingly, however, the rate of business engagement among students is improving over time. For instance, Olofinyehun et al. (2018) revealed improvement in entrepreneurial practices among students in Nigeria. In 2007, 2011

and 2016, the percentage of students engaged in entrepreneurial activity was found to be 26.9%, 27.8% and 36.1% respectively (Adelowo et al., 2021; Olofinyehun et al., 2018; 2022). Conversely, there has not been a consistent increase in the level of entrepreneurial interest among students over time. For instance, over the same period 83.6% of students showed interest in entrepreneurship in 2007, 84.3% in 2011, and 92.7% in 2016, while this figure currently stands at 81.8%. These results are consistent with the findings of research by Sieger (2021) that students’ entrepreneurship intention fluctuates over time, especially as a result of individual differences/preferences and given that the surveys are cross-sectional in nature. When it comes to students’ level of entrepreneurial interest, most students (69.5%) have between high and very high levels of entrepreneurial interest, while few of them have moderate levels of interest and negligible numbers have low and very low levels.

One of the indicators of venture readiness is the development of business plans. The results show that approximately 44% of students had a business plan ready at the time of data collection, indicating their readiness to establish a venture. This suggests that most of the students do not yet have a business plan.

Table 1. Key entrepreneurship activities among undergraduates

Students’ parents have business experience	Frequency	%
No	666	17.7
Yes	3095	82.3
Students are engaged in business		
No	2293	60.9
Yes	1472	39.1
Students are interested in starting their own business		
Yes	3043	81.8
No	677	18.2

Students have created a business plan		
Yes	1517	44.3
No	1906	55.7
Students have taken part in entrepreneurship education		
Yes	2819	74.6
No	962	25.4
Level of interest in starting one's own business		
Very high	1416	43.5
High	847	26.0
Moderate	819	25.2
Low	127	3.9
Very low	47	1.4

Source: calculated by authors

Most students (74.6%) have taken entrepreneurship education courses at university at one time or another. Entrepreneurship courses have been compulsory for all students in tertiary institutions in Nigeria since 2006 when the policy came into force; however, students are free to choose at what point before graduation the course would be taken. In fact, the entrepreneurship course has now been split into practical and theoretical sections, such that students are expected to complete both sections before graduation. For those who have not enrolled in any entrepreneurship courses, they might have more years of study remaining, which provides them with an opportunity to defer the course.

3.1. Predictors of Entrepreneurial Intention at Nigerian Universities

In this section, the key determinants of entrepreneurial intention among the students were explored with particular emphasis on students' perception of universities' entrepreneurial environment, personal entrepreneurial characteristics and entrepreneurship education as clearly stated in the research objective. Here regression analysis was conducted to map and quantify the strength of the relationship between the dependent variable (EI) and the independent

variables (the determinants being PECs, EE and perception of the entrepreneurship environment at universities). The results showed that students' entrepreneurial interest is positively and significantly influenced by entrepreneurship education ($\beta=0.074$, $p<0.001$) and personal entrepreneurial characteristics (PECs) ($\beta=0.178$, $p<0.001$). This suggests that adequate attention should be paid to the two independent variables in the universities to improve students' passion for and drive towards becoming entrepreneurs. This result corroborates earlier findings where EE and PECs contributed significantly to the determination of EI (Olofinyehun et al., 2018; Solesvik, 2019). Similarly, perception of the entrepreneurship environment at universities, broken down further into two factors, namely facilities and motivation/inspiration, was analysed by means of exploratory factor analysis, indicating that motivation/inspiration ($\beta=0.02$, $r<0.001$) had a positive and significant influence on students' EI while facilities ($\beta=-0.03$, $p<0.001$) had the opposite effect. This shows that, beyond entrepreneurship education or the courses taken at university, how students perceive the university ecosystems is germane to determining their inclination towards entrepreneurship, particularly the

Table 3. Regression analysis showing key determinants of entrepreneurship practices among students

Independent variables	B	Std. Error	T	Sig.
(Constant)	-.136	.048	-2.838	.005
Are you interested in starting your own business?	.337	.022	14.967	.000
Have you previously taken any entrepreneurship courses?	.051	.019	2.659	.008
PECs	.078	.018	4.298	.000
EE: Facilities	-.032	.009	-3.655	.000
EE: Motivation/inspiration	-.001	.009	-.102	.919
R	32%			
R2	10%3			
F	76.3**			

Dependent Variable: Entrepreneurship Practice

**p<0.01

Source: calculated by authors

Furthermore, the influence of EE on the key entrepreneurship capabilities developed in the students were examined using regression analysis. The overall results, as presented in Table 4, show that EE positively and significantly influences all entrepreneurship skills and the capability that students claimed to have acquired at university, although the strengths of the relationship differ. Specifically, EE influenced students' ability to identify business ideas ($\beta=0.373$, $p<0.001$), ability to develop networks ($\beta=0.167$, $p<0.001$), practical management skills ($\beta=0.306$, $p<0.001$), and increased students' understanding of attitude, values and motivation for entrepreneurs ($\beta=0.302$, $p<0.001$). Moreover, students' ability to grow a business ($\beta=0.232$, $p<0.001$) and understanding of entrepreneurship ($\beta=0.345$, $p<0.001$) were significantly influenced by EE. These results corroborate the existing literature where entrepreneurship education or training influence the entrepreneurship competencies of students (Lee and Eesley, 2018; Olofinyehun et al., 2018; Solesvik, 2019; Lee and Eesley, 2020). In

fact, Leiva et al. (2022) demonstrated that the skills, abilities and values attained by students at Costa Rican universities positively influence their EI, reinforcing the assertion that the university environment, EE and learning programmes are important drivers of EI. Given that entrepreneurship education programmes bring students from various faculties and departments together, there is a greater chance of them being able to build strong networks and competencies needed for their professional lives after graduation, even if they do not end up as entrepreneurs. Moreover, such programmes tend to increase entrepreneurship awareness within the university community and provide students with ability to recognise business opportunities. In a country where unemployment is high, equipping students with entrepreneurship mindsets through education has been perceived as a plausible policy option, particularly when such programmes are reinforced by the establishment of incubators, hubs, business grant competitions and mentorship schemes.

Table 4. Regression analysis showing the relationship between EE and key entrepreneurship capabilities

Dependent variables	Unstandardised Coefficients		t	Sig.	ANOVA (F)	R	R ²	Adjusted R ²
	B	Std. Error						
Constant	0.283	0.050	5.651	0.000	20.65**	0.093	0.09	0.08
a. Ability to grow a business	0.232	0.051	4.544	0.000				
Constant	0.316	0.048	6.618	0.000	49.94**	0.14	0.02	0.02
b. Increased understanding of entrepreneurship	0.345	0.049	7.067	0.000				
Constant	0.356	0.047	7.547	0.000	39.16**	0.13	0.16	0.16
c. Increased understanding of attitude, value, and motivation for entrepreneurs	0.302	0.048	6.258	0.000				
Constant	0.361	0.048	7.531	0.000	39.16**	0.13	0.016	0.015
d. Practical management skills required to start a business	0.306	0.049	6.257	0.000				
Constant	0.379	0.051	7.423	0.000	10.24**	0.068	0.005	0.004
e. Ability to develop networks	0.167	0.052	3.200	0.001				
Constant	0.382	0.043	8.934	0.000	73.05**	0.17	0.03	0.03
f. Ability to identify business ideas	0.373	0.044	8.547	0.000				

Independent Variable: Entrepreneurship Education **p<0.01

Source: calculated by authors

Conclusion and Recommendations

This study sets out to provide empirical insights into the understanding of key determinants of entrepreneurship interest and practice among students of higher education institutions in Nigeria. It sheds light on the relevance of a conducive entrepreneurial environment within the university to support students’ entrepreneurial learning and inclinations. The study further shows how entrepreneurship education influences the entrepreneurial capabilities of the students. The main argument of policymakers for introducing entrepreneurship education at higher education institutions was to overcome the challenge of unemployment by equipping students with

entrepreneurial competence skills. Beyond the introduction of entrepreneurship education, there are other important variables that could encourage or stimulate entrepreneurial interest among the students, particularly personal entrepreneurial characteristics and their perception of the university entrepreneurship environment. The study utilises publicly available large scale datasets collected from six universities in Nigeria (Olofinyehun et al., 2022). Although the datasets contain series of cross-sectional surveys conducted over four periods, in 2007, 2011, 2016 and 2020-2021, this article essentially focused on the latter. This is because the selected dataset contained information related to key research objectives, namely the perception of the

university entrepreneurship environment and skills acquired by the students who participated in EE. Data was analysed using descriptive and regression analysis (OLS). The study has shown that most of the students are interested in entrepreneurship and have taken entrepreneurship courses while only a few of them confirmed that they were running one form of business or another as at the time of data collection. The study further showed a high level of entrepreneurship interest among the students, although only a few of them had developed business proposals, suggesting their readiness to pursue business in case funds and infrastructure are made available to them. As expected, entrepreneurship education, PECs, parents' business experience and perception of the university entrepreneurship environment are important variables that influenced students' entrepreneurial interest at the universities studied. For those of the students who are already running businesses, the key determinants were EE, PECs and entrepreneurial interest. However, a negative relationship was observed between the students' perception of the university environment and entrepreneurial practice, suggesting that the environment does not support student entrepreneurship. A plausible reason for this result could be the weak entrepreneurship infrastructure at the university by means of which to support innovation and entrepreneurship, as well as the large entrepreneurship class sizes (Siyanbola et al., 2012). From a deeper analysis of the relationship between entrepreneurship education and the capabilities acquired by the students, the study found that EE significantly contributed to a series of entrepreneurship competences among the students, particularly their ability to come up with business ideas, develop networks, management skills and their understanding of entrepreneurship as a whole. To further bolster the culture of innovation and entrepreneurship at Nigerian

universities, it is important to establish entrepreneurship infrastructure where theoretical knowledge can be put into practice. Moreover, the creation of an annual entrepreneurship week where students can pitch business ideas and compete for business grants is an important mechanism by means of which to transition from interest to venture creation. The recent Central Bank Entrepreneurship competitive grant initiative by the federal government could be expanded to further stimulate or bolster the culture of innovation and entrepreneurship among university students. Previous studies have shown that the curriculum, delivery system and capabilities are important when it comes to the quality of the entrepreneurship education received by undergraduates (Valerio et al., 2014; Liñán & Fayolle, 2015; Boldureanu et al., 2020; Morland et al., 2021). Therefore, university administrators and faculties could overhaul the content of the entrepreneurship curriculum, the delivery system and the capabilities of faculties to develop skillsets and competences that have positive bearings on national competitiveness and sustainable development plans. Organising inter- and intra-university entrepreneurship competitions where students and faculties could have the opportunity to pitch their business ideas is another important mechanism for turning ideas into business reality. Another plausible option to improve the entrepreneurship environment at universities would be to create a knowledge sharing platform among all Centres for Entrepreneurship Studies in Nigeria where best practices are shared, resulting into the co-creation of an efficient entrepreneurship education delivery system. This initiative could further create entrepreneurship awareness and consciousness at higher education institutions. Additionally, to optimise the potential of students in terms of business creation, a mentorship programme could be introduced where students are attached

to industry to acquire and further enhance their practical skills.

The study is not without limitations, as it relied on a cross-sectional survey through the use of a self-reported questionnaire that cannot be claimed to be entirely free of common bias. However, the fact that the research instrument had already been validated and used over time reduces the likelihood of bias in the study. Further, the questionnaire items were developed through sound theoretical underpinning and crafted in plain language after a series of brainstorming sessions among faculty and practitioners. The process guaranteed that any bias associated with self-reported study was reduced, if not eliminated. Also, to fully understand the impact of entrepreneurship education on entrepreneurship practice among undergraduates, future studies may consider longitudinal or experimental forms.

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Appendix 1

Key items for university entrepreneurship context and results of factor analysis

Component Matrix	Component	
	1	2
The entrepreneurship environment at my university inspires me to develop new business ideas	0.074	0.867
A favourable environment for becoming an entrepreneur exists at my university	0.133	0.850
Students are encouraged to engage in entrepreneurial activities at my university	0.397	0.651
There are suitable entrepreneurial laboratories and equipment for skills acquisition at my university	0.801	0.242
We were exposed to the practical approach of entrepreneurship or businesses in my department	0.817	0.073
There are sufficient lecture halls for entrepreneurship education at my university	0.782	0.165
Variance explained (%)	35	33.15

$\chi^2=6119$. df = 15, $p<0.01$, Keiser-Meyer-Olkin= 0.773

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalisation

Source: calculated by authors

Pragmatic methodology in management science

HENRYK DŹWIGOŁ, MATEUSZ TRZECIAK

Abstract

The article intends to demonstrate the importance of choosing suitable research methods and techniques in the field of management science, with the goal of enhancing the dependability, depth, and excellence of the conducted research. A two-stage international survey conducted using survey questionnaires based on a target group of academics conducting research in management science and managers conducting research in core management activities was used to achieve the stated goal. The research findings unequivocally emphasise the significance of practical methodology in the pursuit of identifying methods and approaches that impact the trajectory of the research process and the efficacy of organisational operations. The research results obtained provide a broader perspective on pragmatic methodology, especially the perspective of methods for scientific activity subordinated to the pragmatic solution of research problems. The empirical implications of this article focus mainly on answering the research questions posed, thus providing recommendations for both academics conducting research in management science and managers conducting research in core management activities.

Key words

pragmatic methodology, research methods, management science, research process.

DOI: 10.23762/FSO_VOL11_N01_4

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Introduction

The dynamic development of systematic methods for managing knowledge resources brought about by the opportunities provided by information and communication technologies (Chu & Evans, 2021; Kwiek, 2021) is leading to greater interest among researchers in the methodology of

management science (Shaturaev, 2022). Scientific publications covering this issue attempt to incorporate the conventions of methodology creation through the evolution of methods (Ferran-Ferrer et al., 2017; Almalki, 2016; Tonidandel et al., 2016), the identification of common ground

that determines their identity (Hair, 2019; Dźwigoł, 2019) or the analysis of methodological aspects (Van Calster et al., 2021). As Kaushik & Walsh (2019) point out, there is still a lack of a comprehensive view of the achievements of researchers in the field of pragmatic methodology, especially from the perspective of methods for scientific activity subordinated to the pragmatic solution of research problems. In addition, the literature on the issue stresses the requirement for uniqueness in scientific endeavour, which is also made feasible through problematisation (Quinlan et al., 2019). According to Alvesson and Sandberg (2013) or Dźwigoł et al. (2023), there are alarmingly few innovative concepts and few management science research findings that have a significant impact on practice.

This is because traditional ways of expanding knowledge, such as seeking to close the “knowledge gap”, building a hypothesis on top of another or gathering and analysing empirical evidence are no longer as effective as once thought. Moreover, Alvesson & Kärreman (2007) emphasise that data do not necessarily generate an interesting, original research problem, and do not by themselves create reflection. According to the authors, it is useless to try to reduce the subjectivity of the researcher and the subjectivity of the theoretical assumptions they choose because, by doing so, one loses the element that strengthens the environment’s capacity to learn about and comprehend interesting problems in greater depth (Alvesson & Kärreman, 2007). Therefore, during the research process, the focus ought to be on deconstructing the assumptions and foundations that underlie a specific theory, rather than solely on data processing, according to Hiver et al. (2021). Returning to the fundamentals and exploring the deeper levels of knowledge in management science will only aid in eschewing trends.

After all, the outcomes of a scientific endeavour that is popular at a specific moment are challenging to incorporate into outdated paradigms, institutions, beliefs, or sectors (Ahmadin, 2022). Fads, according to Benders & van Veen (2001), can simply create the appearance of novelty and put more pressure on those who provide scientific ideas while producing products of lower calibre. With regard to this, three steps can be identified to reactivate the original curiosity that once inspired researchers, i.e.:

- Identifying the currently recognised basis for a particular type of research (Snyder, 2019);
- Creating conjectures about the causes of conformity and differences, as well as the sources of success in the application thereof (George, 2019);
- Building hope that the breadth of overlapping individual obviousness revealed in later writings can be replicated (Ahmadin, 2022).

The analysis of literature on conducting research in management sciences shows the need to identify the most suitable methods, procedures, and approaches for the research process and the various elements thereof. This identification allows for the recognition of patterns in the perception of the research process and other variables that may impact the selection of appropriate methods and techniques, leading to higher quality research. Moreover, in the methodological layer, the search for models of ideal concepts of method selection enriches the pragmatic methodology of the management sciences (Dźwigoł & Dźwigoł-Barosz, 2018; Tkachenko, 2019) with a new, unprecedented use of methodological approaches in the literature, as it inspires the creation of methods directly applicable to the practice of management (Kanakaris et al., 2019; Snyder, 2019; Hiver et al., 2021).

1. Theoretical background

This chapter focuses on presenting the importance of pragmatic methodology in the search for methods and approaches that affect the research process and the effectiveness of the operations of an organisation.

1.1. Management methodology

Management methodology seeks rules that primarily lead to the acquisition of reliable knowledge, as well as changes that contribute to increasing the efficiency of organisational activities (Thomas & Raheem, 2020; Dźwigoł, 2019). Pragmatic methods are the most ancient group of research methods employed in management science, as noted by Maarouf (2019). These methods have a common-sense quality, according to Dźwigoł (2022). Their characteristic feature is the solution of practical problems faced by human individuals, rather than a focus on reaching the truth (Taguchi, 2018). At their core, their primary value criterion is effectiveness in the area of change, which can mean an increase in organisational efficiency (Kelly & Cordeiro, 2020). Pragmatic methods strive towards implementation techniques, both from the field of law (Donald, Speck, 2019) and engineering (Viroli et al., 2019) against a common-sense background (Dźwigoł, Dźwigoł-Barosz, 2018).

When considering technical and economic sources, the neopositivist movement clearly distinguishes between research approaches and practical ones (Boonmavichit & Boossabong, 2022). Efforts to attain an optimal state of knowledge in the field of organisation and management necessitate the utilisation of an ideal approach, both within the pragmatic and cognitive domains, which results in improved organisational efficiency. In the critical stream, research must be committed to pursuing emancipatory change (Alvesson & Willmott, 1992). On the other hand, Weick (1995) contends that, in contrast, the interpretive-symbolic

paradigm and postmodernism eliminate the distance between the researcher and the organisational reality being investigated. As a result, it is impossible to differentiate between cognitive and pragmatic methods.

As the authors point out (Dźwigoł & Dźwigoł-Barosz, 2018), the range of management methods includes not only specific methods, but also those borrowed from other sciences, for example, the survey method (taken from sociology) (Mohajan 2018), casuistic methods (taken from legal sciences) (Gábriš, 2019), or the observation method (taken from natural sciences) (Qutoshi, 2018).

Sułkowski (2013) asserts that the prevailing perspective is the neopositivist-functional-systems approach, which combines practical techniques that enhance efficiency with cognitive methods that aim to provide reliable and objective knowledge about management and organisation (Hassmén et al., 2016). This approach employs various management tools, such as human resource, financial, and information management, and assesses management efficiency and effectiveness using measurement methods (Armstrong, 1993).

As Flick (2002) notes, the approaches of the neopositivist paradigm are criticised for, among other things, lacking flexibility, being overly purist, and failing to reflect psychosocial dynamics.

Dźwigoł & Dźwigoł-Barosz (2018) identify an alternative paradigm, which is rooted in the humanistic traditions of social sciences. This paradigm encompasses various methods such as:

- Psychological techniques for management that employ qualitative and quantitative research. This includes creative techniques, team formation, attitude and motivation studies, and leadership development;
- Organisational anthropology, which uses field methods to study organisations (Cabot, 2019);

- Ethnomethodology, developed by H. Grafinkel (1967), which uses conversational methods to identify linguistic categories that structure social situations (Hammersley, 2019);
- Sociology of intervention, which emphasises the role of the researcher in forming groups and developing situational solutions (Touraine, 2020);
- Grounded theory, which suggests pluralistic research strategies that combine qualitative and quantitative techniques;
- Case studies, participatory action research, discourse analysis, and metaphorical methods.

The abovementioned methods emphasise qualitative and field research and are applied by both academic researchers and consulting firms. The alternative paradigm employs various research techniques such as participant observation, in-depth and group interviews, social intervention methods, discourse analysis, and critical incident techniques (Halkier, 2010).

1.2. Science and practice in the research process

The methodology of management science faces challenges in the modern scientific and commercial landscape, which highlights the key issues encountered by the methodology of this discipline and limits its potential. Here we can mention external conditions (Semko & Altukhova, 2020), breakthrough periods in its development, taking into account the processes of globalisation (Hussain et al., 2021), or more efficient methodological proposals (Bartnicki & Dyduch, 2019). Establishing guidelines for the use of pragmatic methods, as identified by Dźwigoł & Dźwigoł-Barosz (2018), Maarouf (2019), and Taguchi (2018), is essential in order to enable both researchers and practitioners to select research methods effectively. The dissemination of methodological paradigms, particularly in modern management science, is also crucial for the advancement of this

field of study (Czakon, 2011). These factors would facilitate the selection of appropriate research methods and enhance the development of this branch of science. Modern management science puts the fundamental theories that explain the sources and perceptions of change in organisations at a higher theoretical level (Hussain, 2019). These considerations stem primarily from life cycle theory, theological theory, dialectical theory or evolutionary theory. These seemingly constitutive theories specify the processes of change as a certain cycle of formalised activities and events. In the pursuit of scientific knowledge in the field of management, it is crucial to consider the primary impulse of management practice, as emphasised by Dyer (1996) and McCullough & Cunningham (2010). This concept is closely connected to the internal and external factors that influence the evolution of individual enterprises in response to changes in the environment, as discussed by Agarwal (2018).

Various methodological currents, including engineering, universalist, human relations, operational research, social systems, empirical, systemic, organisational game, situational, and cybernetic approaches, have been analysed, leading to new and radical changes in the field, as detailed by Lisiński (2013) and Mingers & White (2010). Furthermore, contemporary theories such as psychological and sociological theories of organisation by Small (2011) and Schwemmer & Wieczorek (2020), respectively, as well as praxeological, modernist, postmodern, and process models, provide a foundation for further scientific exploration, as highlighted by Dźwigoł & Dźwigoł-Barosz (2018). It is continually improved with fresh material as a result of scientific advancements and the demands of contemporary reality (economic practice) (Závadský et al., 2021).

At the same time, it should be noted that the methodology of the alternative paradigm has certain shortcomings (Panhwar,

2017). Namely, the lack of heterogeneity of methods results in the difficulty of comparing results, and it is not effective and efficient when studying mass processes. Since it is based on assumptions of intersubjectivity, there is difficulty in indicating the objectivity of the results and their reliability. The use of the researcher's personal perspective in the alternative paradigm can lead to ethical concerns, as pointed out by Guba & Lincoln (1994).

There is a strong link between science and practice, as scientific studies are often triggered by real-world problems or phenomena. Science can be divided into theoretical and practical sciences, with the latter aiming to address real-world problems or occurrences. The practical application of research findings is essential, as theoretical sciences seek to understand the natural and social world without considering how people will use the research in their activities (Vesel, 2011). There must be a theoretical layer in addition to the practical layer and vice versa.

By offering models of practical organisational and management solutions as well as strategies for putting them into practice, management science serves the pragmatism of economic and social life (Dźwigoł & Dźwigoł, 2020). Management sciences are closely related to economic activity, and research in this field must be based on both theory and practice. Although management sciences are often considered practical or applied sciences (Trzeciak et al., 2022; Kaushik & Walsh, 2019), they also conduct theoretical research that is essential for advancing the field. Without theoretical research, science cannot progress (Mintzberg, 2017). It is crucial to bear in mind that management sciences emerged in response to economic needs and have evolved in response to changes in the economy. The growth of the economy has led to and continues to lead to the establishment of a reality and environment for

company operations that are becoming increasingly complex. Therefore, the origin of management science can be viewed as generally practical. The conditions of economic and social activity are becoming more complicated and variable as economic and social life becomes more complex. As a result, practice calls for increasing amounts of science. Thus, it can be said that management science is frequently the key to the growth and attainment of an enterprise's competitiveness in the modern economy (Vaníčková & Szczepańska-Woszczyzna, 2020). The temporary nature of the claims made is, regrettably, the fundamental drawback of management science. The following facts account for this impermanence (Dźwigoł & Dźwigoł, 2020):

- The subjects of study in management science are not static, but they change over time due to various external and internal factors. Therefore, the research must consider the variables that affect the evolution of the subject and be conducted in a way that accounts for these variables.
- Companies are complex entities that have multiple components, including human resources, financial resources, technology, and products/services, which makes it difficult to study them. Therefore, researchers must consider the complexity of the research object and use appropriate research methods to obtain a comprehensive understanding thereof.
- Some aspects of management science, such as human behaviour, motivation, and culture, are difficult to measure or quantify. Therefore, researchers must use appropriate research methods that capture these qualitative elements and analyse them effectively.
- The context of the historical era can influence the way management theories and practices are evaluated. Therefore, it is essential to consider the historical context when analysing the validity of management theories.

- There can be issues with the accuracy and generalisability of research findings in management science. Therefore, researchers must use appropriate research methods that minimise bias and error and ensure that the findings are valid and reliable.
- Many management theories and practices are based on normative judgments rather than objective facts. Therefore, it is essential to recognise the normative nature of these assertions and evaluate them accordingly.
- The importance of applying the findings of management research in practice to validate their effectiveness. It suggests that management theories and practices must be tested in the real world to evaluate their impact and effectiveness.

Despite the transience described above, collaboration between science and practice should be strategically considered while running a 21st-century business.

2. Methodology

In this chapter, the authors explain the quantitative research method they used, which involved a deductive approach and a questionnaire. They applied the perspective of critical realism and drew on the conclusions of their literature review to determine the most suitable research methods for management science. To explore the topic in greater depth, the authors formulated six research questions, which aimed to investigate various aspects of research processes in management science. They used a two-stage quantitative study to answer these questions, which involved both theoreticians and practitioners in order to gain a more comprehensive understanding of the subject. This method permitted the researchers to obtain a wider and more comprehensive understanding of the issues being studied in the field of management science.

RQ1. Is it necessary to use case studies to support qualitative methods in research processes?

RQ2. Can combining the science and practice of management only occur after verifying the developed methods, models, or procedures?

RQ3. Does the case study provide an opportunity for an in-depth analysis of the research problem?

RQ4. Can group expert evaluation be the primary method for verifying the direction of research?

RQ5. Is it necessary in research processes for the management sciences, based on the observation of facts and the classification used in the general methodology of inductive sciences, it is essential to use two critical methods? The first method is conducting observations in natural conditions, where the researcher collaborates with the subjects being studied. The second method is observation-intervention, which takes place as part of management activities in the studied entities, where the researcher has a direct impact on the decisions made.

RQ6. Is it possible to enhance the quality of science and practice in management through the development of research-based recommendations?

2.1. Description of the quantitative research method

A two-stage international study was conducted using anonymous survey questionnaires based on a target group of theoreticians (scientists conducting research in management science) and practitioners (managers conducting research as part of their core

management activities). The structure of the survey questionnaires was based on the literature review of research methodology, and discussions with other academics, as suggested by Saunders et al. (2009).

The initial survey was designed to gather information from managers who conduct research as part of their core management activities. It was divided into four parts, with the first part containing general inquiries about research and available methods (six inquiries), the second devoted to the applicability of methods and techniques in management research (two inquiries), the third consisting of questions about improving research processes (four inquiries), and the fourth containing a metric (five questions). The questionnaire included closed (eight questions), open-ended (five questions), and matrix-form (four questions) questions using a five-point Likert scale to ensure ease of completion.

The second survey was aimed at academics conducting research in management science, and consisted of three parts. The

first part contained questions about the relevance of approaches, processes, methods, and techniques in management research (five questions), the second addressed the enhancement of the research process (33 questions), and the third included specific questions (three questions). The majority of the questions were closed-ended and used a matrix format with a five-point Likert scale for ease of completion. Surveys were distributed in hard copy at relevant conferences and electronically to a pre-prepared email database.

The research is presumed to be trustworthy given that it is exploratory in nature. The degree of error, which is tied to the measurement tool employed and emerges randomly in successive measurements made using a particular tool, determines reliability (Cresswell, 2009). Reliability was assessed using Cronbach's alpha coefficient. Each element presented using the widely-used Likert scale, which was adopted for further analysis in this article, is highly reliable, as shown in Table 1.

Table 1. Measuring reliability within the given research questions in the survey questionnaires for scientists and practitioners

Specification	Cronbach's alpha coefficient value	
	Scientists	Practitioners
RQ1	0.876	–
RQ2	0.874	0.964
RQ3	0.878	–
RQ4	0.878	–
RQ5a	0.879	–
RQ5b	0.878	–
RQ6	0.877	0.971

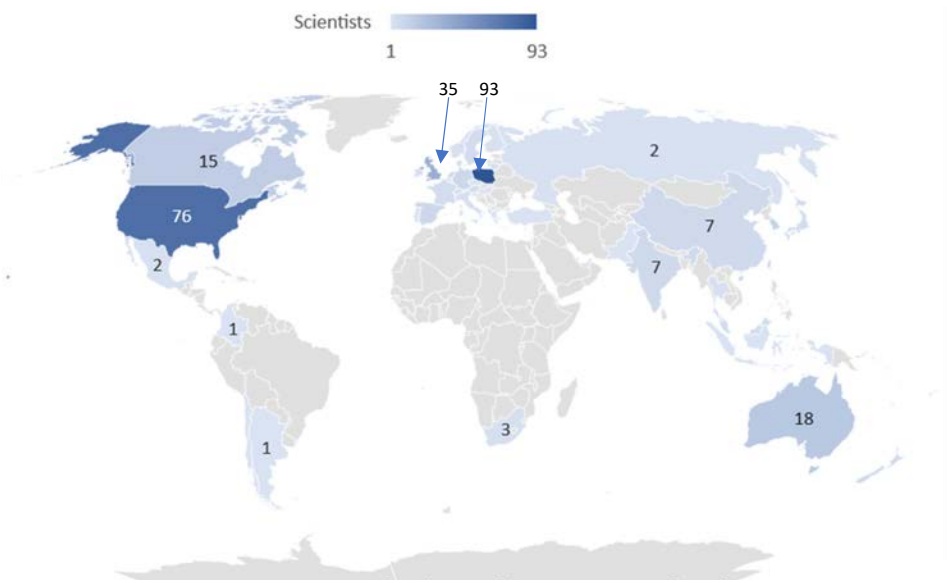
Source: own research

2.2. Description of the quantitative research method

Theoretical selection is the sample technique used in surveys; therefore, the experts should be individuals who are most knowledgeable about the study’s themes (Bell et al., 2018). A quantitative research study was conducted using a survey questionnaire, targeting a sample group of 365 universities with management science departments or units, 23,331 academics affiliated with management sciences, and 235 enterprises.

To ensure representativeness, presumptions were made to calculate the necessary sample size for a group of academics. These presumptions included assuming a p-fraction rate of 50%, an error magnitude of 5%, and a significance level of $\alpha = 0.05$. The minimum sample size was determined to be 385 completed questionnaires. The study surveyed 196 practitioners from 12 countries and 401 management science theorists from 45 nations. The geographical distribution of the respondents is presented in Figure 1 and Table 2.

Figure 1. Geographical distribution of respondents (group of scientists) by country



Source: own research

Table 2. Summary of the distribution of respondents (group of scientists) by country

Country	Number of experts	Percentage	Country	Number of experts	Percentage	Country	Number of experts	Percentage
Poland	93	23.19%	Indonesia	1	0.25%	Russia	2	0.50%
Argentina	1	0.25%	Ireland	2	0.50%	South Africa	3	0.75%
Australia	18	4.49%	Israel	1	0.25%	Singapore	2	0.50%
Austria	5	1.25%	Japan	5	1.25%	Switzerland	4	1.00%
Belgium	3	0.75%	Canada	15	3.74%	Sweden	5	1.25%
Chile	1	0.25%	Colombia	1	0.25%	Thailand	2	0.50%
China	7	1.75%	South Korea	11	2.74%	Taiwan	6	1.50%
Czech Republic	1	0.25%	Lithuania	2	0.50%	Turkey	1	0.25%
Denmark	5	1.25%	Portugal	2	0.50%	USA	76	18.95%
Finland	2	0.50%	Malaysia	5	1.25%	Hungary	1	0.25%
France	5	1.25%	Mexico	2	0.50%	UK	35	8.73%
Greece	1	0.25%	Germany	8	2.00%	Italy	3	0.75%
Spain	8	2.00%	Norway	2	0.50%	United Arab Emirates	1	0.25%
Netherlands	8	2.00%	New Zealand	6	1.50%	Other	26	6.48%
Hong Kong	5	1.25%	Pakistan	1	0.25%			
India	7	1.75%						

Source: own research

In the case of the group of business employees (practitioners), it was determined on the basis of the power factor of the test (Table 3), assuming:

- Hypothesis 0 (H0). $R = I$ (fractional coefficients are equal in both study groups)

- Hypothesis 1 (H1). $R \neq I$ (fractional coefficient in the theoreticians' group is greater than the coefficient of theoreticians in the practitioners' group)

Table 3. The postulated sample size among the group of practitioners

Sample size (factor loads: two fractions, Z test H0: $\pi_1 = \pi_2$)	Value
Fraction in the π_1 population	0.6710
Fraction in the π_2 population	0.3290
Probability of Type I (Alpha) error	0.0500
Target power	0.9000
Power (with correction for continuity)	0.9071
Sample size N1	401
Sample size N2	25

Source: own research

After interpreting the results, it was found that obtaining 196 responses from practitioners fulfils the condition for proving the assumption made earlier, that the fraction in the group of theoreticians is statistically

significantly larger than the fraction in the group of practitioners. Details of the geographic distribution of the group of practitioners are shown in Table 4.

Table 4. Summary of the distribution of respondents (group of practitioners) by country

Country	Number of experts	Percentage	Country	Number of experts	Percentage
Belgium	3	1.53%	France	5	2.55%
Brazil	2	1.02%	Spain	3	1.53%
China	2	1.02%	Ireland	2	1.02%
Denmark	3	1.53%	Japan	3	1.53%
Germany	3	1.53%	USA	28	14.29%
Poland	139	70.92%	UK	3	1.53%

Source: own research

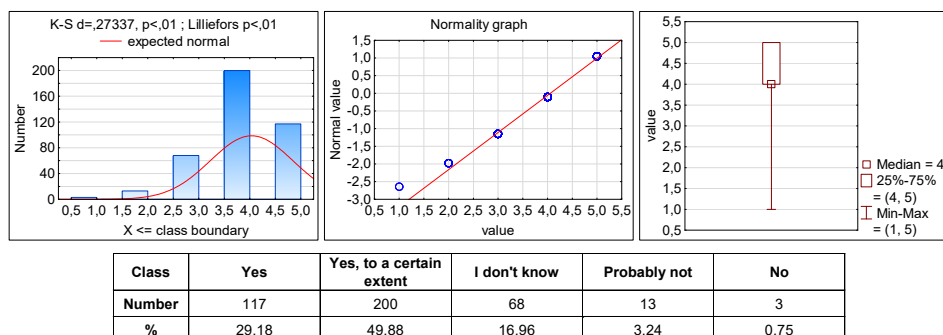
3. Research results

This section displays the findings of studies which were chosen to answer the research questions. The obtained results provide a more comprehensive understanding of the components of the research process, adding

to the practical methodology of management science. The section is organised into six sub-sections based on the chosen methodological framework.

3.1. RQ1 – Is it necessary to use case studies to support qualitative methods in research processes?

Figure 2. Summary of the research findings on the use of case studies to support qualitative methods in research processes. These results are based on a survey of 401 management science theorists



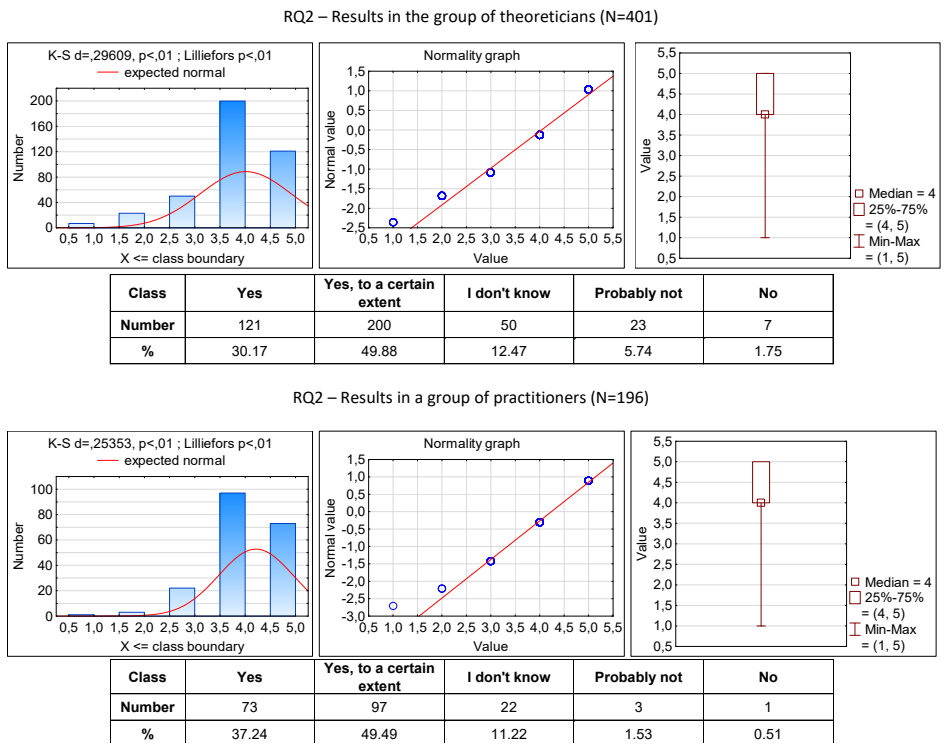
Source: own research

Based on the analysis of survey results, the majority of respondents (78.06%) agreed that case studies can support qualitative methods in research procedures. A study object can be an individual decision on the one hand (Mintzberg, 1979), a given business process of an organisation (Dyer & Nobeoka, 2010), a cluster (e.g., Silicon Valley) or an entire country on the other hand (Buck & Shahrim, 2005). For this reason, it must not be assumed that an object's designation as a case study is determined by its size or characteristics. Unlike quantitative research, where characteristics, sample size, and sampling methods are emphasised, the nature of a case study is determined by the

use of multiple exploratory methods to gain a deeper understanding of the studied phenomenon. In some cases, the nature of the case is determined by the use of interpretive methods, as noted by some researchers (Dul & Hak, 2016). In management sciences, theory testing is conducted through quantitative methods that determine the regularity of a proposed relationship between variables using statistical techniques to confirm the hypothesis. However, case studies are often used to test theories using falsificationism, which means disproving a theory using case studies that contradict it or demonstrate that the theoretical explanation cannot help to understand the organisational reality.

3.2. RQ2 – Can combining the science and practice of management only occur after verifying the developed methods, models, or procedures?

Figure 3. Can combining the science and practice of management only occur after verifying the developed methods, models, or procedures? – survey results: a) group of theoreticians (N=401), b) group of practitioners (N=196)



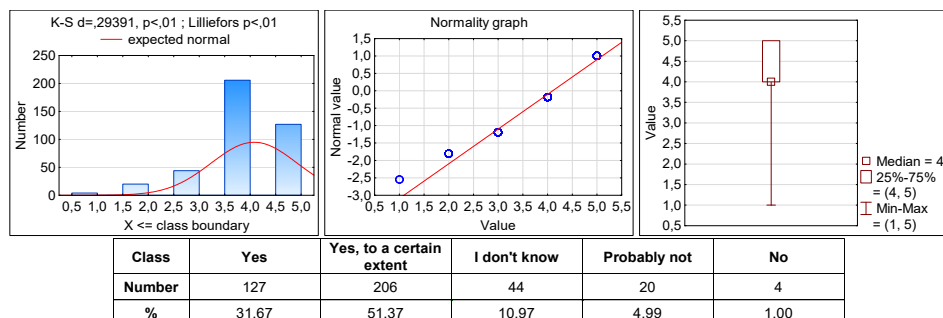
Source: own research

This sentiment is echoed in the literature, as noted by Dźwigoł et al. (2019), who emphasise the importance of employing heterogeneous research methods to provide a comprehensive answer to the research problem. In addition, the increasing use of various modelling, organisational management, and cognition methods has created a need for an open methodology that can facilitate and encourage the integration of numerous methodologies (Thomas, 2017).

Furthermore, it has been pointed out that testing these methodologies, models, or procedures in real-world settings is necessary to lend credibility to the research process and produce dependable data (O’Leary, 2017). In summary, verifying the established methodologies, models, or procedures is a prerequisite for merging management science and practice, and this is supported by both the analysed data and relevant literature on the topic.

3.3. RQ3 – Does the case study provide an opportunity for the in-depth analysis of the research problem?

Figure 4. Does the case study provide an opportunity for the in-depth analysis of the research problem? Survey results from the group of theoreticians (N=401)



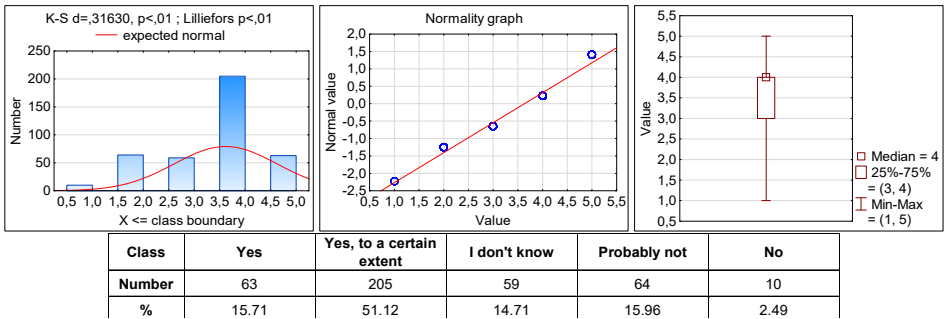
Source: own research

After analysing the data, it has been found that a large majority of respondents (83.04%) believe that case studies provide an opportunity for a comprehensive examination of the research problem. A case study involves a detailed analysis of phenomena and processes in their actual context (Beach and Pedersen, 2016; Tight, 2017), which is beneficial in terms of providing a better understanding of the object of study, although it is not used to test theories, but rather to falsify existing hypotheses. The contextuality of case studies has various consequences,

which may be procedural, cognitive, or tool-oriented. The procedural consequence is due to the inability of the researcher to predict the impact of circumstances at the time of entering the study, leading to the assumption of repetition. The cognitive consequence refers to the situational knowledge gained from case studies, which may not be repeated. Finally, the tool-oriented consequence is that case studies require the consideration not only of the object of study but also its environment and the impact of that environment on the object being studied.

3.4. RQ4 – Can group expert evaluation be the primary method for verifying the direction of research?

Figure 5. Should group expert evaluation be the primary method for verifying the direction of research? Survey results from the group of theoreticians (N=401)



Source: own research

A significant proportion of scientists (66.83%) believe that the group expert evaluation method should be the basis for verifying the direction of research.

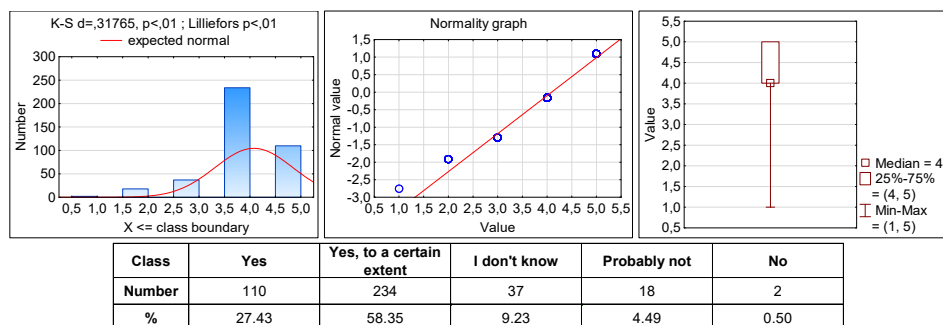
From the above, it can be inferred that utilising a case study allows for a comprehensive examination of the research problem, and expert evaluation is a vital technique for validating the direction of the research. Additionally, it simplifies the creation of the research methodology model and the selection of research methods and techniques. Furthermore, the method of group expert evaluation uses the achievements of the discipline, whose object of research is the processes of creative thinking, i.e. heuristics.

It defines recommendations, through the use of which it is possible to solve problems more effectively. At this point, it should be noted that the role of heuristic methods in business management, with particular reference to decision making, is very large and well-established. In decision making, the method of group expert evaluation is most often used. Dźwigoł (2019) provides additional support to the previous statement, ranking the most significant management science research methods in order of prevalence, which includes observation, interviews, documentary analysis, surveys, and group expert evaluation.

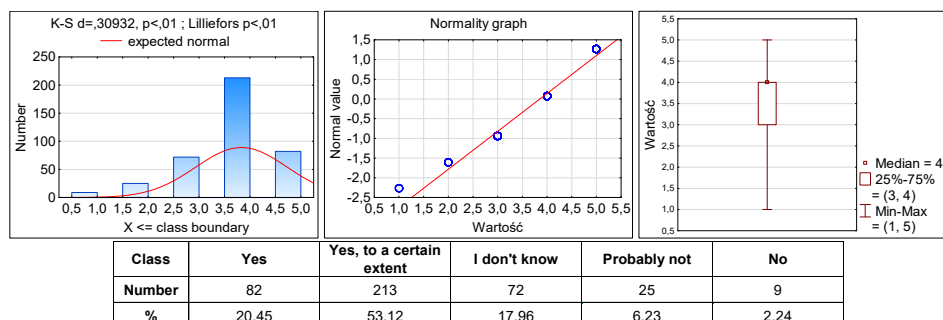
3.5. RQ5 – Is it necessary in research processes for the management sciences, based on the observation of facts and the classification used in the general methodology of inductive sciences, it is essential to use two critical methods?

Figure 6. Summary of research results on: (a) observations of research conducted under natural conditions and (b) observation-interventions. Survey results from the group of theoreticians (N=401)

RQ5 (a) – observations conducted under natural conditions, and the researcher interacts with the subjects under study – research results of theoreticians



RQ5 (b) – observations-interventions that take place as part of management activities in the entities studied, and the researcher has a direct influence on the decisions made – research results of theoreticians



Source: own research

Upon analysing the obtained results, it is evident that a large percentage of the respondents (85.78%) consider the natural observation of ongoing research to be a crucial aspect thereof, which involves direct interaction between the researcher and the subjects under study. Additionally, observation-intervention (73.57%), which involves researcher influence on the decisions made as part of management activities in the subjects under study, was also considered important by the majority of respondents.

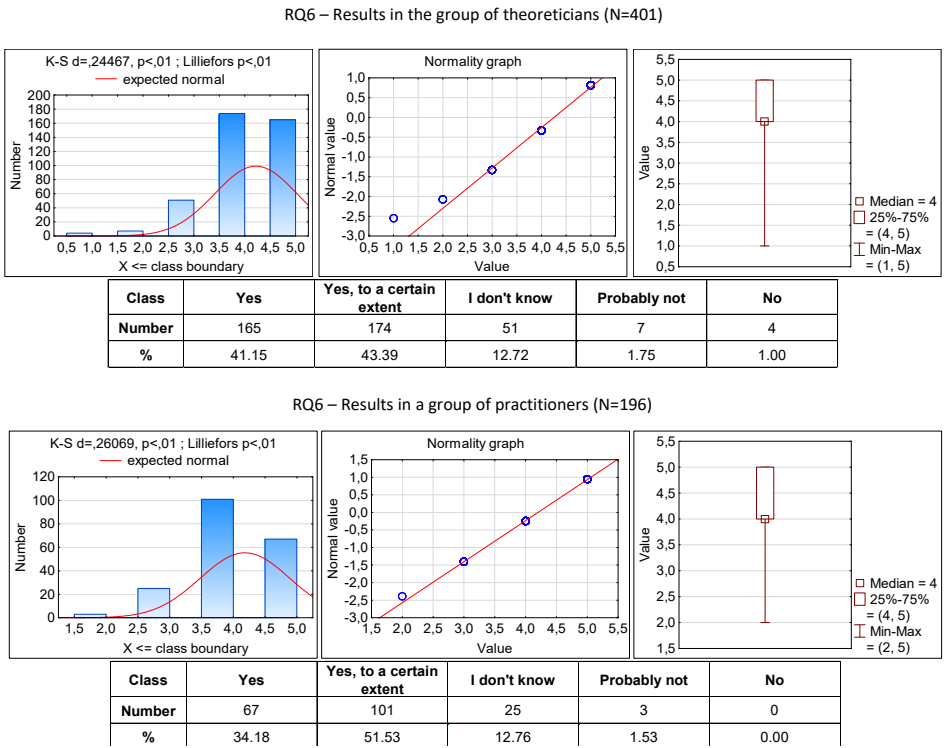
Mariani and Pego-Fernandes (2014) suggest that observation is an extremely adaptable and comprehensive approach to data collection. It is frequently referred to as a research approach for this reason, as well as because of its complexity. This inclination cannot be regarded as appropriate because observation, which brings together several auxiliary techniques, is a key component of cognitive processes. As a result, it is a flexible method of inquiry (Baker, 2000), but it also continues to be the most fundamental

when looked at independently in terms of both its history and substance. Observation is a research technique that uses perception to obtain data (Mariani, Pego-Fernandes, 2014). Observation can be a simple, intuitive way of noting down facts and events, or it can be a more systematic and sophisticated

process that includes the use of tools such as questionnaires, as well as the opportunity to capture images and sound. Additionally, through observation, the researcher can learn a great deal of incredibly “natural” and accurate information about the group being studied (Coe et al., 2021).

3.6. RQ6 – Is it possible to enhance the quality of science and practice in management through the development of research-based recommendations?

Figure 7. Is it possible to enhance the quality of science and practice in management through the development of research-based recommendations?
Research results: a) Group of theoreticians (N=401), b) Group of practitioners (N=196)



Source: own research

The data analysis indicates that both theoreticians (84.54%) and practitioners (85.71%) place significant emphasis on the importance of developing recommendations to enhance the scientific and practical level of the solution, as concluded from the research results.

The conclusions resulting from the analysis (research) are used to expand existing knowledge on the subject or to polemicalise with theory. To conclude, it is important to acknowledge the limitations of the research and suggest areas for further

investigation. In the field of management science, it is common practice to provide recommendations that align with economic realities. The research methodology outlined in management science is influenced by the phenomena observed in organisations.

4. Discussion

The research has made a significant contribution to the field of management science by identifying the most relevant and effective methods, procedures, and approaches for conducting research. Through careful analysis of the data obtained, researchers have been able to identify the most popular research methods, including observation, interview, documentary analysis, survey, and group expert evaluation, and their order of popularity. In addition, the study has highlighted the importance of verifying developed methodologies, models, or procedures before integrating science and practice. This can be achieved through the use of case studies, which provide an opportunity for an in-depth analysis of the research problem, and group expert evaluation, which is a fundamental method for verifying the direction of the research.

Moreover, the study has identified the importance of observation as a versatile and comprehensive technique for gathering information, which can involve both a straightforward, impulsive notation of facts and events and a more controlled process of systematic observation, including additional tools such as questionnaires and recording of images and sound. The research has also found that both observation of ongoing research under natural conditions and observation-interventions are crucial for obtaining relevant information, with researchers having a direct influence on decisions made.

The study has also identified certain regularities in the perception of the research process in the context of management

science, as well as other variables that may impact the importance of selecting appropriate methods and techniques to improve the reliability, level, and quality of the conducted research. Finally, the research has proposed a set of recommendations for management science and practice based on the results obtained, including the importance of presenting recommendations that relate to economic realities and reflecting on the limitations of the research to propose the possibility of further research.

After conducting the proper tests, it is necessary to interpret the obtained results and draw conclusions. It is also important to include the following:

- Discussion in the context of the theoretical model – To what extent do the results of the study align with the existing literature and confirm the theory, and what new insights do they contribute to the theoretical model? Additionally, what elements should be added to the theoretical model based on these findings?
- To describe the limitations of the study, there are three primary groups of constraints that need to be considered. Firstly, there are the limitations concerning the research design. Secondly, there are limitations concerning the research sample, which encompasses the size and characteristics of the participants in the study. Finally, there are limitations that concern the operationalisation of the variables, which involves defining the variables, measuring them, and analysing the results. According to Carton and Hofer (2006), these three groups of limitations are important to consider when evaluating the findings of the study;
- Indications of the rationale for the conducted research – the most common indications are the rationale for theory and the rationale for economic practice;
- Set directions for further research – the conducted research does not close the topic, and most often opens the field for

further discussion. In this section, it is important to note what else can be researched in the area and what additional, more focused research may still be done using the results already collected.

The selection of the research design, development of the research model, and choice of research methods depend on the nature of the research.

Due to the limitations of the research sample in the realm of reaching a large group of organisations that could constitute a representative research sample, research is usually conducted on a random sample. Therefore, the procedure for selecting methods and organisations for a given research process should be developed and verified.

A procedure for purposive sampling in an organisation should be developed.

A procedure should be developed to test the validity of using a survey tool to measure a phenomenon in an organisation.

Mistakes made by researchers in research processes are as follows:

- Lack of proper focus on the appropriate testing procedure;
- Lack of use of diverse research methods;
- Lack of availability of a suitable research subject conditioning the choice of specific methods;
- Inadequate selection of research methods and techniques;
- Economic constraints that reduce the breadth and scope of possible studies;
- Lack of familiarity with the broad spectrum of available research methods and techniques, resulting in the inadequate selection thereof;
- Lack of scientific-utilitarian verification of the research methods and techniques used;
- Poor applicability of the obtained research results;
- Erroneous assumptions made in the research process (construction of research questions, objectives, theses, and hypotheses);

- Not having a recipient of the obtained results in terms of the scope of the material studied;
- The divergence of treatment between theoretical and practical approaches;
- Lack of cooperation with business entities at the stage of creating the research process;
- Lack of reliable measures and their use every year, which would also make it possible to check the replicability of the results of the conducted surveys, thus determining the universality of the measures that emerged.

The traditional hierarchical model of company structure has, up until now, consisted of a collection of departments that, despite having a clear goal for the entire enterprise, decide on their own courses of action. Nowadays, knowledge is valued highly and simple, networked, and orbital structures are sought. Equipping both theorists and practitioners with innovative methods and research techniques seems reasonable in order to facilitate the transfer of knowledge to the enterprise, increase the competitiveness of its management in the market, and implement new strategies for the development of the market economy, such as Industry 4.0. This triggers the need for a permanent search for changes in the organisation, taking into account the life cycle theory, as well as teleological and dialectical theories. Despite the accelerating technical and technological progress, man and his abilities still remain a strategic resource of the enterprise.

There is nothing more practical than a good theory – this generalisation, however, does not harmonise with the expressed conviction of exaggerated theorising in management science, its detachment from current managerial practice or the low level of usefulness of research results for the economy. Extreme assessments usually have little justification, so it is difficult to agree with such criticism as well. Raising

the quality of research in the management sciences becomes a necessity in response to the challenges of civilisation, which are determined by the quality of management science research for the economy, the introduction of the so-called Bologna system to higher education, preferring three levels of study – bachelor's, master's and doctoral, with a preference for dual studies and implementation doctorates. The transfer of sophisticated research methods used in world-class publications, which use formal econometric and statistical apparatus whose value is to provide measurable knowledge for practice, results in an increase in methodologically sophisticated research papers. They are up-to-date and in line with world methodological standards, both in the sense of the direction of research inquiry and choice of methods, as well as in terms of an awareness of their limitations.

The author assumed that methodology is meant as the science of methods, which takes inventory of the methods of the research procedure, describes how they are applied, and characterises the advantages and disadvantages of application to research problems. In the 21st century, its modern approach was introduced to the methodology of management science. Existing methods and techniques have gained methodological added value.

Conclusions

The research results provide valuable insights for developing recommendations for integrating management science and practice. The survey of 401 theoreticians and 196 practitioners suggests that verifying developed methodologies, models, or procedures is essential before combining science and practice. Case studies can be used as a thorough method for analysing the research problem, and group expert evaluation is fundamental in verifying the direction of the research. In terms of research methods, the most popular

ones are observation, interview, documentary analysis, survey, and group expert evaluation. Additionally, both the observation of ongoing research under natural conditions and observation-interventions are crucial for obtaining relevant information, with researchers having a direct influence on decisions made. The contributions of the research to the literature are twofold. Firstly, the results emphasise the significance of practical methodology for selecting methods and approaches that impact the research process and the efficiency of the organisation. Secondly, the study highlights the importance of choosing suitable methods and approaches in management science research to enhance the dependability, level, and quality of the research carried out.

The empirical implications of this article focus mainly on answering the research questions posed, where the following were found:

- Case studies in research procedures should be used to support qualitative methodologies;
- Verification of the methodologies, models, or processes created is necessary before fusing management science and practice;
- The case study offers the chance to analyse the research problem in depth;
- The primary method for confirming the direction of the research being done should be group expert evaluation;
- In order to conduct research in the management sciences using the observation of facts and following the classification of inductive sciences in general methodology, it is essential to utilise both observations conducted under natural conditions and observation-intervention;
- Generating recommendations for management science and practice based on research findings enhances the standards of both science and practice.

Additionally, by involving scientists and practitioners in the research, the author has learned that it is challenging to select only

one approach that would deliver a comprehensive and in-depth recognition of the problem under study. On that basis, using diverse techniques that will offer a thorough solution to the problem at hand is essential. It is also agreed, at this point, to emphasise the necessity of using practical methods in the research processes. They provide full knowledge of the facts, and thus organise the classification applied in the general methodology where induction is used. The presented statements are also affirmed by the findings of Bryman (2006). Mixed research is widely used only in some disciplines, whereby American publications dominate in that domain. Considering other studies in this area (including those by Kaushik and Walsh (2019) and Bryman and Harley (2018)), one can say that mixed methods are well established in management, but at the same time the authors underline that they still leave room for improvement. We accept the drawbacks of the study process that were mostly brought about by the choices we took in terms of the methodological approach. First, due to the limitations of the research sample in the realm of reaching a large group of organisations that could constitute a representative research sample, research is usually conducted on a random sample. Therefore, the procedure for selecting methods and organisations for a given research process should be developed and verified. Second, due to the lack of cooperation with business entities at the stage of creating the research process.

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Risk classification in international trade using methods of cluster analysis

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Abstract

For an exporter, when exporting goods or services, it is important to know the situation in the countries to which the company wishes to export. Territorial risks can have a significant impact on operations, both in the form of profits and huge losses. To assess such a risk, the exporter may rely on credit insurance companies that regularly evaluate the risks of the given country. All insurance companies attempt to collect quantitative and qualitative data as accurately as possible with the aim of conducting an in-depth analysis of potential risk. However, insurance companies have their own methodologies for evaluating international risks, which may differ according to the organisation. The article applies cluster analysis to the assessment of territorial risk based on the example of OECD countries with the aim of classifying countries according to territorial risk based on selected indices. From a practical point of view, the benefit of the article is the use of the cluster analysis method for the purpose of classifying countries according to territorial risk; it offers exporters another source of information about the country which they are interested in exporting to. From a theoretical point of view, it is beneficial to identify key indices that together represent territorial risk and thus fulfil the general definition of territorial risk.

Key words

cluster analysis, export, hierarchical methods, OECD, risk assessment, risk map, squared Euclidean distance metric, territorial risks.

DOI: 10.23762/FSO_VOL11_N01_5

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Introduction

Within international trade, it is necessary to address individual risks. It is not surprising that when exporting goods to other countries, the exporter may face

more risks than when conducting domestic trade. The basis of the transaction is a contract and the so-called international element; therefore, the term 'contract' must not be confused with the term 'transaction'. Rozehnalova & Drlickova (2015) claim that it is necessary to examine a business transaction, more precisely international business transaction as a whole – a possible set of contracts by which they are formed. The risks are of a different nature and relate to the territory to which the transaction is directed, or which affects it; to the transaction itself; or to the entities that carry out the transaction. When exporting goods, it is necessary to find out in advance all the information regarding the country of export. It is important to focus on risks such as a volatile political situation, a state of war, terrorism, strikes, riots, etc. Collectively, these risks are referred to as territorial risks, which are associated with the political, economic, financial and legal environment in the country of export. They arise from the uncertainty inherent in the political or economic developments, the occurrence of natural disasters or the introduction of administrative measures.

Every entrepreneur encounter risks during his activity, and it is no different in the case of an exporter. We can even argue that when exporting goods or services to foreign markets, the probability of occurrence of risk increases. In general, we can define risk as an achieved result that is different from the expected result due to random effects. The risks are classified differently and there is no settled terminology. We can divide risks from different points of view, areas of occurrence, in terms of their measurability, what effect they have on the result or what causes them, etc. This is also true in international trade (Reuvid, 2014; Covello, Menkes & Mumpower, 1986; Ambrus, Rayfuse & Werner, 2017). No matter how the individual authors divide the risks, they can occur simultaneously, i.e. overlap with

each other, but also complement each other. When it comes to international trade, the risks are most often divided into commercial and territorial ones; and lately currency risk has also been mentioned separately.

The most effective preventive measure is quality risk management, which includes obtaining information about individual countries that are the subject of commercial interest of the company (Ritchie & Marshall, 1993). Information can be obtained from various sources, such as international institutions and agencies, representative offices, specialist agencies, and of course the Internet. The starting point for the analysis of international risks can be an institutional rating, which is a standard international tool for assessing the creditworthiness of countries to assess their credibility. The rating indicates the degree of riskiness for foreign companies of doing business in the rated destination and the quantification of the probability that the rated country will meet its obligations. Such ratings are published by several renowned institutions, of which the main ones include Moody's, Standard & Poor's and Fitch Ratings. Various platforms can also be used (e.g. The PRS Group's International Country Risk Guide or CountryRisk.io) which assess international risks from various perspectives; or one may also make use of bespoke evaluation methodologies, which may already include sector-specific parameters.

It is precisely due to the diversity of approaches that the classification of risks differs considerably. The authors either group risks into more specific categories or into broader groups for further application. Just as the approach to risk categorisation differs, the approaches to or methods of risk assessment differ, as do the outputs of individual platforms and agencies. Due to the inconsistency of methods and procedures for determining the degree of risk, the authors determine their own calculation for the objective assessment of risk. The risks of political

and economic indicators were selected for classification. The selected countries are Organisation for Economic Co-operation and Development (OECD) countries, due to their greater diversity compared to countries that are only members of the European Union (EU). The entire territory of the state, and not only a certain part thereof, is always taken to assess the risks of these countries. Ward's method and the squared Euclidean distance metric were used for classification.

The aim of the article is to use the cluster analysis method to classify countries according to territorial risk. The intention is to identify important factors that have a significant impact on exporters and its exports and to divide and select countries in terms of these factors. The task is to create clusters of OECD countries using cluster analysis based on the degree of similarity of individual indices that define territorial risk. Groups of selected countries will be created so that each group will consist of the countries that are most similar in terms of the given indices. The aim of the analysis is the position of countries according to territorial risk, which is identified based on selected indices.

1. Literature review

Mostly of a probabilistic nature, the risks we tend to be aware of offer us the opportunity to measure or estimate them, enabling us to comprehend and justify their consequences. It can be acceptable, undesirable, beneficial, or overwhelming to us. That is why we try to know, measure, evaluate and, above all, manage risks, or to work with them comprehensively within risk management.

In professional literature and sources, risks are divided from different perspectives, but they are typically interconnected and can occur simultaneously or complement each other. It is important to conduct a comprehensive investigation of risks, as reducing

one risk may increase the possibility of another. While risks should be examined separately and independently, it is ultimately necessary to take a global view and analyse interconnected risks as a whole. Both short-term and long-term risk horizons should be considered. Additionally, there is an element of uncertainty that cannot be quantified when assessing risks. The element of uncertainty is closely related to political risk (Riegrova, 2006).

The methods of risk classification are differentiated, and the authors group risks into significantly special categories of risk or group them into broader groups for further application. Entrepreneurs in commercial practice often classify risks into several categories, including commercial, production and market risks, the risk of non-fulfilment of obligations by contracting parties, risks resulting from errors in negotiating business operations, transport risks, risks associated with non-payment for goods and services, and the risk of liability for product defects. In the field of international trade, market risks, commercial risks, transport risks, territorial risks, and currency risks are the main types of risks (Grath, 2008). Polak, Beranova and Tabas (2011) deals with the classification of risks in international trade and the subsequent possibility of evaluation. Böhm (2009) stated a further division for the area of foreign trade practice, namely into traditional and modern risks. Traditional risks include business, production, transport, liability, and legal risks. In addition, this group also includes the risks of incorrectly negotiating a business transaction, the risk of choosing a business partner, risks associated with patents and trademark protection, tariff, and non-tariff barriers, etc. Modern risks are considered such risks as payment, credit (exchange rate) and investment risks.

For the area of insurance, Böhm (2009) presents a division of risks into two basic categories, namely commercial and territorial.

In general, it can be said that commercial risks can be insured on the insurance market without major problems. The problem arises with the territorial ones, because for many reasons it is risky for commercial insurance companies to insure such risks. Territorial risks are therefore impossible or very difficult to insure with commercial insurance companies. In terms of credit insurance, Petrusheva (2016) also divides risks into commercial and non-commercial ones, which includes the risk of natural catastrophes and political risks. On the insurance market, we can meet the offer of commercial credit insurance companies, but also export credit agencies that carry out insurance activities provided by the state. These agencies can then offer special products to cover territorial and long-term commercial risks, while the state takes over guarantees for all their activities. This solves the problem of uninsurable territorial risks (Funatsu, 1986; Vavrova, 2014; Moser, Nestmann and Wedow, 2008). The relationship between risks (political, financial, and economic) and the demand for insurance was discussed in study by Lee, Chiu and Chang (2013). Bar-Niv and Bickelhaupt (1986) also evaluated the relationship between international risks and insurance, resulting in the classification thereof according to purpose, methodology, and perspective, with a division into 15 areas in total.

As already mentioned, territorial risks are a consequence of the emergence of uncertainty about future political and macroeconomic developments. The emergence and development of these quantities is difficult to determine in advance, and therefore the risk itself is difficult to determine and quantify. However, the assessment of territorial risk is of great importance for the exporter and his business activities and business transactions because these risks can greatly negatively affect his results. Territorial risk can have a significant impact, particularly on long-term international contracts and

foreign direct investment. Territorial risk can be divided into narrower groups of individual risks, but they complement each other and are dependent on each other. Therefore, under territorial risk, the following types of risk may be included:

- *Political risk*, which are risks that cannot be easily predicted and therefore have the nature of force majeure. We list here civil unrest, strikes, revolutions, wars. In addition, there may be situations where local government directly intervenes to prevent trade (such as expropriation, seizure of cargo or inability to handle goods). Benacek, Lenihan, Michalikova, Andreosso-O'Callaghan and Kan (2014) deals with political risks in more detail.
- *Commercial policy risk*, which are interventions by the state in the introduction of some administrative measures to limit exports or due to protectionism. These are restrictions in the form of embargoes, the introduction of customs duties and taxes, the establishment of hygienic or technical regulations and other restrictions.
- *Exchange rate risk*, which is related to monetary diversity and the variability of exchange rate developments on global markets. Territorial risk considers exchange rate risk associated with the impossibility of converting funds into another currency and restrictions on transfers.

Political risk assessment has the most significant impact. Political events are a very important factor simply because they are very difficult to predict in the long term. The risk of government intervention includes the risk of expropriation, breach of contract by the government, risks associated with the functioning of the judicial system and possible changes in the approach to foreign investors. There can be several reasons

for the emergence of political risks, and it is obvious that the emergence of political risk is more likely in countries with less political stability. The emergence of these risks can result in the limitation or interruption of business relations, but also in losses, whether financial or property. Benacek et al. (2014) assessed the influence of political risk as being significant, whereby the list of indicators in their research related to foreign direct investment is supplemented by as many as 11 political identifiers (business freedom, trade freedom, monetary freedom, freedom of government, fiscal freedom, property rights, investment freedom, financial freedom, freedom from corruption, education index, and government effectiveness).

The economic conditions in the country are reflected in commercial policy risk and can be a decisive factor in the success of a contract in crisis situations. The disruption also brings administrative measures that may be imposed on the foreign trade of the state. This risk is especially threatening in states that are characterised by internal instability or external conflicts, examples of which are the loss of import licenses, anti-dumping duties, and quotas on imports of certain goods, although these measures are in direct conflict with free market principles. Equally important are regulations introduced to restrict business on the domestic market. These regulations also serve to protect the domestic market and favour domestic producers. If they are violated, the export transaction does not have to be executed or sanctioned (Rožehnalová & Drlicková, 2015). The risk of imposing a trade embargo lies in the fact that if an embargo is imposed between the production and transport of goods to the customer, in most cases one will incur a loss. But it is also worth mentioning a boycott of goods, for example in the case of products produced non-ecologically or unethically.

In terms of territorial risk, we consider the exchange rate risk associated with

the impossibility of converting funds into another currency and the restriction of transfers.

Nevertheless, territorial risk does not have to be understood as a purely negative phenomenon in international trade; on the contrary, it can also represent a great opportunity. This is also proven by various studies on the relationship between risk, credit insurance and the impact on export growth (Rienstra-Munnicha & Turvey, 2005; Janda et al., 2010; Janda et al., 2013; Harvanek & Zabožník, 2015). The most important thing is to obtain as much information as possible about the impending risk and then process it further to be used in management. The authors offer the possibility of self-classification and evaluation of territorial risk based on selected indices. The purpose was to identify important indices that together represent territorial risk and thus meet the general definition of territorial risk. The most effective preventive measure is quality risk management (Hudakova et al., 2017; Hudakova et al., 2018), which includes obtaining information about individual countries that are of commercial interest to the company. Information can be obtained from various sources, such as international institutions and agencies, information from representative offices, specialist agencies, and of course on the Internet. However, Asiri & Hubail (2014) and McAleer & Hoti (2004) pointed out that all information obtained, and evaluations of individual agencies must always be compared and evaluated.

The institutional rating, which is a standard international tool for assessing the creditworthiness of countries to assess their credibility, can be the basis for the analysis of international risks. The rating indicates the degree of riskiness of doing business for foreign companies in the rated destination and the quantification of the probability that the rated country will meet its obligations. Such ratings are published by several renowned institutions, of which the

main ones include Moody's, Standard & Poor's, and Fitch Ratings. However, when setting a rating, two broad areas are considered, namely political and economic risk.

It may therefore be more advantageous for the exporting firm to orient itself directly according to the rating of credit institutions, as they are highly sensitive to planned state interventions, such as restrictions on the allocation of foreign exchange funds, payments, and lending. Investment banks and credit insurers also use ratings to calculate the risk of their portfolios (Baker and Martin, 2011). In the case of self-assessment, they compare their results with those of credit rating agencies. Each insurance company therefore has its own methodology for evaluating risk, where its goal is to always offer the most suitable insurance option.

Pahud de Mortanges & Allers (1996) stated that if specific companies already recognise the influence of political risk and approach analyses, they use some of the following methods: qualitative unstructured methods (judgment and intuition of managers, expert opinions), qualitative structured methods (the Delphi technique, standardised checklists, scenarios), quantitative methods (company-specific methods – ASPRO-SPAIR system, political risk consultants – secondary sources). They concluded that companies should develop their own models for assessing political risks. The reason for this is that on the one hand they will approach the evaluation individually, but above all they will include indicators essential to their segment in the evaluation, e.g. the mining or construction sectors will be more sensitive to environmental changes than other sectors. With that, it will be possible to proceed to the self-assessment of risks as presented in this article.

The authors of the article present and utilise the cluster analysis method to classify countries according to territorial risk. At the same time, they show that it is not necessary to work with a disproportionate number of

criteria, but the intention is to identify important factors that have a significant impact on exports and the exporter and divide selected countries in terms of these factors. It would subsequently be possible to add other important indicators, e.g. for a given industry, as already mentioned. The aim of the analysis is the categorisation of countries according to territorial risk, which is identified based on selected indices, and to compare the resulting division of countries into clusters with the OECD classification.

2. Methodology

Ward's method of cluster analysis was used for the classification of countries according to country risk. Cluster analysis is a multidimensional statistical method used to classify objects. The core of cluster analysis is the classification of objects into groups, or so-called clusters. The goal of clustering is for subjects in the same cluster to be as similar as possible and for objects from different clusters to be minimally similar or not at all similar. Interested readers are referred to, for example, Abonyi & Balazs (2007), Jajuga, Sokolowski & Bock (2002), Kim (2019), Kubler (2010), and Everit (2011) for a thorough explanation of the principles of cluster analysis. Cluster analysis has been developed in various specialised disciplines, such as biology, medicine, geography, computer science and psychology. It is gradually gaining a foothold in economic disciplines; the results can be used, for example, in market segmentation, business management, and marketing, to divide customers into market segments, to determine target markets or new product development (Halaskova and Schwarzova, 2018; Drastichova, 2018).

The input data are OECD countries and indices, based on which territorial risk can be defined. All OECD countries are analysed – Australia, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Chile, Ireland, Iceland, Italy, Israel,

Japan, South Korea, Canada, Colombia, Lithuania, Latvia, Luxembourg, Hungary, Mexico, Germany, the Netherlands, Norway, New Zealand, Poland, Portugal, Austria, Greece, Slovakia, Slovenia, the United Kingdom, Spain, Sweden, Switzerland, Turkey, and the USA.

In the review, territorial risk was divided into political risk, commercial political risk, and exchange rate risk. Territorial risks arise from political and economic events and measures, as opposed to commercial risks, which arise from the economic or financial situation of the debtor. This also led to the selection of indices which demonstrate the territorial risk. These indices were selected based on a previous analysis of the assessment methods used by selected credit insurance companies (Petrova, Krügerova

and Kozieł, 2020) as well as on data accessibility. The latter was an important aspect if the analysis was to become an inspiration for exporters' own risk assessments. The model for territorial risk assessment created by the authors consists of indices which are explained in the following table (Table 1).

To classify territorial risk, the risks of political and economic indicators available from the World Bank, OECD, and data from the World Risk Index are presented. A bespoke formula for determining territorial risk was created, composed of individual indicators. The number of objects (N) is equal to the number of countries in the OECD; therefore, $N = 37$. The number of variables (p) was set to $p = 7$ based on selected indicators.

Table 1. Input data

	Indicator	Abbreviation	Source	Unit	Interval	Year
1	Political Stability and Absence of Violence/Terrorism Index	<i>PSi</i>	<i>World Bank</i>	score	-2.5 – 2.5	2019
2	Gross government debt	<i>GGd</i>	<i>OECD</i>	% GDP	0 – 100	2018/2019
3	Government Effectiveness Index	<i>GEI</i>	<i>World Bank</i>	score	-2.5 – 2.5	2019
4	Control of Corruption Index	<i>CCi</i>	<i>World Bank</i>	score	-2.5 – 2.5	2019
5	Rule of Law Index	<i>RLi</i>	<i>World Bank</i>	score	-2.5 – 2.5	2019
6	Trust in government	<i>Tig</i>	<i>OECD</i>	%	0 – 100	2018
7	Natural disasters	<i>Nd</i>	<i>WorldRiskIndex</i>	%	0 – 100	2020

Source: Bündnis Entwicklung Hilft (2020), OECD (2020a; 2020b), the World Bank (2020), own elaboration

Index identification:

- The *Political Stability and Absence of Violence/Terrorism Index* estimates the likelihood of political instability, politically motivated violence and terrorism in a country. The indicator can take on values ranging from -2.5 to 2.5.
- *Gross government debt* expresses the ratio of government debt to GDP. It measures general government gross debt as a percentage of GDP.
- The *Government Effectiveness Index* includes such indicators as the quality of public services, the degree of

independence from political pressures, the formulation and implementation of policy, the government's commitment to policy, etc. The indicator can again take on values in the range of -2.5 to 2.5.

- The *Control of Corruption Index* represents the level of perception of corruption in the public sector. Index range -2.5 to 2.5.
- The *Rule of Law Index* reflects such indicators as the quality of contract enforcement, property rights, the functioning of the police and judiciary, the level of crime and violence. Everything then represents the level of trust of the people of the given state in the rules of society and the level of their compliance. The index takes values from -2.5 to 2.5.
- *Trust in government* indicates the proportion of people who state that they have confidence in the national government. The data show the proportion of respondents who answered "yes" to the question "Do you trust the

national government in this country?"

The sample of respondents represents the national population aged 15 and over. The indicator is expressed as a percentage of all respondents.

- *Natural disasters* express the level of natural risk, the risk of natural disasters in a given country. The index is influenced by the frequency and intensity of natural disasters in a given country, but also by the country's ability to prevent and cope with a given disaster. Vulnerability is influenced, for example, by socio-economic aspects and readiness to solve a crisis. This index not only evaluates the risks themselves and their impacts, but also coping with a natural disaster and adapting to the future.

After identifying political and economic indicators, the authors verified multicollinearity, or the presence of interdependence of variables. The so-called *Variance Inflation Factor* (VIF) was used to verify multicollinearity:

$$VIF_i = \frac{1}{1 - D_j} \quad (1)$$

where D_j is obtained when the j -th independent variable is regressed against the remaining independent variables.

Authors (James et al., 2013; Tamura et al., 2019; Esley et al., 1980) have stated that there is a strong multicollinearity if $VIF > 10$; these values can then seriously affect and skew the results.

In Table 2, we see that for the dependent variable GE_i the value of VIF is < 10 for most

indices, but for two (CC_i and RL_i), $VIF > 10$, which indicates the presence of strong multicollinearity; therefore, these indices had to be excluded from the subsequent analysis. This multicollinearity verification procedure had to be repeated for each variable, which was always determined to be dependent.

Table 2. Verification of multicollinearity

Model		Coefficients ^a					Collinearity Statistics	
		Unstandardised Coefficients		Standardised Coefficients	t	Sig.		
		B	Std. Error	Beta				
1	(Constant)	0.121	0.106		1.140	0.263		
	CCi	-0.024	0.096	-0.035	-0.252	0.802	0.063	15.845
	RLi	0.849	0.113	1.057	7.489	0.000	0.061	16.355
	Tig	0.003	0.002	0.079	1.487	0.148	0.431	2.319
	Nd	0.005	0.010	0.020	0.491	0.627	0.757	1.321
	PSi	-0.096	0.047	-0.113	-2.054	0.049	0.405	2.470
	GGd	0.000	0.000	0.014	0.355	0.725	0.769	1.300

a. Dependent Variable: GEI

Source: SPSS, own elaboration

Because the selected variables differ in terms of the type of units, the data must be standardised to avoid skewing the results.

Standard deviation or z-score was used for standardisation:

$$y_{ij} = z = \frac{x_{ij} - \bar{x}_j}{s_{x_j}} \quad (2)$$

where the column diameter $\bar{x}_j$ is subtracted from the original value of x_{ij} and divided by the column standard deviation s_{x_j} .

Using clustering by means of Ward's method and the squared Euclidean distance metric, groups of similar OECD countries are defined in terms of territorial risk.

The division of countries into clusters will be performed using Ward's method, where the distance between the g -th cluster and the unification of clusters h and h' can be marked using a formula:

$$D_{g(h,h')} = \frac{(n_h + n_g)D_{gh} + (n_{h'} + n_g)D_{gh'} - n_g D_{hh'}}{n_h + n_{h'} + n_g} \quad (3)$$

This method is very effective, but relatively small clusters are formed. The distances of objects are expressed by the squared

Euclidean distance. The squared Euclidean distance metric was used for the calculation, which is typical of Ward's method:

$$D_{ES}(x_i, x_j) = \sum_{l=1}^m (x_{il} - x_{jl})^2 \quad (4)$$

After the multicollinearity test, two variables had to be discarded and five variables were retained: *PSi* – Political Stability and Absence of Violence/Terrorism

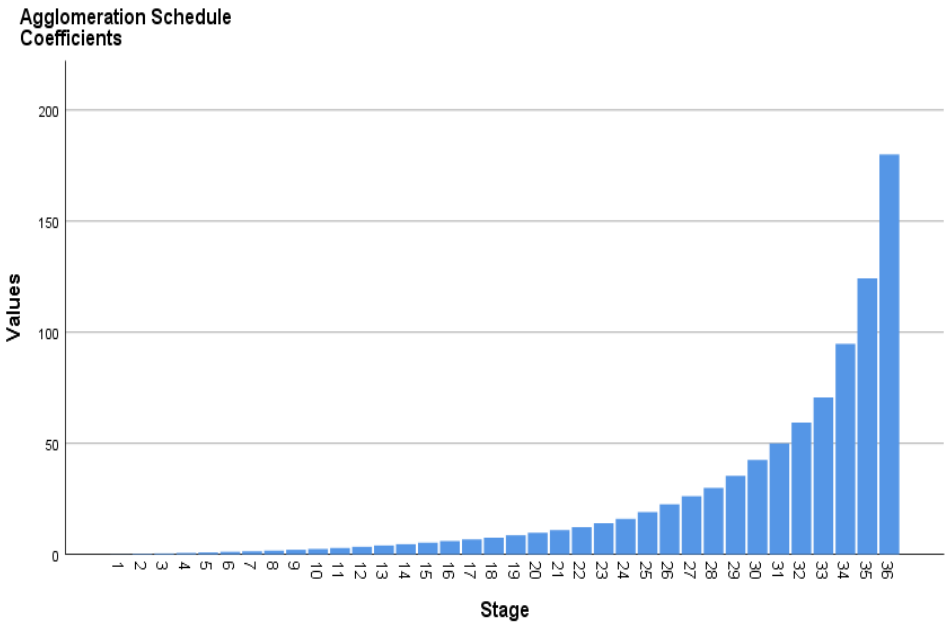
Index, *GGd* – Gross Government Debt Index, *GEi* – Government Effectiveness Index, *Tig* – Trust in Government Index, *Nd* – Natural Disasters Index.

3. Research results

In this part of the paper, the results of cluster analysis are presented. By interpreting the graph (Figure 1), the final number of clusters was set at four. The results are shown in

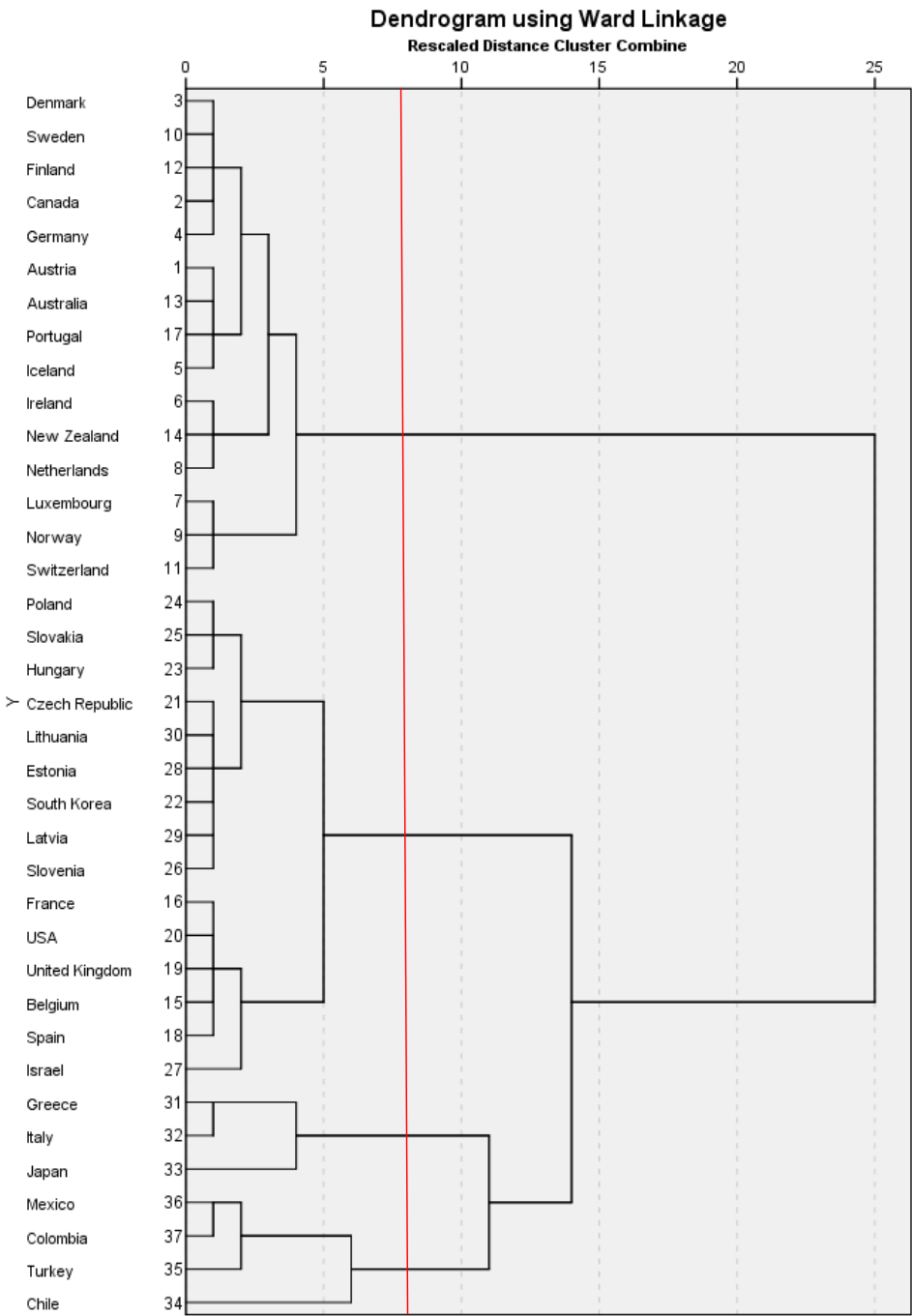
the dendrogram (Figure 2), which is a typical output of hierarchical methods in cluster analysis. Cluster 1 consists of 15 countries, while cluster 2 also consists of 15 countries, cluster 3 three countries and cluster 4 four countries.

Figure 1. Graph for determining the final number of clusters



Source: SPSS, own elaboration

Figure 2. Dendrogram after using Ward’s method



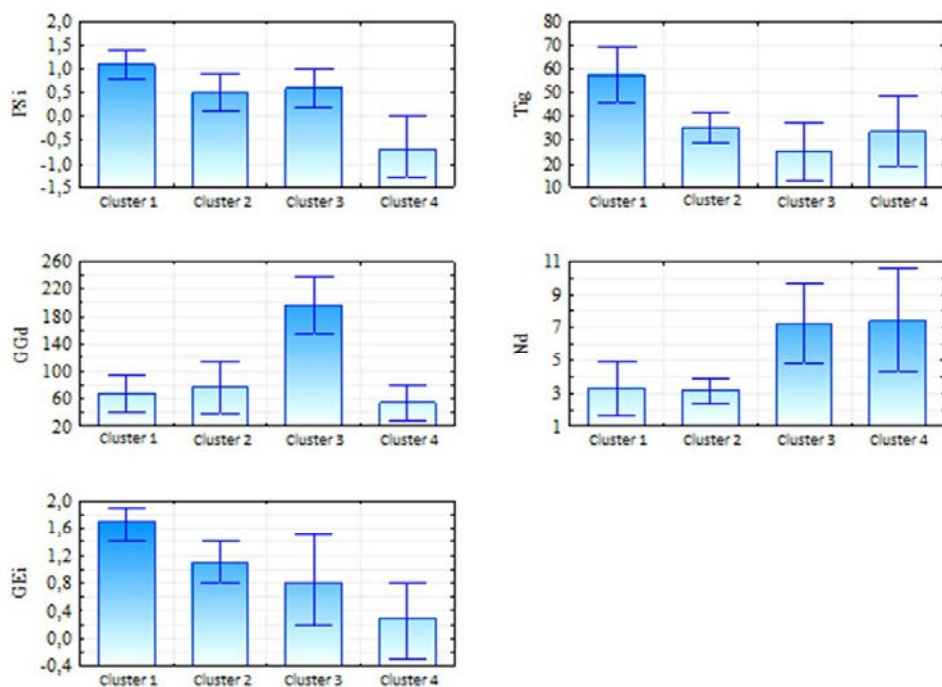
Source: SPSS, own elaboration

Descriptive Statistics											
Ward Method Statistic	N	Range		Mini- mum	Maxi- mum	Mean	Std. Devi- ation	Variance	Skewness		Kurtosis
		Statis- tic	Statis- tic	Statis- tic	Statis- tic	Statistic	Statistic	Statistic	Std. Error	Statis- tic	Std. Error
3	PSi	3	0.75	0.29	1.04	0.5983	0.39307	0.155	1.368	1.225	.
	GGd	3	83.23	155.50	238.73	196.5767	41.62544	1732.678	0.116	1.225	.
	GEi	3	1.18	0.41	1.59	0.8181	0.66622	0.444	1.718	1.225	.
	Tig	3	24.00	14.30	38.30	25.1000	12.17867	148.320	0.852	1.225	.
	Nd	3	4.89	4.75	9.64	7.2133	2.44521	5.979	-0.067	1.225	.
	Valid N (list- wise)	3									
4	PSi	4	1.55	-1.34	0.21	-0.6878	0.65179	0.425	1.022	1.014	1.746
	GGd	4	54.33	34.80	89.13	54.1800	25.08250	629.132	1.289	1.014	0.954
	GEi	4	1.22	-0.16	1.06	0.2558	0.54617	0.298	1.782	1.014	3.404
	Tig	4	31.00	25.00	56.00	33.8500	14.80867	219.297	1.966	1.014	3.890
	Nd	4	7.02	5.03	12.05	7.4250	3.15406	9.948	1.735	1.014	3.183
	Valid N (list- wise)	4									

Source: SPSS, own elaborating

Here values such as range of variation, mean, standard deviation, variance, skewness, and kurtosis are displayed. However, individual clusters were characterised by means and standard deviations. The minimum and maximum are not especially significant, as there may be outliers in some countries, which does not say a great deal about the cluster. By contrast, the mean and standard deviation characterise all the countries of a given cluster. The range of variation, as the difference between the minimum and maximum, is not significant

for similar reasons – it is only the difference between the values of two countries, while the standard deviation is a better measure of variability in the sense that it is calculated from the values of all countries in the cluster. Skewness and kurtosis are related to the normal distribution of data and have minimal link to content interpretation. Therefore, the means and standard deviations of the individual variables for each cluster were chosen for interpretation, which were displayed using range graphs (see Figure 3).

Figure 3. Range graphs of means and standard deviations of variables

Source: own elaboration

Cluster 1 – This cluster consists of the most developed OECD countries. Based on the range graphs, it can be stated that the countries in the first cluster are characterised by the highest values of *PSi*, *GEi* and *Tig*. It is *Tig* that differs most significantly between the countries of the first cluster and the other clusters, which can therefore be interpreted as meaning that a higher level of *Tig* is typical of countries in the first cluster compared to other clusters. The lower value of *Nd* distinguishes the first cluster from the third and fourth clusters, while the value of this index is comparable in comparison with the second cluster. Among the variables, *GGd* has the lowest resolution of the five variables monitored for the first cluster, as its values are comparable to the values for the second and fourth clusters and distinguish only the third cluster. Thus, the high values of the variables *Tig*, *PSi* and *GEi* can be described as typical of the first cluster specifically.

Cluster 2 – Looking at the range graphs, it can be stated that for the second cluster of countries, none of the five monitored variables is significantly distinguished from the other clusters. *PSi* values are comparable to the third cluster, *GGd* values are comparable to the first and fourth clusters, *Tig* values are comparable to the fourth cluster and partially to the third, and *Nd* index values are comparable to the first cluster. The most different values for the second cluster, although not significantly so, are those of *GEi*, which are lower than the corresponding values for the first cluster of slightly more developed countries, slightly higher than for the third cluster of countries with high levels of government debt, and significantly higher than for the fourth cluster.

Cluster 3 – For the third cluster of countries, the most strongly differentiating variable is *GGd*, the values of which are significantly higher for this cluster than for the

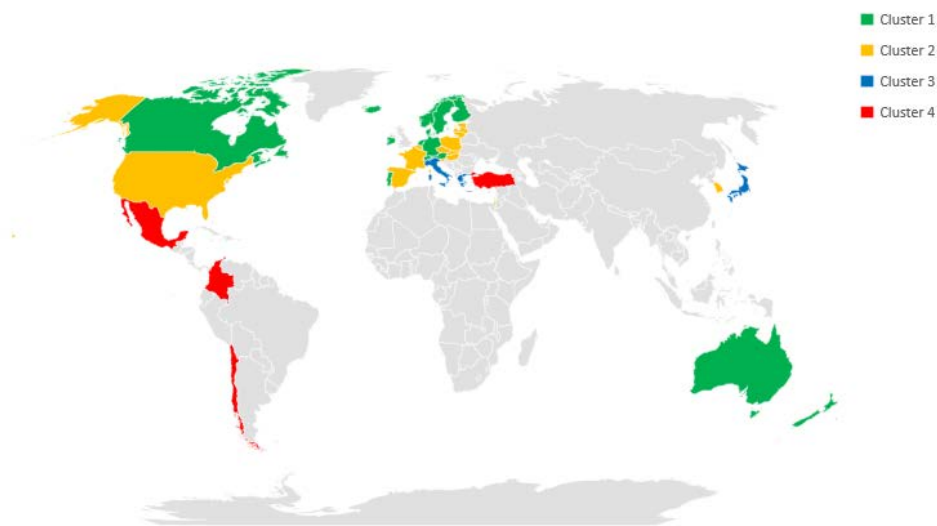
other three clusters. The resolution of the other four variables is minimal compared to GGd . The values of PSi are lower than for the first cluster of the most developed OECD countries, comparable to the second cluster of less developed countries and significantly higher than for the fourth cluster of the lowest rated countries. The values of Tig are the lowest for this cluster compared to other clusters; however, due to the high values of standard deviations, this is not a difference that can be said to characterise the third cluster. Nonetheless, it is worth noting that the correlations of GGd with other variables revealed the most negative and at the same time statistically significant correlation with Tig , which shows that high levels of indebtedness are often associated with lower levels of trust in government. The third cluster may be the group of countries where this phenomenon occurs most frequently,

because in comparison with other clusters it has the highest values of GGd and at the same time the lowest values of Tig .

Cluster 4 – Countries included in the fourth cluster are assessed as riskier according to the OECD methodology, as well as that of most credit insurance companies. Based on the range graphs, it can be stated that the countries in this cluster are characterised by the lowest values of PSi and the lowest values of GEi . The values of the other three variables do not differentiate the fourth cluster from its counterparts as clearly, because the values of GGd are comparable to the first and second cluster, the values of Tig are comparable to the second cluster and the values of Nd are comparable to the third cluster.

The results of the overall cluster analysis can be seen in Figure 4 in the form of a map of OECD countries categorised by individual clusters.

Figure 4. Classification of OECD countries into clusters according to Ward's method



Source: own elaboration

One-way ANOVA was also used to test the differences between clusters (Table 4). This makes it possible to assess the influence of individual variables on the classification into clusters and to verify the differences

between individual clusters. Based on the resulting ANOVA, it may be said that all clusters differ statistically from each other in terms of all variables. All variables are statistically significant at the 0.05 significance

level ($\alpha = 0.05$). The F-statistics are highest for the *Political Stability and Absence of Violence/Terrorism Index* (PSi) and the *Government Effectiveness Index* (GEi). However, this does not affect significance.

Table 4. One-way ANOVA

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
PSi	Between Groups	10.699	3	3.566	23.926	0.000
	Within Groups	4.919	33	0.149		
	Total	15.618	36			
GGd	Between Groups	45776.050	3	15258.683	14.007	0.000
	Within Groups	35947990	33	1089.333		
	Total	81724.040	36			
GEi	Between Groups	7.553	3	2.518	21.278	0.000
	Within Groups	3.905	33	0.118		
	Total	11.458	36			
Tig	Between Groups	5363.691	3	1787.897	17.037	0.000
	Within Groups	3463.086	33	104.942		
	Total	8826.777	36			
Nd	Between Groups	95.286	3	31.762	12.186	0.000
	Within Groups	86.011	33	2.606		
	Total	181.297	36			

Source: SPSS, own elaboration

4. Discussion

After determining our own indices for the classification of territorial risk and the

subsequent division of countries into clusters, we can compare the results with the OECD classification – see Table 5.

Table 5. Comparison of clusters with OECD classification

Cluster	Countries in the cluster	OECD classification
1	Denmark, Sweden, Finland, Canada, Germany, Austria, Australia, Portugal, Iceland, Ireland, New Zealand, Netherlands, Luxembourg, Norway, Switzerland	0
2	Poland, Slovakia, Hungary, the Czech Republic, Lithuania, Estonia, South Korea, Latvia, Slovenia, France, the USA, the United Kingdom, Belgium, Spain, Israel	0
3	Greece, Italy, Japan	0

Cluster	Countries in the cluster	OECD classification
4	Chile	0
	Mexico	3
	Colombia	4
	Turkey	5

Source: own elaboration

It may be seen that most countries are classified as non-risk and are in category 0. The only exceptions are Turkey, Mexico, and Colombia. This result is also comparable with the results of the cluster analysis, as part of which these countries were included in cluster 4, albeit Chile, which was placed in category 0 of the OECD classification, was also included in this cluster. However, it is important to remember that the OECD classification uses the CRAM model in its methodology, and it considers several factors, as well as the payment experience reported by participants. Based on the final score, the country is then included in one of eight categories. The results of the applied cluster analysis are therefore comparable to the OECD classification. However, only a limited number of indicators are considered, based on which countries are divided into clusters. The number of indices was limited not only due to the choice of the applied method, but also due to the availability of data – not all indicators calculated by the OECD are publicly available.

Conclusions

Cluster analysis was applied to the input data – OECD countries and pre-selected indicators that characterise the territorial risk. There were 37 objects altogether, represented by individual OECD countries and seven variables – selected indices which represent political and economic indicators that have been available and drawn from the World

Bank, OECD, and World Risk Index data. Ward's method, which may be classified as a method of hierarchical cluster analysis, was used.

Based on the results of the method, four clusters were determined, which, after description and evaluation of the character thereof, were compared by assessing the riskiness of OECD countries. The OECD classifies most countries in category 0, which includes non-risk countries. The only exceptions are Turkey, Mexico, and Colombia. In comparison with the results of cluster analysis, Chile was also included in the fourth cluster. The results of the applied cluster analysis are therefore comparable to the OECD classification. However, only a limited number of indicators are considered, and the experience of exporters is not taken into consideration. The number of indices was limited not only due to the choice of the applied method, but also due to the availability of data – not all indicators calculated by the OECD are publicly available. The results of the cluster analysis were then displayed on a world map.

At first glance, it might seem that the division of countries into individual clusters based on Ward's method is surprising and inconsistent. However, after a closer examination of the reasons for the inclusion of individual countries in a particular cluster, these make sense and fit a logical whole. Thus, it is suddenly possible to look at individual countries through a completely different prism.

It is clear to the authors of the article that even this method of dividing individual countries has its limitations. One of the main limitations may be the lack of data with which to work. On the other hand, it is possible to work with the input data further, for example by extending them or, conversely, narrowing them according to the specific requirements for the division into clusters.

However, the authors see the fundamental benefit of grouping countries in the fact that for both entrepreneurs and other stakeholders (such as insurance companies), clustering offers another source of information about the country which they are interested in exporting to. On the one hand, entrepreneurs usually do not have the capacity or knowledge to assess the situation in individual countries in detail (therefore, for example, the OECD has also chosen a simple classification of risk assessments on a scale from 0 to 7). On the other hand, the assessment of the riskiness of a given country according to a simple number may not always have adequate informative value. The division of countries into clusters allows the entrepreneur to use the knowledge of one country (or group of countries) to obtain an idea of other countries included in the same cluster. As can be seen from the comparison made in Table 3, the countries rated OECD risk level 0 are in all four clusters. The cluster analysis thus enables stratification even within individual degrees of risk. As mentioned by the authors, this allows stakeholders to obtain a clearer idea of the situation in each country, or to obtain information for a specific situation by choosing the appropriate indicators.

Acknowledgements

This work was supported by the VŠB-Technical University under the auspices of SGS Grant project No. SP2020/77 (Risk Assessment in International Trade in Selected OECD Countries and Risk Minimisation in the Context of the Czech Exporter).

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Towards Achieving Sustainable Development: Interactions between Migration and Education

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Abstract

According to the Resolution on the Global Sustainable Development Goals to be achieved by 2030, labour and intellectual capital have been identified as key drivers of socioeconomic development, leading to appropriate adjustments in migration policy and alignment with European standards. The paper aims to empirically justify the link between migration and the achievement of Sustainable Development Goals in Ukraine. The study applied the Butterworth filter and revealed fluctuations in the time series of changes in the net migration index and the indicators of achieving the Sustainable Development Goals. This makes it possible to consider the retrospective and actual data of the series, as well as to level the phase transitions in the output time series compared to the input (by using a recurrence filter). In addition, the study applies correlation analysis to identify the coincidence/discrepancy of the identified trends. The findings confirmed that the most significant countercyclical and cyclical statistical dependence with the index of net migration growth is found for unemployment (correlation coefficient – -0.75), per capita income (0.73), income inequality (-0.72), greenhouse gas emissions (-0.69), and the corruption index (-0.67). The findings allow us to conclude that the appropriate conditions and institutional support for achieving the life-quality indicators of the SDGs have not been developed. Thus, the Ukrainian government should focus on providing appropriate access to education, creating new jobs, and stimulating intellectual migration into the country.

Key words

migration, intellectual capital, inclusive, economic growth, unemployment, income gap.

DOI: 10.23762/FSO_VOL11_N01_6

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Introduction

The Agenda on Sustainable Development Goals (SDGs) requires a change in the paradigms of state policies for economic development. According to the Resolution on the Global Sustainable Development Goals to be achieved by 2030, labour and intellectual capital have been identified as key drivers of socioeconomic development, leading to appropriate adjustments in migration policy. The improvement of the education system could minimise the outflow of intellectual capital from the country. A wide range of global projects on the internationalisation of education and academic mobility, scholarship and grant programmes for students and scientists have been implemented worldwide. On the one hand, government regulatory interventions aim to promote the retention of highly productive foreign intellectual capital in the destination country, turning “educational” and “scientific” migrants into residents. On the other hand, it makes it possible to prevent the outflow of a country’s qualified labour forces. Increasing employment options abroad by means of education and professional training further stimulates long-term external migration. The migration of youth and more educated, highly skilled people has serious long-term consequences for the economic and social stability of countries.

It should be noted that Ukraine continues to lag behind the EU member states in terms of economic development, the level of well-being and, in general, in achieving the SDGs. Considering the Bertelsmann Stiftung and SDSN reports, among Visegrád countries, the Czech Republic had the highest value of SDG achievement in 2016-2019. It should be noted that Ukraine had a positive dynamic in achieving the SDGs for 2016-2019. Thus, the integrated SDG Index was 66.39 in 2016 and 72.8 in 2019. At the same time, Ukraine has the lowest value of the SDG Index among Visegrád countries. Thus, the average value of SDGs for Visegrád

countries is 75.1, with an average value of net migration growth of 1.33 (Sachs et al., 2019). Compared to EU countries, which have a policy of gradually attracting highly qualified immigrants, as well as young specialists from among foreign students, foreign migration to Ukraine is currently not a mitigating factor in the negative processes of the country’s social, economic and environmental development. In this case, it is necessary to provide the appropriate adjustment of Ukrainian migration policy and harmonisation with European standards as best practices. Thus, the paper aims to estimate the impact of education on migration in the country in the context of its impact on the achievement of the SDGs. Despite the existence of studies that analyse the impact of migration on economic, social, and environmental development for certain countries, this study studies the link between migration and SDGs in Ukraine. In addition, the paper discusses the competitiveness of the higher education systems of EU countries as an important determinant to attract new labour resources to the country and reduce their outflow abroad, with the aim of establishing mechanisms through which they influence the achievement of SDGs.

The paper is structured as follows: the introduction contains an explanation of the necessity of analysing the link between migration and SDG achievement; the literature review comprises an analysis of the theoretical landscape on the relationship between migration and SDG achievement; the methods and methodology section describes the methodology and instruments by means of which to achieve the goals of the paper; the results section carries an explanation of the findings; and finally, the concluding section features a discussion of the core results, comparison with previous research, limitations and potential further directions for investigation.

1. Literature review

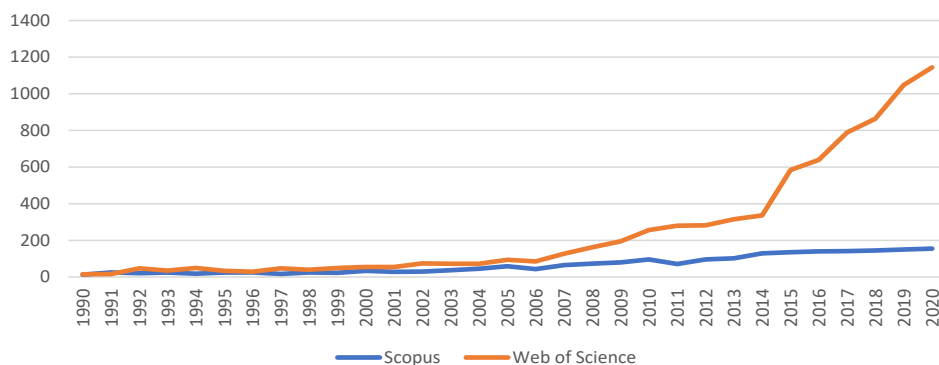
1.1. Migration and SDGs

The results of the analysis of the theoretical background on migration show that migration is a complex process that depends on a vast range of factors. In addition, most recent trends in global development show that migrants consider countries to be successful in achieving SDGs. The greater the degree of SDG achievement, the more affordable and appropriate the conditions for living and development. Thus, all dimensions that impact migrants' decisions could be merged by the following groups: economic – unemployment, average wage, inflation, etc. (Lyulyov et al., 2018; Kuzior, 2022; Didenko et al., 2021; Kwilinski et al., 2022; Moskalenko et al., 2022; Nawawi et al., 2022; Szczepańska-Woszczyna et al., 2022); social – access to education, health and social services, social infrastructure, etc. (Shkarlet et al., 2019; Us et al., 2022; Dzwigol, 2022; Kuzior et al., 2022; Miśkiewicz, 2021a; Szczepańska-Woszczyna & Gatnar, 2022; Trzeciak et al., 2022; Tih et al., 2016); ecological – air pollution, waste accumulation, environmental degradation, share of renewable energies, etc. (Gavkalova et al., 2022; Kwilinski et al., 2020b; 2022a; Lyulyov et al., 2021a; 2021b; Melnychenko, 2021; Miśkiewicz, 2018; 2020; Miśkiewicz et

al., 2021; Polcyn et al., 2022; Prokopenko & Miśkiewicz, 2020; Saługa et al., 2020; 2021); political – freedom, voice and accountability, transparency, corruption, governance efficiency, rule of law, ease of doing business, etc. (Pudryk et al., 2021; Lyulyov et al., 2021b; Miśkiewicz, 2022; Ziabina et al., 2023); innovation and digitalisation – access to the Internet, government digitalisation, digital infrastructure, etc. (Gallo et al., 2018; Butko et al., 2019; Kwilinski, 2019; Kwilinski & Kuzior, 2020; Miśkiewicz, 2021b; Miśkiewicz et al., 2022; Vaničková & Szczepańska-Woszczyna, 2020).

The results of publication dynamics on migration in terms of the framework to achieve the Sustainable Development Goals confirm that publications have been rising since 2015. It should be noted that in 2015, the global Sustainable Development Goals to be achieved by 2030 were updated. As a consequence, interest in research in this area has risen among the scientific community. The number of publications has been growing every year in the Scopus and Web of Science databases. More specifically, according to Scopus, in 2016 the number of publications increased by 19% compared to 2015, in 2017 by 37%, in 2018 by 40%, in 2019 by 67% and in 2020 by 81%. The dynamics of publishing activity are shown in Figure 1.

Figure 1. Publication activity on the issue of migration in terms of the achievement of Sustainable Development Goals



Source: calculated by authors

Yeoh et al. (2005) and Holliday (2012) analysed the impact of migration on economic development. Yeoh et al. (2005) confirmed the close relationship between education and development in Asian countries. At the same time, Holliday (2012) underlined the necessity of developing a powerful lifelong education system. In addition, access to education is the core dimension in achieving the targeted indicators, as it allows labour migrants to adapt to the new economic and social conditions in the destination country. Based on a survey of employers and migrants in the United Kingdom, scholars (Findlay and McCollum, 2013; McCollum et al., 2013) highlighted the motives of labour migrants: education, well-being and income. They underlined the fact that labour migrants chose the country-destination based on the comparative analysis of appropriate capabilities of self-development and the affordability of education for children. Based on Nepalese cases, Thieme and Wyss (2005) empirically justified the thesis that labour migration is conducive to attracting financial capital, enhancing education and accumulating intellectual capital, which are the basis for the sustainable development of the country. Hackl (2018) underlined the fact that developing countries should decline migration to reduce inequalities in the framework to achieve SDGs. Mitze et al. (2008) empirically proved the statistically significant impact of regional wage differentiations and unemployment rates on migrants' behaviour within neoclassic economic theory. They applied Vector Autoregressive Models and the Generalised Method of Moments to check the research hypothesis. Considering the empirical findings, scholars underline the necessity of regulating the labour market, updating social policies and developing supporting systems for migrants. Past studies (Pudryk et al., 2021; Kwilinski et al., 2022b) apply the FMOLS technique to confirm the statistically significant impact of innovation development and

governance efficiency on net migration in Bulgaria, Croatia, Lithuania, Latvia, Poland, and Romania. Similar conclusions pertaining to the impact of innovation on migrants were confirmed by Gallo et al. (2019). In addition, the researchers highlighted the positive impact of talent management on the attractiveness of the countries to highly qualified labour. Considering the results of the abovementioned analyses, the paper aims to verify the link between migration and SDG achievement in Ukraine.

1.2. Education and Migration

The analysis of the theoretical background on the links between education and migration allows us to conclude that countries that have better results in attaining the SDGs also have higher-quality educational systems, which allows them to attract more intellectual capital to the country. On the other hand, less developed countries should accumulate forces to make available and attract new highly qualified labour resources from developed countries. In addition, it allows them to promote the achievement of the SDGs. Ka & Xiao (2016) stated that the intensification of global competition for intellectual capital and the low quality of education and scientific research in higher education institutions in China provoke an increase in student emigration to obtain higher education abroad. Consequently, it leads to the outflow of intellectual capital and limits the Chinese achievement of the SDGs. It should be noted that China has already activated the internationalisation of higher education, improving the education system through the implementation of best global practices, in particular encouraging the development of transnational higher education to change the structure of higher education. Beine et al. (2003) investigated the relationship between migrants' education and human development for 50 countries, confirming the restriction of economic growth for countries with a high intellectual

capital migration rate (if exceeding 20%) and/or the outflow of people with higher education (if exceeding 5%). However, Welch & Zhen (2008) showed that researcher emigration provokes positive and negative effects alike for the origin and destination countries. Thus, the emigration of highly qualified labour ensures the relationship between China and the destination country. Miyagiwa (1991) confirmed the hypothesis that the brain drain increases the education and income for the destination country of migrants. At the same time, the transfer of technologies and knowledge because of circular migration increases labour productivity and education quality in the country. Rao (1979) analysed the brain drain among students from Australia, the USA, Canada and France. Based on a comparison analysis, Rao (1979) shows that students from different countries have similar options and capabilities for future employment despite differences in countries of origin, social status, and experience. He determined that 98% of students who are studying as part of scholarship programmes return to their countries of origin after graduation. In addition, he emphasised that Australian support programmes for young scientists are the most effective. Haupt and Janeba (2009) proved that the brain drain has a statistically significant impact on the distribution of income between skilled and unskilled workers. Consequently, it leads to increasing income gaps in countries, which is controversial in the context of the SDGs. In the beginning, the decrease in migration expenditure is the catalyst for the growth of net incomes among skilled and unskilled workers. Later, however, it provokes a decrease in the net incomes of all households. At the same time, the level and quality of education of labour resources is a decisive dimension in the context of income differentiation. Odhiambo (2013) investigated the reasons and motives for the outflow of intellectual capital from Kenya, determining that the government

needs to take advantage of the experience of emigrants who have returned to the country. In addition, scientists should emphasise the spread of educational programmes for the retraining of re-emigrants. Hornstein & Taylor (2018) analysed migration in Croatia, which has been activated after the integration of that nation into the EU. They systemised the direction for limiting the migration of intellectual capital from the country. As such, reforming the education system and providing employment for young people could stop the outflow of intellectual capital. In addition, they highlighted the necessity of intensifying non-formal education, particularly life-long education. Ionescu & Polgreen (2009) confirmed the statistically significant positive relationship between public spending on education and the emigration of American youth between states. The findings confirmed that investment in higher education could attract students to the country/state. If the government does not benefit from increasing the financing of higher education, then there is a positive relationship between state spending in this area and the emigration of students after completing their studies. However, this relationship could be transformed into an inverse one, because government spending on the development of education will ensure the expected effects (increasing intellectual capital in the country, ensuring the conduct of scientific research, development of innovative technologies, etc.). Djajic et al. (2019) confirmed the causal relationship between government spending on education and the intentions of young people to work abroad. Justman & Thisse (1997) confirmed the hypothesis that mobility of intellectual capital has a negative effect on government expenditure on education. Consequently, it provokes a decline in investment in intellectual capital development. Djajic et al. (2012) identified that government subsidies for education in the countries of origin, as well as the establishment of restrictions on

cross-border migration, could restrict the outflow of intellectual capital. Stark & Wang (2002) justified the mechanisms of exchange and optimal combination of subsidies for migration and education both in the countries of origin and destination. Along with the brain drain issue, Pires (2015) investigated the issue of “brain waste”, defining it as the loss of competencies by highly qualified labour resources during their emigration as a result of their competencies not being needed in the labour market of the destination country. Pires (2015) concluded that migration reduces incentives for young people to obtain an education and improve their skills in the origin countries. In the destination country, the growth of immigrants leads to an influx of unskilled labour. At the same time, subsidies for students ensure the growth of intellectual capital in the country of origin. It has been proven that an effective state educational policy and equal access to education for both residents and immigrants contributes to the transnational transfer of knowledge, best practices and the latest technologies. Based on the case of Nigeria, Akindipe (2020) confirmed the hypothesis on the relationship between the state funding of education, the number of strikes by teachers of HEIs and the number of emigrants whose goal is to study. Chadha et al. (2016) confirmed the hypothesis that quality of education has a statistically significant impact on emigrants of highly skilled labour resources in India. Scholars have underlined the fact that the Indian government has introduced a vast range of educational programmes to attract intellectual capital to the country, such as Educate in India; Make in India; Digital India, Skill India; Start-up India; Stand-up India; and Swatch Bharat. Torrasi & Pernagallo (2020) applied a probit model to determine the nature and strength of the influence of the job satisfaction of scientific employees on their intention to emigrate, emphasising the need to increase the competitiveness of higher

education in Italy by reformatting the organisational management of HEIs. Baruch et al. (2007) listed the core reasons that entice youth to stay in their country of origin: self-development, quality of education, and support from the diaspora. Prior studies (Baruch et al., 2007; Torrasi & Pernagallo, 2020; Akindipe, 2020) have identified statistically significant factors influencing international students’ decision to stay and work in Taiwan after graduation, namely subjective factors, experience and level of satisfaction with the quality of education at the HEIs, and unemployment in the country. Based on empirical results (Baruch et al., 2007; Torrasi & Pernagallo, 2020; Akindipe, 2020), scientists have confirmed that unemployment in a country is one of the most influential factors that encourages highly qualified immigrants to stay in the country. At the same time, the experience and satisfaction with the quality of education at an HEI does not have a statistically significant effect on the intentions to stay in the country among immigrants after completing education. Considering the abovementioned factors, this study tests the following hypothesis:

Hypothesis: The competitiveness of the national system of higher education is an important determinant that affects the attraction of new labour resources in the country and the reduction of their outflow abroad.

2. Methodology

The study analyses the link between migration and SDG achievement in Ukraine for 2000-2021. Migration is estimated by the index of net migration growth, which is calculated by experts from the International Organisation for Migration. The achievement of SDGs is explained by relevant subindexes of the SDG index (Sachs et al., 2021). The core SDG indicators are shown in Table 1.

Table 1. The subindexes of the SDG Index selected for investigation

Sustainable Development Goals	The indicator of achievement of the relevant SDGs	
SDG1. Poverty alleviation, SDG10. Reducing inequality	P	poverty risk
	In	income inequality
SDG3. Strong health and well-being	L	lifetime
	Ex	household expenditures
SDG4. Quality education	Edh	higher education enrolment ratio
	Eds	enrolment ratio in secondary education
	Edsc	rate of coverage of preschool education
SDG5. Gender equality	Fem	share of women in top management
SDG8. Decent work and economic growth	Un	unemployment rate
	GNI	income per capita
SDG9. Industry, innovation and infrastructure	Exrd	government spending on research and development
SDG13. Mitigation of the consequences of climate change	GHG	greenhouse gas emissions
SDG16. Peace, justice and strong institutions	CC	corruption index
SDG17. Partnership for sustainable development	Imp	imports from developing countries

Source: calculated by authors

Each SDG has its own features and extrema for different levels that are not comparable. Consequently, it limits the relevant interpretation of the achievement of SDGs. In this case, it is necessary to filter the data of

the investigation. Thus, the study applies the Hodrick-Prescott and Butterworth filters (Hodrick and Prescott, 1997; Butterworth, 1930; Gomez, 2001) to categorise time series data:

$$y_t = \tau_t + c_t \quad (1)$$

where τ_t is the trend factor and is the cyclical factor.

Considering the methodology at the first stage, the trend factor is calculated as follows:

$$\tau_t = y_t + c_t \quad (2)$$

In the second stage, the study applies regression analysis to check the coincidence/noncoincidence of the changes in the net migration flow in Ukraine and the trends of key indicators of SDG achievement.

The study applies clustering to range the European countries within the integral level of competitiveness of higher education systems, which evaluates the quantitative and

qualitative characteristics and internationalisation of HEIs:

- number of people studying at HEIs as a share of the total population;
- quality of HEIs according to the Global Competitive Index;
- the index of the quality of education according to the Human Development Index;
- the number of foreigners studying at HEIs as a share of the total number of students.

This makes it possible to verify the hypothesis that the competitiveness of the national system of higher education affects the attraction of new labour resources in the country and the reduction of their outflow abroad.

$$f(x) = \left(\frac{1}{(2\pi)^{\frac{q}{2}} |\Sigma|^{\frac{1}{2}}} \right) * \exp \left\{ -\frac{1}{2} * (x - \mu)^T * \Sigma^{-1} (x - \mu) \right\} \quad (3)$$

where μ – vector of mathematical expectations of parameters x ; $|\Sigma|$ – covariance matrix of the vector of mathematical expectations of parameters x ; $|\Sigma|$ – the determinant of the covariance matrix; T – transposition operator; $\sigma^2 = (x - \mu)^T \times \Sigma^{-1} (x - \mu)$ – Mahalanobis distance.

The abovementioned algorithm eliminates the problem of the existence of latent

To cluster the countries, the study uses algorithms for calculating expected estimates of statistical model parameters and maximising the logarithmic function of the likelihood of its statistical distributions:

1. determination of the expected value of the parameters' distribution of the competitiveness of HEIs and the corresponding value of the logarithmic likelihood function;
2. maximisation of the log-likelihood function by means of the appropriate replacement of distribution parameters;
3. algorithm actions until the increment of the log-likelihood function at some iteration becomes less than the given value:

variables and the incompleteness of data pertaining to the model parameters.

In the next stage, the study applies logit and probit models to estimate the probability of the net migration flow in the countries of the respective clusters exceeding its volume in the base cluster (the first one) and the probability of a change in the intensity of migration processes for each cluster:

$$Mig_i^* = \beta_i X_i + u_i \quad (4)$$

$$\begin{cases} Mig_i = 0, & \text{if } Mig_i^* < 0, \\ Mig_i = 1, & \text{if } Mig_i^* \geq 0 \end{cases} \quad (5)$$

where Mig_i^* – net migration flow in the country over the past five years; X_i – competitiveness of HEIs in the i -country of each cluster; β_i – estimated coefficient of the model; u_i – stochastic model error; Coef. – estimated coefficient; Prob. – statistical significance.

The research sample consisted of 33 European countries (Bulgaria, Croatia, Italy, Hungary, Malta, Portugal, Romania, Slovakia, Serbia, Ukraine, Germany, France, Great Britain, Belgium, the Czech Republic, Denmark, Estonia, Ireland, Latvia, Lithuania, Austria, Poland, Slovenia, Finland, Sweden,

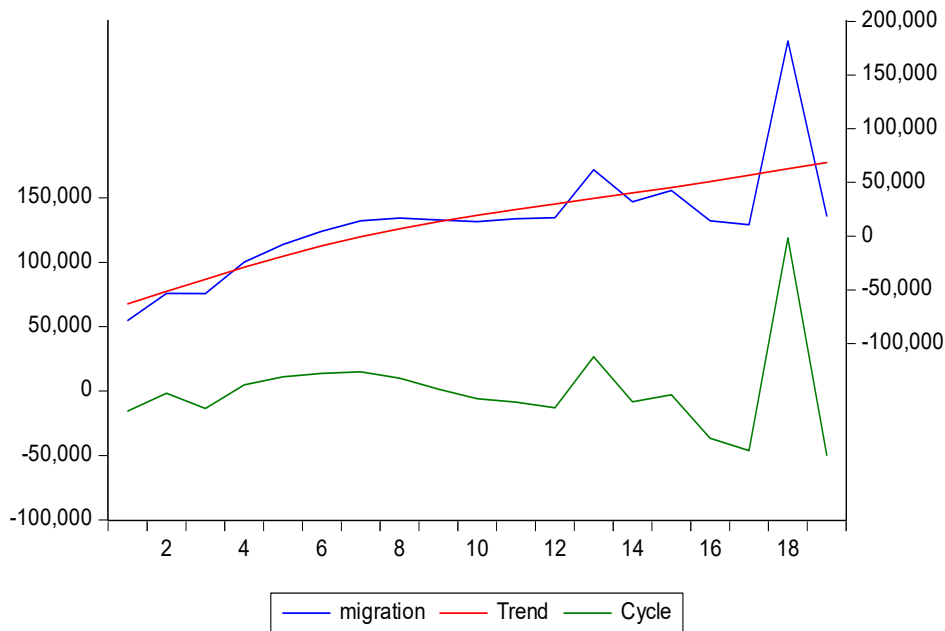
Iceland, Norway, Switzerland, Greece, Spain, Cyprus, Luxembourg, Turkey) and Ukraine. The study period is given as 2010 to 2020 due to the limited data of the parameters for the assessment of the competitiveness of higher education systems.

3. Research results

3.1. Assessment of Migration impact on SDGs

Considering the abovementioned methodology, the Hodrick-Prescott and Butterworth filters are applied to verify the inflection in time series data for the net migration flow index. The results of the Hodrick-Prescott and Butterworth filters are shown in Figures 2 and 3, respectively.

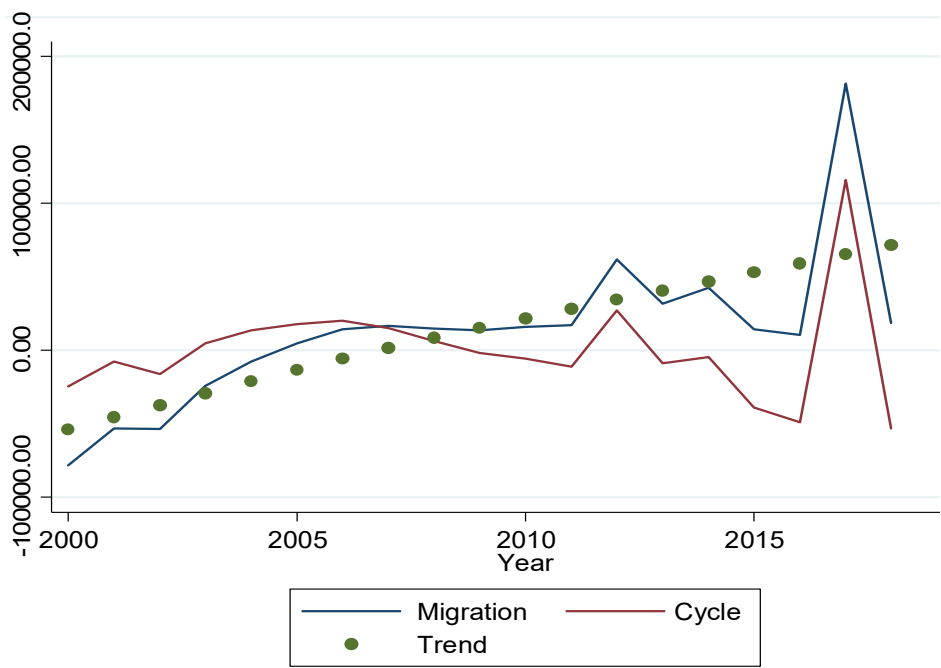
Figure 2. Fluctuations in the time series of net migration growth, according to the Hodrick-Prescott filter



Note: Trend – the trend component of the time series of net migration growth index; Cycle – the cyclical component of the time series of net migration growth index; migration – net migration growth index

Source: own elaboration

Figure 3. Fluctuations in the time series of net migration growth, according to the Butterworth filter



Note: Trend – the trend component of the time series of net migration growth index; Cycle – the cyclical component of the time series of net migration growth index; migration – net migration growth index

Source: own elaboration

The findings in Figures 2 and 3 confirm the high level of accuracy of the obtained results according to the Butterworth filter. This allows the researchers to consider the retrospective and actual data series and eliminate the phase transitions in the output time series compared to the input time series due to the use of a recurrent filter.

At the next stage, the study applies correlation analysis to verify the coincidence/noncoincidence of the changes in the net migration flow index in Ukraine and the trends of key indicators of SDG achievement (Table 2).

Table 2. The empirical results of the analysis of coincidence/noncoincidence of the changes in the net migration flow in Ukraine and the trends of key indicators of SDG achievement

Sustainable Development Goals	Symbols	Corel	Pr	V*
SDG1. Poverty alleviation, SDG10. Reducing inequality	P	-0.43	0.00*	–
	In	-0.72	0.00*	→
SDG3. Strong health and well-being	L	0.39	0.03	
	Ex	-0.34	0.06**	↗
SDG4. Quality education	Edh	0.56	0.00*	↗
	Eds	0.43	0.00*	↗
	Edsc	0.53	0.04**	↗
SDG5. Gender equality	Fem	-0.45	0.44	↗
SDG8. Decent work and economic growth	Un	-0.75	0.00*	↗
	GNI	0.73	0.00*	↗
SDG9. Industry, innovation and infrastructure	Exrd	0.58	0.00*	–
SDG13. Mitigation of the consequences of climate change	GHG	-0.69	0.00*	↗
SDG16. Peace, justice and strong institutions	CC	-0.67	0.00*	↗
SDG17. Partnership for sustainable development	Imp	0.45	0.67	↗

Notes: V* – the dynamics of achieving the Sustainable Development Goals according to the analytical report Sustainable Development Report 2021; Corel – the correlation coefficient of net migration growth index and the indicator of SGD achievement; – SDG achieved or highly likely to be completed by 2030; ↗ – the positive dynamic in terms of SDG achievement; → – stagnation, no progress toward SDG achievement; ↓ – negative dynamics in terms of SDG achievement; Pr – statistical significance at the level of 1% (*), 5%(**)

Source: calculated by authors

The most significant anticyclonic and cyclical statistical dependence with the net migration growth index was found for the unemployment rate (correlation coefficient – 0.75, statistical significance at the 1% level), income per capita (0.73, statistical significance at the 1% level), income inequality (-0.72, statistical significance at the 1% level), greenhouse gas emissions (-0.69, statistical significance at the 1% level), and the corruption index (-0.67, statistical significance at the 1% level). At the same time, the correlation coefficient is below 0.5 for the following indicators: quality education; partnership for sustainable development; gender equality; strong health and well-being; and

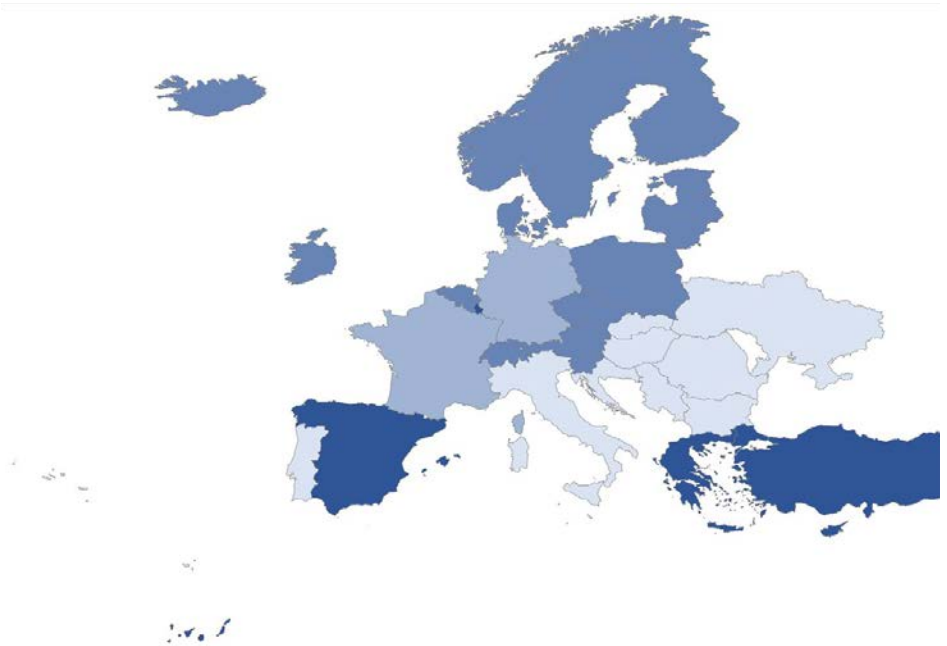
poverty risk. This means that Ukraine has not developed suitable conditions and institutional support for achieving the life-quality indicators of the SDGs.

3.2. Assessment of the influence of the national system of higher education on attracting new labour resources to the country and reducing their outflow abroad

The results of the clustering of countries depending on the competitiveness of national higher education systems are shown in Figure 4. The first cluster includes 10 European countries, in which there is a change in conceptual approaches to the

management of the higher education system in the direction of the transition from state control to institutional autonomy. However, the speed, mechanisms of reform and models of government financing of higher education differ in each country of the cluster.

Figure 4. The clustering of countries depends on the competitiveness of national higher education systems



Cluster	Country (probability of joining the cluster)
1 (light blue)	Bulgaria (1.00*), Croatia (0.96*), Italy (0.96*), Hungary (0.99*), Malta (0.95**), Portugal (0.97*), Romania (1.00*), Slovakia (0.98*), Serbia (1.00*), Ukraine (0.94**)
2 (blue)	Germany (1.00*), France (1.00*), Great Britain (1.00*)
3 (dark blue)	Belgium (1.00*); Czech Republic (0.98*), Denmark (1.00), Estonia (1.00*), Ireland (1.00*), Latvia (0.99*), Lithuania (1.00), Austria (1.00*), Poland (0.89), Slovenia (1.00*), Finland (1.00*), Sweden (1.00*), Iceland (1.00*), Norway (1.00*), Switzerland (1.00*)
4 (navy blue)	Greece (1.00*), Spain (0.96*), Cyprus (1.00*), Luxembourg (1.00*), Turkey (1.00*)

Source: own elaboration

The second cluster merges the following countries: Germany, France, and Great Britain. The key elements of their educational policy are broad opportunities for state financing of educational and scientific reforms of higher education, institutional autonomy of higher education institutions to manage funds, highly developed

university management, strong interaction of the academic environment with the business sector, the high quality of scientific research and the potential of scientific and pedagogical workers. The countries from the third cluster (15 EU countries) actively implement reforms in higher education and increase the number of private

education institutions. The fourth cluster focuses on the development of higher education through key performance indicators, and the distribution of state financial resources depends on the progress towards achieving these targets.

The results of the assessment of the probability of the net migration flow in the countries of the respective clusters exceeding its volume in the base cluster (the first one), as well as the probability of a change in the intensity of migration processes for each cluster, are shown in Table 3.

Table 3. Assessment of the probability of exceeding the base net migration flow and changes in the intensity of migration processes for each cluster

Cluster	Logit-model		Probit-model	
	Coef.	Prob.	Coef.	Prob.
<i>Probability of Mig in the relevant cluster exceeding Mig of the first cluster</i>				
2	2.891	0.074	1.712	0.064
3	0.811	0.512	0.439	0.501
4	0.811	0.598	0.439	0.599
<i>Probability of further changes Mig</i>				
1	0.101	0.292	0.101	0.292
2	0.667	0.014	0.667	0.014
3	0.234	0.053	0.234	0.053
4	0.221	0.264	0.221	0.264

Source: calculated by authors

The findings (Table 3) show that the forecast probability of growth in net migration flow is highest in countries from the second cluster (66.7%) and sufficient in countries from the third cluster (23.4%), while for countries from the first and fourth clusters, the probability of such growth is not statistically significant. In addition, the Ukrainian model of higher education does not contribute to the attraction of highly productive intellectual capital from abroad, but, on the contrary, brings about an increase in the risk of “intellectual labour emigration” (the so-called brain drain). The probability of the net migration flow in Germany, France, and Great Britain exceeding its value for Ukraine (and other countries in the second cluster) is maximised with a value of 2.89 (logit model) and 1.71 (probit model). In

addition, for Ukraine, there is no probability (prob. = 0.292) that the net migration flow will change in the future as a result of promising changes in the higher education system. On the other hand, in the countries from the second and third clusters, this probability is somewhat high.

Conclusions

The abovementioned results allow the authors to identify the anticyclonic and cyclical statistical dependence between the net migration growth index and indicators of SDG achievement. Thus, the net migration growth index has a statistically significant negative correlation with the unemployment rate, income inequality, greenhouse gas emissions, and the corruption index.

However, the statistically significant positive correlation is with income per capita. Considering the empirical findings on the coincidence/noncoincidence of the net migration flow index in Ukraine and the trends of key indicators of SDG achievement, the following policy implications could be developed:

1. renewal of agreements on cooperation with destination countries of Ukrainian migrants to legalise their temporary employment and guarantee them social and pension security. Implementation of measures to increase the financial literacy of migrants, including through the use of online technologies;
2. synchronisation of the databases of the State Migration Service of Ukraine with the electronic health care system (eHealth) to ensure timely medical assistance and ensure the implementation of the programme of medical guarantees for migrants. Consolidation at the legislative level of limits and time horizons for offering compensation to migrants as a result of damage to their property and health;
3. implementation of a cooperative model of institutional partnership between authorities and other business entities of the non-state sector to enhance formal and informal education. Updating the legal basis for the development of the life-long education system, and recognition of the results of informal education of migrants;
4. adoption of targeted programmes with co-financing projects of non-governmental, non-commercial or private organisations for legal and psychological support of female migrants who face violence and become victims of human trafficking;
5. implementing a points-based migration system depending on competencies (knowledge of a foreign language, level of education, seniority, work experience,

etc.) for each of the groups of labour emigrants (highly qualified and skilled workers, students, temporary migrants) similar to the Canadian, Australian, or United Kingdom systems, etc., as well as offering a job search service according to their skills profile;

6. developing a working group to regulate issues of return migration among intellectual capital. Implementation of the practice of holding job fairs in the main destination countries to stimulate the return of domestic migrants to the country. Introduction of state scholarship programmes, including co-financing with non-governmental and international organisations, to activate educational and scientific immigration;
7. reducing corruption and increasing trust in state institutions by creating an information portal on the basis of the government website for migrants' support in the matters of employment, social and legal protection, economic and financial assistance, health care, entrepreneurship, etc.
8. development of legislation based on financial assistance (including state lending) to emigrants when starting their own businesses and the creation of investment funds to support their start-up projects, provided they are implemented in Ukraine. It is necessary to provide an online data exchange between Ukraine and partner countries to manage migration.

Despite the valuable findings, this study has several limitations. Thus, it is necessary to extend the horizon of the investigation and the number of countries analysed. This will allow Ukraine to be compared with other countries on the path to achieving SDGs. In addition, the study considers the linear linkages between selected variables. However, Ukrainian development is unstable and contradictory, which provokes a nonlinear relationship. Moreover, SDG

achievement requires the collaboration of all stakeholders and an increase in institutional quality. Thus, it is necessary to consider not only corruption but also state transparency, accountability, level of trust, freedom, etc.

Funding: “Green investing: cointegration model of transmission ESG effects in the chain “green brand of Ukraine – social responsibility of business”” (0121U100468, Ministry of Education and Science of Ukraine).

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The impact of selected environmental factors on the perception of a company's financial performance in the SME segment

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Abstract

The environmental dimension is a significant part of a firm's development, which is crucial to retaining and increasing competitiveness. The aim of the paper was to define and quantify the influence of selected environmental aspects on perceiving the financial performance of a company in the segment of small and medium-sized enterprises (SMEs) in V4 countries. The empirical research included 1,398 respondents who expressed their opinions on statements by means of which the influence of selected environmental aspects on the perception of a company's financial performance was examined. The formulated statistical hypotheses were verified using a linear regression model. The results of the research confirmed the statistically significant positive influence of all the researched environmental factors on the perception of financial performance of SMEs in V4 countries and the survival of SMEs in the markets in the upcoming five-year period. SMEs in V4 countries positively perceive environmental responsibility as a significant part of company management, within which this responsibility is also considered. SMEs in V4 countries also agreed with the fact that including environmental practices in company management is associated with higher costs. The relatively strongest dependency was determined between the factors of considering environmental responsibility and the statement that responsibility brings about higher costs.

Key words

small and medium-sized enterprises, environmental sustainability, environmental management system, green practices, environmental performance, V4 countries.

DOI: 10.23762/FSO_VOL11_N01_7

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Introduction

The concept of sustainable development is currently the focus of attention of researchers, entrepreneurs and economic policy-makers around the world. It is important for the growth and development of every country so that companies are able to monitor the social attributes of business activities alongside their economic interests.

In this context, evaluating the effects of environmental factors is significant in terms of the financial performance of SMEs, which are predisposed to specific characteristics, e.g. the lower availability of external capital, a flat organisational structure, the owner often being a manager in the company, lack of human resources, a higher degree of staff universality, insufficient state support, etc. (Gavurova et al., 2020; Belas & Sopkova, 2016; Kozubikova et al., 2015; Smekalova et al., 2014).

SMEs are an important component of the business environment thanks to their share in the performance of European economies (Rozsa et al., 2022; Forcadell et al., 2021; Belas et al., 2020).

This paper deals with the effects of environmental factors on the perception of the financial performance of SMEs in Visegrad countries (hereinafter referred to as V4 countries).

The originality of this research is based on the views and attitudes of companies as revealed in the course of robust empirical research; the significant relationships between the environmental attitudes of companies and attitudes related to financial performance are sought by means of advanced scientific methods.

The paper is structured as follows. The current studies in the subject of the research that have led us to preparation for the empirical research are presented in the introduction. The aims and methodology of the research are presented in the subsequent section of the paper. The substantive

findings are given in an aggregated form in the final part.

1. Literature review

Global climate issues have resulted in irreversible changes in some cases and are some of the most crucial issues facing the planet nowadays; moreover, technological progress and the excessive use of machines have had a negative impact on the environment (Jaiswal et al., 2019). Environmental sustainability is an inevitable part of management for today's SMEs (Bakos et al., 2020; Quader et al., 2016; Boakye et al., 2021; Gotschol et al., 2014; Ik & Azeez, 2020). Boakye et al. (2021) consider climate change a threat to environmental sustainability and emphasise the consequence of this problem for a wide range of subjects – firms, public and non-profit organisations that aim to apply environmentally sustainable practices, despite the fact that the effects may differ depending on the business sector. Tothova et al. (2022) discovered that whether or not a hotel was green was irrelevant during periods of economic crisis, and the effect on competitiveness was not proven in terms of hotel type. Moreover, it is the typology of a manager's (or businessperson's) personality that the application of new strategic plans depends on. It may be stated that strategies tend to be rather more conservative with age (e.g. Borisov & Vinogradov, 2022).

SMEs, generating a high proportion of economic performance both across Europe and globally as they do, are an integral part of this process and play a significant role in terms of both the causes and origins of negative impacts on the environment and in terms of possible agents mitigating the negative consequences and providing measures to prevent them (Reyes-Rodríguez, 2021; Quader et al., 2016; Boakye et al., 2021). A pro-green behavioural change is inevitable

if one wishes to achieve sustainable development (Iz & Azeez, 2020). Given that the issue of business sustainability in relation to the environment is underestimated in the SME sector, it is necessary to pay sufficient attention to the issue of its implementation (Lewis et al., 2015). Iz and Azeez (2020) emphasise that re-orienting all the members of an organisation towards environmentally friendly behaviour cannot be achieved by coercion, but rather by creating an environment where people will be willing to accept environmental responsibility.

In the context of the position of SMEs in European countries, the environmental sustainability of their business is urgent (Syafri et al., 2021; Gotschol et al., 2014; Crossley et al., 2021). These consequences are strengthened when environmental and related socially responsible measures are included in the strategic management of SMEs, particularly their social capital management systems (Mishchuk et al., 2022), brand development (Samoliuk et al., 2022), and CSR programmes (Gallardo-Vázquez & Lizcano-Álvarez, 2020). The effectiveness of these actions has increasingly been aligned with environmental protection management (Ginevičius, 2022). Globally, the potential for SMEs to collectively impact the environment in a negative way is significant (Lewis et al., 2015; Lynch-Wood & Williamson, 2015). Previous research predominantly dealt with environmental practices in large companies; however, this issue in the context of the SME sector has not been sufficiently covered (Syafri et al., 2021; Sadiq et al., 2021).

The V4 countries (Czechia, Poland, Slovakia and Hungary) are close both in terms of their geographical proximity to one another in Central Europe and due to their shared history, values and culture. In relation to environmental practices, Simionescu et al. (2021) suppose that these countries have historically been faced with problems such as an insufficiently qualified workforce, corruption in the state sector, and a lack of capital, and are still

predominantly industrially-based economies which demonstrate a high level of production of greenhouse gases in comparison with other developed countries. The implementation of innovative environmental practices to mitigate or to prevent such impacts is impeded by scepticism, outdated legislation, a lack of competences and a dysfunctional market environment.

On the other hand, many technological ideas, e.g. algal biofuel, are not yet economically sound. Therefore, it is necessary to find optimal bioproduction know-how for the future (Marousek et al., 2022). Even biostations producing biogas are not necessarily effective; it depends on the composition of biowaste, which is an input in electricity generation (Marousek et al., 2020a). The composition of biowaste even has an influence on soil yield, as the fermentative residues from biostations are further used as a fertiliser with a highly negative effect from a long-term perspective. The need to combine technological and economic effects resulting in the required synergies is quite obvious (Marousek et al., 2020b; 2020c).

Lewis et al. (2015) and Graafland et al. (2016) emphasise that despite the significance of SMEs, it is necessary to respect their specific and distinctive characteristics, namely the specific rules and standards of each industry, as well as the specifics of each individual SME related to their size, age, and the management structure. Graafland et al. (2016) underline the fact that SMEs have more adaptable and leaner organisational structures, less codified management practices, and informal communication channels in comparison with large companies (Forcadell et al., 2021).

Due to the abovementioned characteristics, several studies assume that formal environmental management techniques, such as public environmental reporting, audits, and environmental management plans, are inappropriate for SMEs due to their informal and diverse nature. However, the employment of

formal methods may also be advantageous for SMEs; for example, by improving internal management and fostering organisational learning and innovation (Graafland et al., 2016). The effectiveness of these processes can improve a great deal in the scope of appropriate governance in institutional surroundings of SME activity (Digdowiseiso & Sugiyanto, 2021). It has been proven to have a positive influence on overall economic growth in this case (Amoah et al., 2022). However, when enhancing overall innovativeness, it becomes essential to understand the role of environmental corporate social responsibility (CSR), not only in the case of large companies (Forcadell et al., 2021; Dvorský et al., 2021) but in smaller ones as well.

Environmentally-based business management is one of many values that attempt to enhance a company's success (Syafri et al., 2021). Environmental practices are actions taken by businesses to reduce the impact of their operations, goods, and services on the environment. Examples of these actions include limiting waste, conserving resources, recycling, and providing organically grown or environmentally friendly goods (Hoogendoorn et al., 2015). Johnstone (2020) considers an environmental management system (EMS) to be a collection of procedures that enables a company to reduce its environmental impact and improve operational effectiveness through a continuous cycle of process planning, implementation, review, and improvement. Concepts such as sustainable development, sustainable enterprise, and CSR are all closely tied to environmental principles (Hoogendoorn et al., 2015; Dey et al., 2018; Dvorský et al., 2021).

Implementing environmental strategies as part of a broader company policy is ideally based on the awareness and responsibility of management combined with duly motivated employees with regard to the environment and the preservation thereof for future generations. In most cases, however, it tends to be a consequence of obligatory

respect for the external regulatory powers and regulations that have a positive effect on their implementation. Li et al. (2022) confirmed a positive relationship between the presence of a sustainability committee and its effectiveness, which indicates its active role in the environmental performance of firms. They found that the composition of such a committee, its authority and resources, which positively and significantly influence the effectiveness of said committee, are the most important determinants. Ik and Azeez (2020) emphasised that should a company apply green practices to foster sustainability, it requires a workforce that have a set of pro-environmental skills at their disposal related to implementing the technologies that are indispensable for meeting ecological objectives. On the other hand, Alraja et al. (2022) stated that green human resource management practices cannot be adopted without external support, especially on the part of governments.

Boakye et al. (2021) also advocated for a positive relationship between financial and environmental performance, discovering that environmental awareness provides greater advantages than approaches focused only on compliance with the rules. The advantages come from operational effectiveness, personnel advantages (better staff morale, higher staff retention, and improved communication), and the avoidance of fines, reduced waste, lower insurance, and higher energy efficiency. Moreover, Ahmed and Streimikiene (2021) argued that environmental and social responsibility have a positive effect on decreasing operational costs, increasing profits and business competitiveness. At the same time, economic concerns and regulatory forces have a positive influence on business performance and competitiveness in the course of creating value for an enterprise. Uyar (2021) also pointed out the effect of reducing costs and demonstrated that implementing environmental strategies supports sustainability

performance, which consequently improves financial performance. Similarly, Ahmed et al. (2021) discovered that a proactive environmental strategy, competitive advantages resulting from differentiation and cost leadership significantly and positively influence the sustainability of companies including financial performance. A positive relationship between environmental sustainability practices, competitive advantage and business performance is also supported by the findings of Pereira-Moliner et al. (2021). Similarly, it is further supported by the findings of Metz et al. (2016), Rehman et al. (2021), and Çelik & Çevirgen (2021), who see a positive impact on the enhancement of competitiveness and company value in implementing environmental sustainability, especially by using sustainability-driven innovation in the sense of an innovative approach which uses environmental sustainability to improve the performance of a company.

Xu and Chen (2020) found that financial sustainability is positively influenced by environmental management and debt financing that can link the effect of environmental management to financial sustainability. De Mendonca and Zhou (2019) found that environmental orientation that focuses on environmental sustainability is directly and positively linked to the degree of indebtedness and long-term market value.

The implementation of EMS in SMEs involves high costs, legislation and other impediments linked thereto, e.g. the need for the individual interest of employees and them having sufficient qualifications (Uyar et al., 2021). As Metz et al. (2016) put it:

“Many companies see environmental sustainability as a cost—a legal and social obligation requiring investments that may never be recovered—rather than as an opportunity.”

However, according to Graafland and Smid (2016), SMEs can improve the standard of environmental management in

their businesses by implementing a number of simple process changes without necessarily incurring significant administrative expenses. Setting goals for items such as energy or water consumption or waste production can be done even by very small businesses with 10 or fewer employees without resorting to time-consuming and expensive bureaucratic processes.

Vea et al. (2020) turned their attention to environmental sustainability boundaries, not only from the perspective of applying environmental sustainability practices in the future, but also from the perspective of their impact. These boundaries may be useful in directing environmentally sustainable practices by evaluating the environmental performance of current actions in relation to such boundaries, and they ought to always be assessed in relation to the values espoused by the enterprise.

Summing up the current findings, it seems clear that environmental sustainability, along with economic sustainability and the social state, need to be seen as an essential part of company management from the perspective of sustainable company development. Despite the fact that recent attention has been paid especially to large companies, the issue of responsibility to the environment is topical for the SME segment in V4 countries with respect to their specifics.

2. Methodology

The aim of the paper is to define and quantify the influence of selected environmental aspects on perceiving the financial performance of companies in the SME segment.

The owners and top managers of small and medium-sized enterprises doing business in one of the V4 group countries (hereinafter referred to as ‘respondents’) participated in the research. The research was undertaken by means of the Computer Assisted Web Interviewing

(CAWI) research method in June 2022. The main criterion of data collection was approximately double the number of microenterprises in proportion to the number of SMEs in the dataset. Said criterion was defined for the reason that the business environment in V4 countries is characterised by a higher number of microenterprises in contrast to SMEs. A further criterion of data collection was the proportional representation of individual respondent groups in accordance with selected demographic criteria in relation to the proportional representation in the fundamental set of respondents in the selected country. The selected dataset failed to prove significant deviations from the given criteria of data collection. Data collection was undertaken by MNFORCE, an external company which is established in the V4 countries and Austria. MNFORCE implements the quality standards of ESOMAR, the global business community of insights and analytics.

A total of 1,398 SMEs participated in the data collection stage. The structure of SMEs in accordance with the country of business activities was as follows: 347 (24.8%) SMEs from the Czech Republic (CR), 322 (23.0%) SMEs from Slovakia, 381 (28.1%) SMEs from Poland (PL) and 348 (24.9%) SMEs from Hungary (HU). The size of the selected dataset determined the minimum size of the selected sample of respondents to be 684. The number of respondents in the overall dataset is more than twice as many as the minimal limit.

The questionnaire contained 52 closed questions and consisted of several parts: the demographic characteristics of the SME and the respondent (nine questions);

respondents' attitudes to human resource management (seven statements); business ethics (five statements); Corporate Social Responsibility (CSR; eight statements); environmental aspects (EA; four statements); Digitalisation (DG; three statements); sustainability (S; five statements); financial management and crisis phenomena in business (FM and CPB; 10 statements). All variables (i.e. statements, questions) were evaluated equally by the respondents (except for the demographic characteristics of SMEs) on a scale from 1 ('strongly agree') to 5 ('strongly disagree'). The responses to the statements pertaining to ES, FM and the demographic characteristics of enterprises were used to fulfil the aim of the paper.

The structure of respondents was as follows ($n = 1,398$): the size of the enterprise: 678 microenterprises, 347 small enterprises, and 323 medium-sized enterprises; the area of business activities: 368 – services, 264 – trade, 226 – production, 112 – construction, 46 – agriculture, 54 – transport, 226 – tourism, 102 – other areas of business activity; the time period of an enterprise's involvement in business activities: 370 enterprises operating for less than three years, 550 enterprises operating for between three and 10 years, and 478 enterprises operating for more than 10 years; areas of business activity: 410 – the capital city, 988 – other regions.

The independent (EA) and dependent (FM) variables are defined in Table 1. The table also contains the calculated characteristics of descriptive statistics (M – Mean, SD – Standard Deviation, S – Skewness, K – Kurtosis).

Table 1. The descriptive characteristics of EA and FM indicators of SMEs

Indicator	Independent variables – Environmental aspects of business (EA)	M	SD	S	K
EA ₁	Responsibility to the environment is an important area of company management.	1.761	0.823	1.416	1.115
EA ₂	Environmental responsibility is taken into consideration in the course of managing the company.	1.832	0.843	1.147	1.014
EA ₃	Environmental responsibility brings about higher costs for the company.	1.925	0.909	0.427	0.865
EA ₄	Our company actively participates in the protection of the environment.	2.021	0.916	0.538	0.821
FMs	Dependent variables – Financial management (FM)	M	SD	S	K
FM ₁	I view the financial performance of our company positively.	1.928	0.838	0.859	0.881
FM ₂	Our company is going to survive on the market for the next five years.	1.866	0.863	0.801	0.930

Source: own elaboration

The results of descriptive characteristics (K, S) confirmed (K, S values are within the value interval from -2 to 2) were such that a normal division was confirmed for every variable (both dependent and independent). The statement that environmental responsibility is an important area of company management (EA₁; M = 1.761) was most commonly confirmed by the respondents. This statement also drew the highest consistency among respondents' attitudes (EA₁; SD = 0.823).

The results of validity and reliability (FL – Factor loadings; CA – Cronbach's Alpha; AVE – Average Variance Extracted; CR – Composite Reliability) factors (EA, FM) with the use of the extraction method principal component analysis (PCA) presented below confirmed the internal consistency of factors. FL: EA₁ – FL = 0.875; EA₂ – FL = 0.890; EA₃ – FL = 0.792; EA₄ – FL = 0.871; EA: AVE = 0.736; CR = 0.918; CA = 0.850. FL: FM₁ – FL = 0.917; FM₂ – FL = 0.917; FM: AVE = 0.841; CR = 0.914; CA = 0.810.

The following hypotheses were formed to fulfil the main aim of the paper:

H1: Environmental aspects have a statistically significant impact (EA₁ – H1_EA₁; ...; EA₄ – H1_EA₄) on the financial performance of a company (FM₁).

H2: Environmental aspects have a statistically significant impact (EA₁ – H2_EA₁; ...; EA₄ – H2_EA₄) on the likelihood of a company surviving on the markets over the upcoming five years (FM₂).

Linear Regression Models (LRM) were applied to the quantification and verification of causal relations between dependent (FMs) and independent variables (EAs). The variables were formulated in such a way so that the respondents' attitudes to environmental aspects (EAs) would linearly converge with statements on the financial management of companies (FMs). Pairwise correlation coefficients between variables (EAs, FMs) were presented in a modified correlation matrix. A T-test was used to verify their statistical significance (Lancaster & Hamdan, 1964). The estimate of regressive coefficients (RCs) was determined with the use of the least squares method (Stewart, 1987). RC is statistically significant if the

p-value of the t-test is lower than the significance level (Arnold, 1980). The significance level (α) was ; shape of linear regression models (LRMs) in general was as follows:

$$LRM_b : FM_b = \beta_0 + \beta_1 \times EA_1 + \beta_2 \times EA_2 + \beta_3 \times EA_3 + \beta_4 \times EA_4 + \varepsilon_n; \tag{1}$$

where: $b = 1, 2$; FM – indicator of financial management; $EA_1, \dots, EA_4$ – environmental aspects of business; ε_i – random error.

LRMs contained the following regressive characteristics: multiple correlation coefficient (MCC), coefficient of determination (R^2), and adjusted coefficient of determination (Adj. R^2). The verification of LRM significance was carried out by means of the analysis of variance method (ANOVA; SS – sum of squares; ME – mean of squares; SE – standard error; df. – degree of freedom; F-ratio, p-value) (Breslow, 1990). The presence of dependencies between independent variables (EAs) was defined with the use of a variance inflation factor (VIF). The VIF needs to be calculated if the LRM consists of more than three statistically significant independent variables (O'Brien, 2007). Autocorrelation was not the subject

of the analysis because data file are not data of time series (case study contains only categorical variables). The Shapiro-Wilkov test (S-W test) was applied to verify the statement that the differences between theoretical and real values become a normal difference (Zheng & Yu, 2015). The homogeneity of variances was verified by means of Bartlett's test. The above assumptions are accepted when the p-value of Bartlett's test is greater than the level of significance (Arnold, 1980). IBM SPSS Statistics (version 28) was used for all the results of the case study.

3. Research results

The results of the adjusted correlation matrix of dependencies between variables (EAs, FMs) are listed with the results of their statistical significance in Table 2.

Table 2. The dependence between variables (EAs and FMs)

CM	FM ₁	FM ₂	EA ₁	EA ₂	EA ₃	EA ₄
EA ₁	0.408*	0.375*	1			
EA ₂	0.422*	0.368*	0.760*	1		
EA ₃	0.373*	0.331*	0.457*	0.450*	1	
EA ₄	0.425*	0.404*	0.662*	0.711*	0.506*	1

Note: CM – Correlation matrix. Statistically significant correlation at the level of significance $\alpha = 1\%$.
Source: own elaboration

The results of correlation analysis (Table 2) proved that all the presented pairwise coefficients of dependency are statistically significant at the 1% level of significance. There are positive dependencies, ranging from averagely strong up to strong, between environmental aspects ($r \in <0.450; 0.760>$). The strongest dependency is between EA_1 and EA_2 ($r = 0.760$). The values of pairwise

coefficients of correlation between dependent variables (FMs) and independent variables ($EA_1, \dots, EA_4$) showed positive dependencies ranging from weak to averagely strong (FM_1 : $r \in <0.373; 0.425>$; FM_2 : $r \in <0.331; 0.404>$).

3.1. The impact of environmental aspects on the perception of a company's financial performance

The results of applying regression analysis to the perception of a company's financial performance (FM_1), when LRM_1 influences the independent variables (EAs), are shown in Table 3.

Table 3. LRM_1 – The verification of the impact of EA aspects on FM_1

Regression characteristics					
MCC	0.490	Adj.R ²	0.238		
R ²	0.240	SE	0.732		
Verifications of the statistical significance of LRM ₁					
ANOVA	Df.	SS	MS	F- ratio	
Regression	4	235.568	58.892	109.949	
Residual	1393	746.135	0.536	p-value	
Total	1397	981.703	0.00001*		
Estimates and verifications of the statistical significance of regression coefficients					
Independent variable	Regression Coefficients (RC)	Standard Error	t-Stat	p-value	VIF
Intercept	0.857	0.055	15.615	0.000	-
EA ₁	0.114	0.038	2.979	0.003**	2.589
EA ₂	0.144	0.040	3.641	0.000*	2.907
EA ₃	0.162	0.025	6.368	0.000*	1.398
EA ₄	0.145	0.033	4.453	0.000*	2.333

Note: Statistically significant LRM_1 at the level of significance $\alpha = 1\%^*$; $\alpha = 5\%^{**}$.

Source: own elaboration

The results in Table 3 show that the suggested LRM_1 of linear relations between the dependent variable and the environmental aspects is statistically significant (F-ratio = 109.949 and p-value = 0.00001). The suggested LRM_1 explains 23.8% of the variability of

the dependent variable FM_1 . All the examined environmental aspects (EAs) are statistically significant. The linear regression function obtains the following form:

$$LRM_1: FM_1 = 0.857 + 0.114 \times EA_1 + 0.144 \times EA_2 + 0.162 \times EA_3 + 0.145 \times EA_4 \quad (2)$$

where: FM_1 – the perception of a company's financial performance; $EA_1, \dots, EA_4$ – environmental aspects of business.

Homoscedasticity was supported (Bartlett's Test: LRM_1 – p-value = 0.107). The normal distribution of errors was supported for the regression model (S-W test:

LRM_1 – p-value = 0.187). Hypotheses $H1_{EA_1}$; $H1_{EA_2}$; $H1_{EA_3}$ and $H1_{EA_4}$ were confirmed.

3.2. The influence of environmental aspects on the likelihood of a company surviving on the markets for the next five years

The results of applying regression analysis to the perception to survive of company on the market for the next five years (FM₂), when LRM₂ influences the independent variables (EAs), are shown in Table 4.

Table 4. LRM₂ – The verification of the impact of EA aspects on FM₂

Regression characteristics					
MCC	0.447	Adj.R ²	0.198		
R ²	0.200	SE	0.773		
Verifications of the statistical significance of LRM ₂					
ANOVA	Df.	SS	MS	F- ratio	
Regression	4	208.090	52.023	87.111	
Residual	1393	831.896	0.597	p-value	
Total	1397	1039.986	0.00001*		
Estimates and verifications of the statistical significance of regression coefficients					
Independent variable	Regression Coefficients (RC)	Standard Error	t-Stat	p-value	VIF
Intercept	0.867	0.058	14.962	0.000	-
EA ₁	0.137	0.040	3.388	0.001*	2.587
EA ₂	0.061	0.042	1.470	0.142	2.911
EA ₃	0.135	0.027	5.022	0.000*	1.400
EA ₄	0.191	0.034	5.537	0.000*	2.335

Note: Statistically significant LRM₂ at the level of significance α = 1%*.

Source: own elaboration

The results given in Table 4 show that the LRM₂ of linear relations between the dependent variable (FM₂) and the environmental aspects (EAs) is statistically significant (F-ratio = 87.111 and p-value = 0.00001). The suggested LRM₂ explains 19.8% of the variability of the dependent variable (FM₂).

All the examined environmental aspects (EAs) are statistically significant at the significance level of 0.01%, except EA₂ (statistically insignificant variable; p-value = 0.142). The linear regression function forms the following shape:

$$LRM_2: FM_2 = 0.867 + 0.137 \times EA_1 + 0.061 \times EA_2 + 0.135 \times EA_3 + 0.191 \times EA_4 \quad (3)$$

where: FM₂ – the likelihood of a company continuing to operate on the market in the next five years; EA₁, ..., EA₄ – environmental aspects of business.

Homoscedasticity was supported (Bartlett’s Test: LRM₂ – p-value = 0.147).

The normal distribution of errors was supported for the regression model (S-W test: LRM₁ – p-value = 0.214). Hypotheses H2_ EA₁; H2_ EA₃ and H2_ EA₄ were confirmed. Hypothesis H2_ EA₂ was rejected.

4. Discussion

The empirical research on the business environment of SMEs in V4 countries gave rise to several interesting findings. In accordance with the subjective attitudes of businesspeople in the SME segment, it was found that all the environmental factors studied positively affect the positive perception of the financial performance of a company. The perception of a firm's financial performance is most influenced by the attitude which companies have towards the fact that environmental responsibility brings about higher costs ($\beta_3 = 0.162$). The second significant factor in this area is the strong conviction held by companies that they actively participate in the protection of the environment ($\beta_4 = 0.145$). The companies unequivocally claimed that they take environmental responsibility into consideration in management ($\beta_2 = 0.144$).

The research concludes that factor EA₂ bears no statistically significant influence on FM₂ attitudes, which may be interpreted as saying that environmental responsibility bears no influence on companies' perception of the likelihood of the company surviving on the market for the next five years.

On the contrary, the factors EA₄, EA₁ and EA₃ do not have an influence on such attitudes. The greatest influence was attributed to the independent variable EA₄, according to which the companies claimed that they actively participate in the protection of the environment ($\beta_4 = 0.191$). The second most important factor was EA₁, according to which the companies declared that environmental responsibility is an important area of company management ($\beta_1 = 0.137$). The third most significant factor was EA₃, referring to an attitude that environmental responsibility brings about higher costs for the company ($\beta_3 = 0.135$).

The results of the research confirm the significance of respecting CRS principles in the SME environment, which is emphasised

by Forcadell et al. (2021), among others (e.g. Hoogendoorn et al., 2015; Dey et al., 2018).

The results of the research also follow on from the conclusions of studies emphasising the significance of environmentally-based business management (Syafri et al., 2021), within which companies are able to significantly implement innovation in operational procedures, save input resources, recycle (Hoogendoorn et al., 2015) and increase operating efficiency (Johnstone, 2020).

This research also follows on from the conclusions of Uvar (2021), according to whom the implementation of environmental strategies exerts a direct effect on the sustainability of a firm's overall performance and financial performance, as well as positively influencing the growth of competitive advantages (Rehman et al., 2021; Metz et al., 2016).

The results of the research expand the current knowledge pertaining to the impact of costs on companies' environmental policies in the context of conclusions reached by Graafland and Smid (2016), as SMEs are able to reduce direct costs of production more significantly due to a lower level of bureaucracy and greater managerial flexibility.

Conclusions

The aim of the paper was to define and quantify the impact of environmental aspects on the perception of the financial performance of firms in the SME segment.

The study revealed interesting findings that complement and enlarge theoretical knowledge in this relatively little explored, but therefore even more significant, area.

The essential conclusion that can be formulated on the basis of this research is that despite their specifics, SMEs pay significant attention to environmental factors and certainly perceive the need to implement 'green' approaches in their business activities.

SMEs in V4 countries unequivocally claimed that they perceive responsibility

to the environment as a significant part of company management, accepting the necessity of increased costs arising from this area, and thus demonstrated a willingness to actively participate in the protection of the environment.

In the context of the current economic situation, it is a positive sign that companies perceive their current and future performance quite optimistically and believe that they will survive in the medium term. In this vein, the research showed the influence of environmental factors on the evaluation of a firm's financial performance and sustainability in the market.

This research has certain limitations; therefore, it is appropriate to see it in the context of the empirical research undertaken, and also in the context of the current economic situation. However, we assume that it has given rise to certain stimuli for a discussion of the issue and may provide the inspiration for further research.

The future research that our scientific team intends to conduct will focus on the construction of a complex model of the dependency of economic, social and environmental factors on a company's sustainability in the SME segment.

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The role of human capital in the relationship between foreign direct investment and exports in the Association of Southeast Asian Nations

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Abstract

DOI: 10.23762/FSO_VOL11_N01_8

Foreign direct investment (FDI) plays a vital role in capital formation and is also an indispensable factor in economic growth in developing countries. While human capital is an important resource for the production process, this capital includes skills, knowledge, and experience in the working and learning process of employees. The research objective is to investigate the role of human capital in the relationship between FDI and exports (EXP) in the Association of Southeast Asian Nations (ASEAN). The present study used the Pooled Ordinary Least Squares model, the fixed effects model and the random effects model to analyse balanced panel data from nine ASEAN countries in the period from 1990 to 2020. The research results show that FDI has a positive and significant impact on EXP in ASEAN countries. At the same time, human capital plays a moderating role in the relationship between FDI and exports in ASEAN countries. From the findings of this study, several recommendations to boost the absorption capacity of FDI in order to increase exports in ASEAN countries are proposed.

Key words

exports, foreign direct investment, human capital, moderator, trade.

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Introduction

International commerce takes place to fulfil the needs of a nation, in which exports, in particular, are a way of generating the foreign

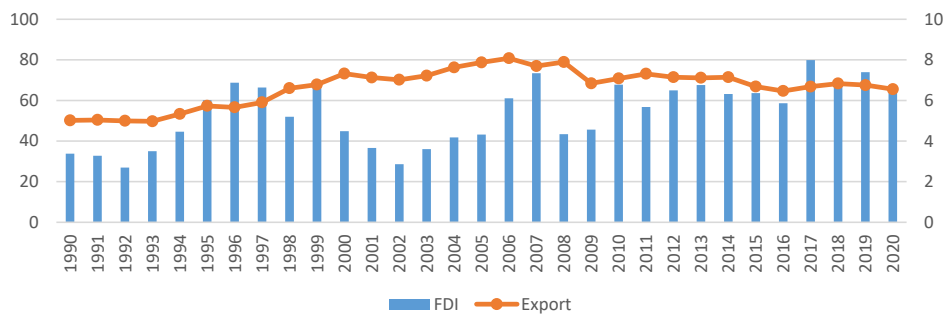
revenues necessary to fund the acquisition of products and services; achieving economies of scale, scope, and specialisation in

production; and gaining expertise on a global scale (Prasanna, 2010). In a globalised world, each country has its own particular advantages in exported products; the country is then recognised as being competitive in the trade of specific product(s). Exports, therefore, play an essential role in bringing in foreign currency to serve the fiscal and monetary needs of a country. However, the comparative advantages of most developing countries still depend on primary goods and labour-intensive manufacturing industries. Countries chronologically develop and accumulate capital and skills, wages increase, and their competitive base also adapts to the new conditions.

Consequently, economies had to upgrade their labour-intensive exports into ones with higher added value, and they had to move on to new, more advanced operations. Such an upgrade requires higher skills and technological inputs. Countries can achieve these goals in several ways. One approach is to improve the capacity of local investments, while another is to attract FDI for export-oriented activities. For developing countries, where technology and capital are lacking, relying on external resources to promote production processes and capital accumulation is faster

than improving domestic manufacturing capacities. As a result, FDI plays a vital role in the host countries' capital accumulation and technological resources, where abundant and economical labour resources are available. Moving production to another nation is a strategic decision for parent firms, for example, to escape high environmental or labour taxes in their own countries while expanding manufacturing in host countries. From the perspective of the host countries, FDI has gained greater recognition as a critical tool for resource movement across national boundaries to boost economic performance, competitiveness, and exports. Therefore, FDI flows seem to benefit both investors and host countries, which helps to rebalance and optimise capital flows because of imperfectly competitive economies. From these analyses, developing countries can receive FDI inflows when the resources, i.e. labour, manufacturing capacities, and materials, are available to absorb FDI. In turn, FDI bolsters exports by enhancing the specific export capabilities. In this context, the Association of Southeast Asian Nations (ASEAN) has indeed become a region which reliably absorbs FDI from multinational enterprises around the world.

Figure 1. Evolution of FDI and Exports in ASEAN, 1990-2020



Source: World Development Indicators (2022a, 2022b)

Figure 1 shows that FDI inflows to the ASEAN region have a typical N-shaped pattern, beginning to increase in the 1990s, then decreasing along with the Asian

economic crisis and the global financial crisis in 1997-2002 and 2007- 2009, respectively, and finally growing rapidly in the period after 2009. As a result, FDI

in the region reached a record high of US\$182 billion in 2019, making ASEAN the biggest beneficiary of FDI in the developing world. Due to the unprecedented consequences of the COVID-19 pandemic, FDI in the region decreased to US\$137 billion in 2020, a considerable reduction. However, compared to the worldwide FDI decline, ASEAN did significantly better, with its share of global FDI increasing from 11.9% to 13.7% in 2020 (ASEAN & United Nations, 2021). On the other hand, the average export values for the period 1990-2020 also have the same change trend as FDI (as shown in Figure 1). In particular, the export trend line also decreased in the two phases of the Asian financial crisis and the global financial crisis, before increasing in the remaining periods. This suggests that there is a link between FDI and exports. Specifically, FDI has an impact on the exports of countries, in which the spillovers of FDI impacts emerge because foreign capital inflows may bring about a variety of competitive advantages, such as greater knowledge and technology, resulting in increased productivity, or improve the export markets in comparison to domestic enterprises (Frankel and Romer, 1999; Helpman and Hoffmaister, 1997).

This increased trend reflects increasing investor interest and confidence in investing and conducting business in the ASEAN region. Indeed, ASEAN has become one of the focal points for attracting FDI because it simultaneously satisfies various conditions to engage investors. Specifically, ASEAN is a large market, with a population of approximately 600 million people, and the economies within continue to grow, meaning that purchasing power is increasing. In addition, the ASEAN region has abundant labour resources and reasonable labour costs that can meet the outsourcing and assembly needs of large corporations. Most importantly, the region has

an export-oriented policy, which enhances the potential impact of FDI on exports. The purpose of this article is to determine if FDI has been a critical factor in the growth of exports from ASEAN countries. To do so, the researchers examine and seek to account for the influence of FDI on host economy exports. Previous studies have revealed that FDI has historically played a significant role in exporting natural resources (Asiedu & Lien, 2011; Hayat, 2018; Kinda, 2013), and its involvement in the export of certain processed agricultural goods is expanding (Amighini & Sanfilippo, 2014; Vural & Zortuk, 2011). It is also becoming more prevalent in the service sector, particularly tourism (UNCTAD, 1994). As a result, FDI inflows directly influence exports; thus, obtaining further FDI would be justifiable.

In the next section, the literature review is presented; while Section 3 describes the model and data measurement. The experimental results and discussion are presented in Section 4. Finally, the policy implications and conclusions based on the empirical results are discussed in Section 5.

1. Literature review

1.1. FDI and exports

FDI inflows bring valuable investment to host countries, including increased production capacities and export values. In detail, FDI inflows can enhance productivity through spillovers of technology and advances such as the importation of modern equipment, as well as learning by watching (Barro and Sala-i-Martin, 1997; De Mello Jr, 1997) and promoting domestic production through participation in the supply chain of joint-venture multinational enterprises (De Mello Jr, 1997). In addition, FDI enterprises directly increase host countries' export capability (Borensztein et al., 1998). Several empirical studies have supported this relationship; however, the inverted

pattern has been quite different. Aitken et al. (1997) demonstrated the external effect of FDI on exports in Bangladesh, where the entry of a single Korean multinational to the garment exports industry led to the establishment of several domestic export firms, resulting in the creation of the country's largest export industry. The authors argued that entering overseas markets lowers entry costs for other potential exporters, either through learning effects or business relationships. The spillover effects of one firm's export activities help other enterprises minimise the cost of exporting. However, Aitken and Harrison (1999) were concerned about the negative effect of FDI, arguing that multinational corporations generate fierce rivalry with indigenous enterprises due to their low marginal production costs. The advantage allows FDI corporates to capture a substantial portion of local demand, forcing domestic enterprises to reduce output, thereby increasing their average costs and diminishing their competitiveness. As a result, FDI inflows may have no effect on the economy, despite the increase in exports (Nguyen et al., 2022).

Kutan and Vukšić (2007) explained the success of host countries through the prism of the activities of multinational companies, which possess superior expertise and technology, have a better understanding of export markets, or have a stronger connection to the parent company's supply chain than do local enterprises. However, the authors also note that the evidence supports their hypotheses only for some countries which have recently joined the European Union. Prasanna (2010) stated that FDI inflows have a considerable beneficial effect on export performance when examining the FDI-exports nexus in India. Additionally, the study argued that domestic initiatives to boost manufacturing exports should be reassessed in light of the FDI regulatory scheme to obtain superlative and long-term advantages. Harding and Javorcik (2012)

found that FDI has a positive effect on export quality in developing countries, based on an examination of 105 countries from 1984 to 2000. Specifically, sectors hierarchised in national efforts to attract FDI have 11% greater unit values of exported products than other sectors. As a result, the policies, which aim to attract FDI to upgrade the export structures of developing countries, were deemed necessary. More importantly, there is no evidence that FDI enhances the similarities between the export structures of developing and developed nations, respectively. In other words, attracting FDI can be a realistic approach for low- and middle-income countries seeking to improve the quality of export values. Anwar and Sun (2018) also found that increased FDI in China's manufacturing sector resulted in a considerable improvement in the quality of Chinese exports.

On the other hand, Rehman and Ding (2020) observed that FDI outflows (OFDI) significantly boost export sophistication in China. As a result, the nexus between them could enhance the quality of exports and enable them to catch up to developed economies. Zhang and Chen (2020) added empirical evidence that OFDI has a positive and substantial effect on export sophistication in established coastal districts, but no effect is observed in less developed inland locations. Regarding the ASEAN region, Anwar and Nguyen (2011) emphasised transactional connections which formed between foreign firms and domestic ones, followed by FDI inflows in the case of Vietnam. It is revealed that the presence of foreign firms in Vietnam, via horizontal and forward connections, has a significant impact on local firms' decisions to export and their subsequent share of total exports. This means that the export spillovers experienced by Vietnamese manufacturing firms are primarily the result of horizontal and forward connections facilitated by FDI. Based on these analyses, FDI may boost a country's

export quality by enhancing domestic production capability in the region. Therefore, the hypothesis is formed to show the relationship between FDI and exports.

H1: FDI enhances the value of exports in ASEAN countries.

1.2. FDI and human capital

Human capital (HCA) may be defined as the components of health, education, and skill which are incorporated in each individual (Sehrawat & Singh, 2019), public education and research expenditure (Kohpaiboon, 2003), or the multi-dimensional index (Alvarado et al., 2021). Although the measurements vary, the association between FDI and HCA is widely observed. Borensztein et al. (1998) argue that the extent of the influence of FDI on growth in general, and exports in particular, in the host countries depends greatly on the human factor as well as the ability to implement advanced technologies brought by FDI, otherwise FDI will be ineffective. Furthermore, Alvarado et al. (2017) reveal that the low level of human capital may explain the negative FDI in the economies of Latin America. Lipsey and Sjöholm (2005) also argues that the host country can only receive the benefits of FDI if these countries have a highly qualified workforce. Therefore, the mechanism for the relationship between FDI and HCA is based on labour advantages, which are determined by several factors, e.g. skills, education, labour force structure, labour costs, and technology transfer. For instance, technology transfer is thought to occur through five channels: learning by watching, labour mobility, supplier contacts, customer contacts, and networking (Günther, 2002), amongst which the development of human capital and learning by watching are the most critical factors in determining economic growth (Balasubramanyam et al., 2019). Several previous studies focused on

the role of HCA in attracting FDI. One such example was research by Ramasamy and Yeung (2010), who examined a sample of 20 provinces in China. The empirical evidence shows that cheap labour attracts FDI, especially for inland provinces, while rising FDI inflow influences wage rates in the coastal provinces. However, the authors also noted that the benefits of cheap labour is only relevant in the short term. The favourable business climate, a suitable education policy, and incentives for increased R&D are long-term strategies to attract FDI inflows. Abbas et al. (2021) investigated a cross-sectional sample of 103 developing and transition countries, discovering that the wage bill is the most significant factor in attracting FDI. This implies that multinational corporations find cheap labour in the host country. Additionally, the authors observe no contradiction between enterprises seeking HCA and firms seeking inexpensive labour, meaning that FDI firms also obtain skilled labour. Kheng, Sun, and Anwar (2017) analysed data from 55 developing nations from 1980 to 2011, discovering a bidirectional causal relationship between HCA and FDI, meaning that FDI and HCA development strategies should be coordinated. Additionally, the authors highlighted the fact that governments should invest in HCA development by increasing education and training expenditures to achieve similar economic success to that of countries such as Brazil and China.

Dutta and Osei-Yeboah (2013) added the role of political rights and civil liberties in the relationship between FDI and HCA. Specifically, these two factors enable HCA to profit more efficiently from FDI inflows. Moreover, the existence of these two elements strengthens the correlation between HCA and FDI inflows. On the other hand, Zhuang (2017) showed that FDI from OECD nations had a favourable influence on secondary and university education in 16 East Asian countries from 1985 to 2010. The reason for this

is that FDI from the OECD countries may contain more advanced technology that demands more skilled labour. In other words, FDI stimulates the human capital in the host countries to meet the beneficial effects of receiving FDI from technologically advanced countries. Regarding the ASEAN region, previous studies indicated several factors that affect the FDI-HCA. Thangavelu and Narjoko (2014) emphasised the importance of the domestic absorptive capacity of the economies. ASEAN countries, therefore, ought to align their infrastructure, especially HCA, to provide multinational companies (MNCs) with the necessary linkages to the global network and also to move the domestic industries seamlessly up the global production value chain. Asada (2020) found that FDI in Vietnam contributes to HCA in the long run; albeit the relationship was ambiguous in the short run.

Based on these studies, a relationship between FDI and HCA may exist, inasmuch as

HCA plays an important role in attracting FDI inflows due to the abundant resources in the region. Additionally, countries in the region have a suitable labour structure that can meet the human resource requirements for multinational companies. In turn, FDI boosts a country’s export quality by enhancing the domestic production capability. Therefore, the following hypothesis pertains to the relationship between FDI and exports given the presence of HCA:

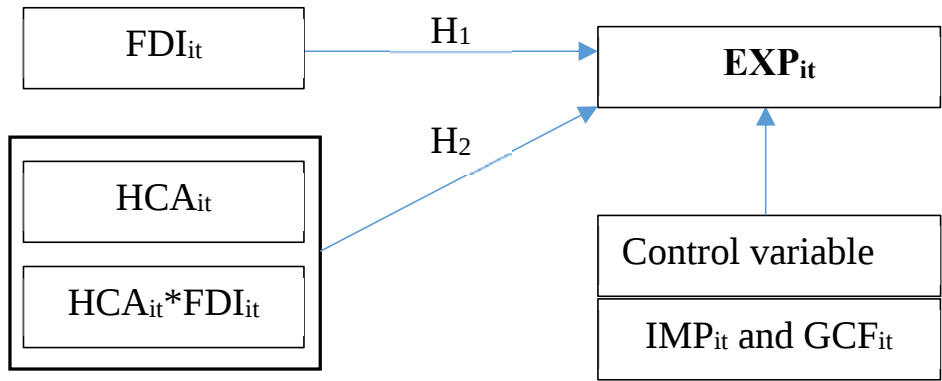
H2: HCA boosts the relationship between FDI and EXP in ASEAN countries.

2. Research model and data

2.1. Research model

To analyse and evaluate the role of human capital in the relationship between FDI and EXP, this study used a multivariable regression model to test the two research hypotheses as follows:

Figure 2. Overview of the research model



Source: Own elaboration

In which:

- EXP_{it} : Exports of country i at time t;
- FDI_{it} : the amount of foreign direct investment capital of country i at time t;
- HCA_{it} : Human capital of country i at time t;
- HCA_{it}*FDI_{it} : the interaction between FDI and HCA of country i at time t;
- IMP_{it} : the import of country i at time t (the control variable) ;
- GCF_{it} : the Gross Capital Formation of country i at time t (the control variable).

According to this research model, besides determining the impact of FDI on EXP, HCA and HCA*FDI on EXP, there are also the control variables IMP and GCF. More

specifically, to test the first hypothesis, the study examined the multivariate regression FDI-EXP as follows.

$$EXP_{it} = + FDI_{it} + IMP_{it} + GCF_{it} + \quad (1)$$

where EXP and FDI are exports and foreign direct investment, while IMP and GCF are imports and gross capital formation, which play the role of control variables to measure the possible effectiveness of export values. $i = 1, 2, \dots, n$ represents the countries while $t =$

$1, 2, \dots, n$ denotes the period of examination, and denotes the error terms in the model.

To test the second hypothesis, the study investigated the equation to test the moderator as introduced by Baron and Kenny (1986).

$$EXP_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 HCA_{it} + \beta_3 FDI_{it} * HCA_{it} + \beta_4 IMP_{it} + \beta_5 GCF_{it} + e_{1it} \quad (2)$$

where HCA denotes human capital, and FDI*HCA is the interaction between FDI and HCA. IMP and GCF are imports and gross capital formation, which play the role of control variables to measure the possible effectiveness of export values. $i = 1, 2, \dots, n$ represents the countries, while $t = 1, 2, \dots, n$ denotes the period of examination, and e_{1it} denotes the error terms in the model.

Human capital (HCA) is proven to be the moderator if β_3 is significant. Additionally, the significant values of β_1 and β_2 reveal how the magnitude of the moderator affects the dependent variable.

The Pooled Ordinary Least Squares model (Pooled OLS), fixed effects model (FEM), and random effects model (REM) were applied for the equations (1) and (2) to find an appropriate estimator, which captures the relationship between variables in the study. It is noted that the heterogeneous panel could affect the chosen appropriate estimator in the proposed model. To confirm the reliability of the results, the F-test to compare results between Pooled OLS and FEM estimators, and the Hausman test for the choice between FEM and REM were also employed (refer to Islam et al. (2020) and Siriopoulos et al. (2021) for a detailed discussion). In addition, the correlation and Wald tests are also

examined to confirm the reliability of the model.

2.2. Data measurement and data collection

Exports (EXP) were measured by exports of goods and services (% of GDP), indicating the total export values compared with the total GDP in a country within a year. The higher the EXP, the more open to trade a country is. Foreign direct investment (FDI) was calculated by the ratio of FDI inflows to GDP. The human capital variable (HCA) was indicated by the labour force participation rate, or the ratio of the workforce to the total population aged 15-64 (refer to previous studies for a similar approach). The labour force was a proxy for the HCA due to the available labour in a country, indicating the availability of labour to meet the needs of multinational companies. Imports of goods and services and gross capital formation measure the other two control variables, IMP and GCF, respectively. These two variables were also denoted by the ratio of GDP, capturing the possible effects on exports. These variables were derived from World Development Indicators for all nine ASEAN countries, i.e. Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, the Philippines, Singapore, Thailand, and Vietnam, for 1990-2020. Due to a lack of

data in the same period, data for Myanmar was removed from the sample. In total, the data sample consists of 279 observations.

The measurement of the variables in the research model and the expected impact of these variables are summarised in Table 1.

Table 1. Measured Variables

Variable	Abbreviation	Description	Reference	Expected sign
Exports	EXP	Exports of goods and services divided by GDP (%)	Anwar and Sun (2018), Harding and Javorcik (2012)	
Foreign Direct Investment	FDI	The ratio of FDI inflows and GDP (%)	Prasanna (2010), Jawaid, Raza, Mustafa, and Karim (2016)	Positive
Human capital	HCA	Labour force participation rate (%)	Tebaldi (2011), Blanchard and Olney (2017)	Positive
Imports	IMP	Imports of goods and services divided by GDP (%)	Irandoost and Ericsson (2004), Feng, Li, and Swenson (2016)	Positive
Gross Capital Formation	GCF	The ratio of Gross Capital Formation and GDP (%)	Tebaldi (2011), Kabaklarli, Duran, and Üçler (2017)	Positive

Source: own elaboration

3. Results and Discussion

3.1. Description

The variables described in this study are shown in Table 2. The results reveal that the average export values in the ASEAN region for the period 1990-2020 were 66.63%, indicating that openness to trade in this region was relatively high. However, there is

a crucial difference between the maximum and minimum values visible, the former of which belonged to Singapore in 2008, while the latter was from Cambodia in 1990. Additionally, the standard deviation of the exports equals 48.94%, which is higher than the minimum value, indicating a considerable difference in exports between countries in the ASEAN region.

Table 2. Description of variables

	EXP	FDI	HCA	IMP	GCF
Mean	66.63%	5.41%	73.75%	63.16%	25.71%
Median	56.44%	3.44%	70.9%	51.24%	25.42%
Maximum	228.99%	32.17%	87.98%	208.33%	43.64%
Minimum	10.16%	-2.76%	61.77%	16.02%	7.92%
Std. Dev.	48.94%	5.82%	7.63%	41.31%	7.85%
Observations	279	279	279	279	279

Source: own elaboration

A similar trend is also found in exports, which has the same fluctuation in terms of FDI inflows, since there are significant disparities in high- and middle-income countries compared with lower-income countries. Specifically, Singapore continued to attract FDI when reaching a regional peak of 32.17% in 2019; meanwhile, Indonesia continuously demonstrated lower FDI inflows than outflows in 1999-2001. This suggests a correlation between exports and FDI inflows in ASEAN countries, in which countries with high FDI inflows are directly related to high levels of exports. It is also worth noting that Singapore is the leading country in the region in terms of both exports and FDI indexes, with an average value of 186.8% and 17.5%, respectively, both of which are more than three times the ASEAN average. This implies that countries with a high level of openness to trade achieve the dual goals of attracting FDI and increasing exports. For the HCA variable, a degree of uniformity in the mean, median and standard deviation imply that there is a certain similarity in the labour force in ASEAN countries.

3.2. Correlation of variables

Regarding the correlation test for the variables included in the proposed model, Table 3 shows that most of the variables are correlated at different levels of statistical significance. It is noted that one pair of independent variables has a high correlation coefficient at 1% statistical significance; for instance, $r(\text{FDI}, \text{IMP}) = 0.746$, indicating that there is a possible overlap between FDI and IMP. In other words, the model is likely to bear the risk of a multicollinearity problem. Therefore, the Wald test was undertaken to confirm the necessity of these two variables in the proposed model. The results reveal that the statistical significance F-value (FDI, IMP) = 25.94 at 1%, implying the rejection of the null hypothesis H_0 ($a = b = 0$). Furthermore, the variance inflation factors of each independent variable are lower than 5, indicating that there is no collinearity. In other words, the selected variables are eligible for presentation in the proposed model without facing the problem of collinearity.

Table 3. Correlation tests

	EXP	FDI	HCA	IMP	GCF
EXP	1				
FDI (2.47)	0.711***	1			
HCA (1.12)	-0.119**	0.205***	1		
IMP (2.43)	0.965***	0.746***	0.009	1	
GCF (1.07)	0.165***	0.119***	-0.141**	0.215***	1

*** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. Values in parentheses present the centred VIF of each variable.

Source: own elaboration

3.3. Analysis of the hypotheses

3.3.1. The first hypothesis

The regression results derived from three estimation techniques, namely Pooled OLS, FEM and REM, on the relationship between variables are shown in Table 4.

Table 4. The relationship between FDI and exports

EXP is the dependent variable	Pooled OLS	FEM	REM
FDI	0.21* [1.04]	0.07* [1.87]	0.06* [1.68]
IMP	1.18*** [41.49]	1.09*** [36.24]	1.11*** [37.69]
GCF	-0.28*** [-2.79]	-0.71*** [-12.73]	-0.70*** [-12.72]
C	0.63 [0.23]	15.15*** [7.25]	14.76*** [3.25]
1 st test (F-value)	F-value = 107 > F-critical = 0.23		
2 nd test (Hausman test)	Chi-Sq. Stat = 3.73, d.f = 3, Prob = 0.29		

***p < 0.01, **p < 0.05, and *p < 0.1. t-statistics are in parentheses ().

Source: own elaboration

The regression results of Eq.(1) show that the statistical evidence supporting hypothesis H1 is weak (at a 10% significance level). Specifically, all three estimation methods, Pooled OLS, FEM and REM, reveal that FDI weakly affects exports within the ASEAN countries. Model selection tests were also applied to find the appropriate estimator. In particular, for the comparison between Pooled OLS and FEM (the first test), the F-value equals 107, which is larger than the F-critical value (0.23), implying the rejection of hypothesis H0: there is no difference between countries in the model. In other words, FEM is more suitable than Pooled OLS. For the comparison between REM and FEM models (the second test), the Chi-square statistic equals 3.73 with probability at 0.29, indicating no rejection of hypothesis H0: there is no correlation between the errors and the regressors in the model. In other words, REM is more appropriate than FEM.

Based on these findings, REM was chosen to present the obtained data set, and

some results derived from REM are as follows.

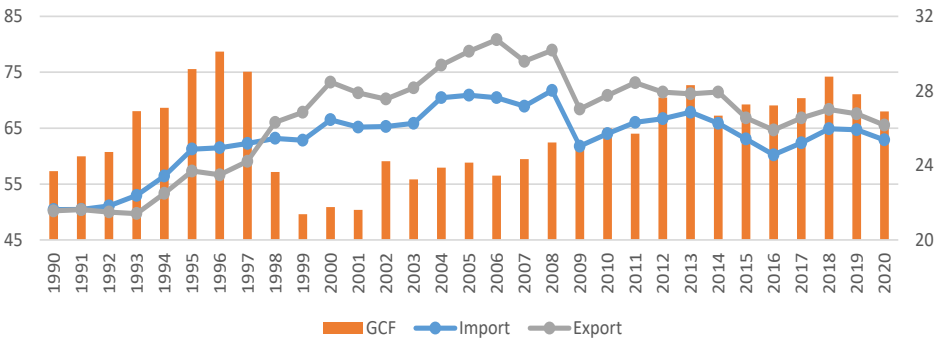
First, FDI inflows have a positive impact on exports. Our findings are in line with those of Prasanna (2010) in India, Jawaid et al. (2016) in Pakistan, and Anwar and Nguyen (2011) in the ASEAN region. The cause of this phenomenon can be explained by the fact that FDI inflows in the region directly serve export products. The increasing trend of export-oriented countries in the ASEAN region links FDI and exports in the region. For example, several Australian MNCs operate in only one nation, utilising it as a base from which to undertake business in other countries. For example, Treasury Wine Estates utilises Singapore as its headquarters for coordinating sales to other ASEAN countries, whereas Graincorp, a producer of grain and other commodities, operates a single sales office in Singapore for its exports throughout the ASEAN region (ASEAN & United Nations, 2021). However, it is also noteworthy that both the impact coefficients

and the amount of statistical evidence are relatively small, suggesting that boosting FDI does not lead to a significant increase in exports in the region. In other words, countries in the region need to consider their policies carefully if they promote exports through attracting FDI.

Second, exports are closely related to the two control variables in the model, namely imports (IMP) and gross capital formation (GCF). Specifically, EXP is strongly

positively correlated with IMP. Figure 2 also shows that during periods of the most substantial increase/decrease in exports, imports also increase/decrease accordingly, implying a solid relationship between them. The correlation suggests that trade openness-oriented policies, which aim to increase the production of export goods, need to gradually increase imports of raw materials, machinery, and equipment.

Figure 3. Evolution of Imports, Gross Capital Formation, and Exports in ASEAN, 1990-2020



Source: World Development Indicators (2022a, 2022c, 2022d)

In contrast, GCF shows a significantly negative impact on exports. The explanation for this phenomenon could be that the total domestic investment capital is not concentrated on the production of goods for export. Instead, GCF focused on other economic interests such as infrastructure development and domestic demand production. Thus, even during periods of a sharp decline in exports, such as during the global financial crisis of 2008-2010, GCF has remained at pre-crisis levels. The empirical evidence implies that increasing imports can boost exports; meanwhile, domestic capital could crowd out the effects of FDI on exports.

Third, since REM is a method suited to the dataset, implying that each country has distinguished characteristics for both

intercepts and slopes, in other words, the differences in the degree of reactivity between independent variables and exports indeed exist. Thus, it is necessary to consider the specificity of each country instead of a standard policy for all countries in the region. The difference (if any) is beyond the scope of this article. One may therefore suppose that additional variables are needed in the following studies to measure the responsiveness of one or more variables that can affect exports.

3.3.2. The second hypothesis

The regression results derived from three estimation techniques, i.e. Pooled OLS, FEM and REM, testing the moderator role of HCA in the relationship between FDI and exports, are shown in Table 5.

Table 5. The moderator role of human capital in the relationship between FDI and exports

EXP is the dependent variable	Pooled OLS	FEM	REM
FDI	0.15 [0.08]	7.06*** [6.38]	7.06*** [6.49]
HCA	0.96*** [7.12]	0.58** [2.11]	0.76*** [3.17]
FDI*HCA	0.01 (0.26)	0.09*** (6.45)	0.09*** (6.59)
IMP	1.13*** [42.68]	1.11*** [37.87]	1.11*** [40.20]
GCF	-0.39*** [-4.56]	-0.69*** [-13.02]	-0.69*** [-13.20]
C	74.5*** [7.54]	57.26*** [2.76]	70.29*** [3.84]
1 st test (F-value)	F-value = 84 > F-critical = 0.23		
2 nd test (Hausman test)	Chi-Sq. Stat = 1.06, d.f = 5, Prob = 0.59		

***p < 0.01, **p < 0.05, and *p < 0.1. t-statistics are in parentheses ().
Source: own elaboration

The regression results of Eq. (2) show solid statistical evidence supporting hypothesis H2 at a 1% significance level. Specifically, FEM and REM methods both show the impact of the interaction variable (HCA*FDI) on the exports of ASEAN countries. In addition, the FDI coefficient on exports in the presence of HCA in both FEM and REM reached 7.06%. In other words, human capital promoted FDI with a more substantial effect on exports. This implies that human capital is a moderator in the FDI-Exports nexus. The finding contributes to the literature that the HCA bolsters the FDI-Exports nexus, since its presence may influence the magnitude of the effect of FDI capital on exports.

Model selection tests were also applied to find the best estimation method. Specifically, for the comparison between the Pooled OLS and FEM (in the first test), the F-value equals 84, which is larger than the F-critical (0.23), implying the rejection of the null hypothesis H0: there are no differences among countries in the model. In other words, the FEM model is more suitable than Pooled OLS. Regarding the comparison between REM and FEM (in the second test), the Chi-square statistic equals 1.06 with probability at 0.59, indicating the rejection of hypothesis H0: there is no correlation

between the errors and the regressors in the model. In other words, REM is more appropriate than FEM. From these results, REM was chosen for further analyses on the obtained data set, and the present interpretation was drawn from REM as follows.

First, the results from the regression model show that HCA plays a role in enhancing the FDI-EXP nexus in ASEAN countries. The study also compares the magnitude of the FDI impact on exports in Eq.(1) and Eq.(2). The results show that the presence of HCA has made FDI have a more substantial effect on exports in the region. In detail, if FDI increases by 1%, then exports only increase by 0.07% in Eq.(1); meanwhile the ratio is 1:7.06 in Eq.(2), showing that the impact of FDI on exports increases significantly in the presence of HCA. This also suggests that FDI in the region flows into intensive labour export industries. Our findings support hypothesis H2 that in ASEAN countries, where the labour force is abundant, export flows will benefit from FDI inflows into the region. Our findings are in line with those of Thangavelu and Narjoko (2014) and Zhuang (2017) on the importance of HCA in attracting FDI. In addition, the present study adds the moderating role of HCA in the FDI-EXP nexus to the literature.

Second, the REM estimation method is suited to the data, which measures the moderating role of HCA. Thus, similarly to the results in Eq.(1), each country is different in terms of both intercepts and slopes, implying that the degree of reactivity between independent variables and exports is distinguished. Therefore, it is necessary to consider the specific policies of each country rather than for all standard policies applied to all countries in the region. The differences in each country's labour structure can affect the level of impact on FDI inflows both directly and indirectly. Subsequent studies may measure the response of exports to FDI and HCA in order to identify other factors which potentially explain these differences.

Conclusions

The study analyses the relationship between FDI, HCA, and EXP by means of quantitative analysis based on the panel data estimation for nine ASEAN countries within the period 1990-2020. Three estimation methods, namely Pooled OLS, FEM, and REM, were applied to examine the proposed model. At the same time, reinforcement tests were also employed according to the proposed hypotheses. The empirical results show that FDI inflows have a significantly positive effect on exports in the region. Although the impact is small and the statistical evidence is weak, it is crucial to recognise the importance of attracting FDI in the region to promote export production and the associated benefit to individual national economies. More interestingly, the main contribution of this study points to the mechanism of the reinforcing effect of HCA on the FDI-EXP nexus, which still represents a gap in the current literature. The statistical evidence suggests that the reinforcing effect is present and relatively straightforward in terms of coefficient effect and statistical levels. Specifically, ASEAN is a region with abundant labour resources with reasonable prices

compared to other regions. Accordingly, the presence of HCA strengthens the impact of FDI on exports. In other words, FDI inflows are also channelled into labour-intensive export manufacturing industries. Therefore, this advantage is still a crucial factor within the region. Policies focusing on attracting FDI should be associated with the structure of labour resources. As a result, countries need to pay attention to the local labour resources in order to meet production requirements, which have increased sharply in recent years.

In addition, exports are also closely correlated with two other factors, namely imports and gross capital formation, in which an increase in imports supports exports; meanwhile, domestic capital tends to be inversely related to exports. This evidence suggests that export-promoting FDI access policies need to be adequately optimised so as not to overlap with domestic capital, not supporting exports. Econometrics exercises show that REM estimation applies to both Eq.(1) and (2), implying that individual countries have different responses regarding the FDI-EXP nexus and the moderating role of human capital. As a result, policies which aim to attract FDI based on human capital advantages that promote exports need to be carefully designed following the labour structure for each country.

However, due to this being beyond the scope of the present research, the present study has not classified the categories of FDI inflows, which may individually affect the relationship between FDI and exports. For example, industry-oriented FDI capital has different effects on exports compared to service/infrastructure-oriented FDI capital. Furthermore, the chosen method (FEM) has not provided statistical evidence for amending policies for each individual nation. Future research may consider both limitations presented in this study in order to more deeply analyse the FDI-exports nexus.

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Has Policy Rate Been an Effective Tool in Taming Inflation?: A Sub-Saharan African Perspective

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Abstract

DOI: 10.23762/FSO_VOL11_N01_9

This paper explores the effectiveness of monetary policy rate as a tool to tame inflation in sub-Saharan Africa (SSA) using the system GMM estimator and other econometric approaches. Financial data (unconsolidated) from Orbis for the period 2011-2018 was used for the purpose of this study. We find that expected inflation, GDP growth rate, unemployment, the exchange rate, broad money supply, and policy rate significantly influence the inflation rate in SSA. The result clearly points to the fact that targeting inflation using monetary policy rate has not been an effective tool for taming inflation in SSA. To the extent that the baseline result indicates the monetary policy rate has no substantial impact on inflation in the region, there is therefore the need to re-evaluate monetary policy design that could help control inflation. In terms of potential policy implications of this paper based on our results, policy makers or monetary authorities should not arbitrarily raise policy rate to control inflation but should also consider other monetary policies such as money supply. The paper concludes that the credibility and accountability of the monetary policy authorities should be improved by setting targets appropriate to their institutional capacity and meeting them.

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Key words

monetary policy rate, GMM, inflation, sub-Saharan Africa.

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Introduction

To combat inflation while promoting economic growth and safeguarding the vulnerable requires policymakers to engineer a tactful approach to ensure a soft landing.

There is no denying that a contractionary monetary policy is the preferred strategy. The central bank sets the monetary policy rate to influence the evolution of

the economy's main monetary variables. Though there are other means of controlling inflation, such as price and wage controls, the former has proved more effective. The policy rate is the short-term, often overnight, rate that central banks charge commercial banks while lending or giving loans to them. In recent years the persistent increase in the general price levels of goods and services within sub-Saharan Africa (hereinafter, SSA) has become a challenge to policymakers. The situation has been unsatisfactory due to the COVID-19 pandemic, rising energy prices, and high public debt. These factors explain current load shedding in South Africa, currency depreciation, and elevated inflation in Ghana and Nigeria, to name but a few. It is widely accepted that external factors have had more significant explanatory momentum than domestic factors in explaining inflation in recent years (*World Economic Outlook, October 2022: Countering the Cost-of-Living Crisis*, no date). The IMF Report (2022) has revealed that most African countries, especially those within the SSA region, have recorded median inflation as high as 9% since July 2022, compared to slightly above the 5% average pre-pandemic era (2009-2019). The transmission mechanism of monetary policy significantly affects both output and prices. A contractionary monetary policy, similarly to an increased interest rate, raises the cost of borrowing, reduces consumers' disposable incomes, and decreases investors' investment capabilities. The aftermath should see a decline in economic activity with lower inflation. A further impact of the contractionary policy is the appreciation of the domestic currency, as foreign investors seek to take advantage of the increased interest rates. Exports become expensive, and imports become relatively cheaper, leading to a deteriorating balance of payment. Taylor (1993) stated that any deviation in the inflation target and output gap will induce

monetary policymakers to alter the interest rate to ensure price stability and growth. Monetary policy in SSA has been centred on money targets and exchange rate pegs. Since the 1960s, when most SSA countries regained independence, most of their currencies were pegged to the UK pound and French franc and were managed by currency boards. The independent activities of central banks surfaced after the collapse of currency boards due to nationalist movements. Also, the failure of the Bretton Woods system led to an increase in the duties performed by the central bank through exchange rate management. Over time, a high concentration on primary exports and unfavourable commodity terms of trade led to distortions in macroeconomic and monetary policy regimes. Nevertheless, by the early 2000s, most SSA countries experienced macroeconomic stability through single-digit inflation and sustained growth. After 2007 when some countries had adopted inflation targeting with the reduced role of the exchange rate as a nominal anchor, it has become essential for countries within the region to adopt better countercyclical policies to sustain output and prices (see Aryeetey and Fosu, 2002; Berg and Portillo, 2018). Monetary policy arrangements in SSA in the past decade have witnessed significant improvement in SSA. Andrieu et al. (2018) attribute this to the independence of central bank, more sustained and stable growth, support from fiscal-based stabilisation efforts, and stabilising inflation to single digits on average. Despite the strides made, monetary policy and credibility generally remain weaker (Mishkin, 2003; Kovac et al., 2022) and have been attributed to relatively high inflation within the region. Mainstream economics emphasises that the main objective of monetary policy is to be able to determine the level of inflation in the economy. Ball (1999) argues that a sound monetary policy should produce

low average inflation and keep output and inflation as low as possible. Countries such as New Zealand and Canada adopted monetary policies targeting inflation as far back as the 1990s; Ghana, Uganda, and South Africa have also made the switch, with the principal target of the European Central Bank (ECB) being price stability, to mention but a few. Although a great deal of empirical research has been done on the nexus between monetary policy and inflation, many of them have concentrated more on country specifics than on cross-country ones, and several have surveyed the SSA region (see e.g. Savvides, 1998; Asongu, 2014), while others have focused on broad money supply and exchange rate as the only monetary policy variables. This means there is still scope for the empirical exploration of modern monetary policy analysis and inflation in sub-Saharan Africa. By employing a dynamic panel regression model, this paper contributes to extant literature in SSA by employing a wider database from countries across SSA to explore how monetary policy rates have been an effective tool in stabilising inflation following the global financial crisis of 2008. We address these challenges in this paper by employing the generalised method of moments (GMM) to ascertain the effectiveness of monetary policy rates in addressing inflation fluctuations in SSA. Amato and Gerlach (2002) stated that countries which pursue inflation targeting can execute a more systematic interest rate response by the central bank to inflation and that the effective transmission of monetary policy is expected. Against this background, the intention of this paper was to explore how the countries within SSA have influenced inflation with the policy rate and how certain macroeconomic variables have affected inflation.

The rest of the article is structured as follows: a brief review of the literature on the monetary policy rate and inflation is undertaken in section 1. The empirical

strategy and data are presented in section 2. Section 3 contains the model estimation and results, whilst section 4 discusses the main results

1. Literature Review

The literature on inflation is one area of macroeconomics that has been explored in great detail, both theoretically and empirically. It explains how harmful inflation could be if greater attention is not directed thereto. Two leading theories are proposed in the literature, namely the monetarist theory and the structuralist theory. The monetarist theory stems from demand-related factors bolstered by expansionary monetary and fiscal policies. Proponents argue that increased economic growth and employment increase the money supply, creating inflationary pressures (Hendry, 2001; Smets and Wouters, 2003). Structuralists view factors influencing inflation from supply-side-related sources. They believe that when prices of factors of production such as labour cost and inputs increase, it is reflected in the prices of the final output, and this causes inflation (see Bernanke, 2005; Christiano et al., 2005).

The cross-country and country-specific determinants of inflation have attracted various theories to explain the perspectives of developed, developing, and emerging economies alike. Gbadebo and Mohammed (2015) used the error correction model on quarterly data from Nigeria between 1989 and 2012. Their main motive was to determine how monetary policy controlled inflationary pressures. They found that the major causes of inflation in Nigeria were interest rates, exchange rates, money supply, and oil prices. While money supply and oil price positively affected inflation, exchange rates and interest rates had the opposite effect. This meant that exchange rate targeting was a primary instrument used by monetary authorities to manage inflation within the study period. Bonga-Bonga and Kabundi (2011) also

examined the impact of the monetary policy instrument and repurchase rate on inflation and output in South Africa between 1998 and 2008. They employed the structural vector autoregressive model (SVAR), finding that monetary policy instruments and repurchase rates did not impact inflation over their sample period.

Based on a cross-country assessment, Asongu (2014) explored the effect of monetary policy on inflation in Africa from 1987 to 2010, employing the vector autoregressive model and the vector error correction model. He used financial depth, allocation efficiency, financial activity, and financial size as proxies for monetary policy, concluding that the variables affected long-run price variability. However, in situations of distortions, depth and size were significant adjusters of inflation to cointegration. However, the short-run impact of monetary policy variables on inflation was not overwhelming. Mohanty and Klau (2004) also reviewed monetary policies and interest rate-setting behaviour in some developing economies. They concluded that in most emerging economies, monetary policy responded more strongly to exchange rates than inflation and the output gap.

Contemporary empirical data provides mixed results on inflation using policy rates across the globe. Using a panel data set of 28 EU countries in the period 1970-2015, Afonso, Alves and Balhote (2019) show how economic and institutional events influence the reaction of central monetary authorities when inflation has a significant impact on monetary policies. However, contradictory evidence was reported by Cavoli, Gopalan and Rajan (2023), who reported that monetary policy rate and the coefficients to the monetary policy rule are lower when the economy has significant number of the population involved and engaged into banking activities. This research was based on the study of 47 emerging and developing economies between 1995 and 2017.

2. Methodology

This section of the paper discusses and explains all the variables used in this research, not excluding data strategy and model specification. Macroeconomic data for 31 sub-Saharan African countries were obtained from the IMF, the World Bank, and IFS for 2010-2021. In order to meet the objective of this paper, widely used variables, both theoretical and empirical, were employed (Emerenini and Eke, 2014; Cioran, 2014; Hossain and Islam, 2013).

Since the objective of this paper is to provide empirical evidence of how policy rates have been employed over the years by various central banks across the sub-Saharan African region to control inflation, we use the consumer price index as our dependent variable (see Emerenini and Eke (2014)).

As one of the explanatory variables, the broad money supply represented by M2 in the model is expected to have a positive relationship with inflation. This is because a rise in the monetary base pushes individuals within an economy to increase their spending on goods and services, thereby leading to an increase in prices.

GDP growth is also expected to have a significant and positive impact on inflation, mainly post-dated (a rise in inflation following an increase in economic growth). It stands to reason that inflation could be expected given the current level of economic growth.

A positive/negative coefficient is expected for the exchange rate depending on how heavily dependent the economy is on imports. A sharp depreciation of the local currency in an import-driven economy is likely to lead to a sustained increase in the prices of goods and services.

Unemployment is one of the explanatory variables of this study, and an inverse relationship between inflation and this variable is expected. As such, inflation targeting can serve as a means of managing unemployment in an economy.

As the policy rate is used as a means of controlling the rise in inflation and price stability, a negative/positive coefficient is expected for this variable depending on the characteristics of the economy under study and the real interest rate, which has a direct correlation with policy rate and is expected to have a similar relationship to inflation.

To help empirically analyse how central banks use policy rates across the

Sub-Saharan African continent to control inflation and stabilise prices, a dynamic panel model is used (TWO SYSTEM GMM). Using this dynamic panel model will help to tackle any potential endogeneity problem that may be encountered between inflation as our dependent variable and the explanatory variables. The dynamic mathematical model, which is based on both short-run and long-run analysis, is as follows

$$\text{CPI}_{jt} = \beta_0 + \beta_1 \text{CPI}_{jt-1} + \beta_2 \text{EXCHR}_{jt} + \beta_3 \text{M2}_{jt} + \beta_4 \text{GDP}_{jt} + \beta_5 \text{POLICY_RATE}_{jt} + \beta_6 \text{REALINTRATE}_{jt} + \varepsilon_{it} \quad (1)$$

where CPI_{jt} in the model relates to the consumer price index (inflation) in country j and time t , EXCHR relates to the exchange rate; M2 represents broad money supply; GDP represents annual GDP growth; POLICY_RATE represents the monetary policy rate of central banks; REALINTRATE is the real interest rate, and ε_{it} is the error term.

The dynamic panel model was used to include a lagged dependent variable in the model and to address the issue of endogeneity and inconsistency of the results. Two of the specification tests proposed by Arellano

and Bond (1991) were investigated, since the validity of the instruments affects the consistency of the GMM estimator (Sargan-Hansen test). A check for the first and second-order serial auto-correlation of the Arellano-Bond test was also run. These tests were used to verify the presence/absence of first/second order serial correlation in the dynamic model.

Further, the long-term impact of the model was also tested, where significant variables from the first estimate were measured. The long-run effects for the K^{th} parameter are computed as follows:

$$B_k \div [1 - \phi] \quad (2)$$

3. Research results

This section presents the empirical results from research into how the monetary policy rate of central banks is used to tame inflation or otherwise for 31 sub-Saharan African countries based on short-run analysis. The descriptive statistics and the correlation matrix are presented in appendix 1 and 2, respectively.

Table 1 shows the results of the impact of monetary policy rate as a means of controlling inflation in 31 sub-Saharan African countries using two-step system GMM estimation. To begin with, the validity of the two-step system GMM used for this research should be verified. The lagged dependent

variable (Consumer Price Index) was significant, which justifies the use of the dynamic specification. The validity of the instruments used for this study from the diagnostics test was also confirmed. The values of $\text{AR}(1)$ and $\text{AR}(2)$ for Arellano-Bond serial correlation showed the presence of first-order serial correlation for $\text{AR}(1)$ and the absence of second-order serial correlation for $\text{AR}(2)$. The null hypothesis of over-identification of instruments of the Hansen's J test p -value was equally within the accepted value, hence the acceptance of the null hypothesis. The variables used for this study showed no sign of suffering from multi-collinearity issues, as shown in Appendix 2.

4. Discussions

From the GMM estimation in Table 1, GDP was significant at 10% with a positive coefficient, which confirms the earlier prediction of the positive impact of GDP on inflation in the short-run. This result supports the monetarist theory that inflation fuels economic growth to some extent. Empirical evidence, as in the research of Koulakiotis, Lyroudi and Papasyriopoulos (2012), supports our research results from 14 European countries where strong evidence of a bi-directional effect was found using a panel univariate GARCH model. Further empirical evidence from Samuel et al. (2015) and Enejoh and Tsauni (2017) supports our results. However, other empirical evidence (Koulakiotis, Lyroudi and Papasyriopoulos, 2012; Emerenini and Eke, 2014; Olugbenga Adaramola and Dada, 2020) indicates that inflation has an inverse relationship to economic growth for research done in Nigeria and Europe.

Unemployment in the short run was also negative and significant at 10% from the GMM estimates in Table 1. This result also supports the earlier prediction of a negative relationship. This result suggests that inflation targeting can serve as an effective tool for managing unemployment, since a percentage increase in unemployment reduces inflation in a significant manner. In support of our results, Cioran (2014) provides empirical evidence of the negative impact of unemployment on inflation in Romania using an OLS regression estimation method. Further evidence (Korkmaz and Abdullazade, 2020) shows a unidirectional negative relationship between unemployment and inflation.

Table 1 also shows a negative and significant (5%) impact of the exchange rate on inflation. This result indicates that in the short run, a percentage increase in the exchange rate for countries under study leads to a 5% decrease in inflation. This result is surprising because sub-Saharan African

countries are import dependent, significantly affecting their exchange rate, and leading to inflation challenges in both the short and long term. The relative stability of the local currencies in the countries under study could lead to reduced inflation. The results are supported by Emerenini & Eke's (2014) research on the impact of the policy rate on inflation in Nigeria. Other empirical results, however, point to the positive impact of the exchange rate on inflation (Monfared & Akin, 2017; Samuel et al., 2015).

As predicted earlier, money supply (M2) had a significant positive effect at 1% based on short-run analysis. This implies that a percentage increase in money supply will likely increase inflation by 1%. A great deal of empirical evidence supports these results, as shown in Table 1 (Emerenini and Eke, 2014; Monfared and Akin, 2017; Batarseh, 2021). Using a Granger causality test for the period 1980-2019, Batarseh (2021) found that the money supply in Jordan positively impacted inflation and was also significant at 5%.

The primary variable of interest, the monetary policy rate, was positive and significant at 1%, as seen in Table 1. This result suggests that an increase in the policy rate in sub-Saharan African countries does not help curb inflation rise for the period under study. Empirical evidence from Cioran (2014) supports these results, whereby a study of the causal relationship between the monetary policy rate and other macroeconomic variables showed a direct relationship between inflation and policy rate in Romania for the period 1997-2013. However, Emerenini and Eke (2014) showed evidence of an inverse relationship, although the results were insignificant for a Nigerian study for the period 2007-2014.

The real interest rate from Table 1 was positive, albeit not significant; suggesting that a real interest rate increase will most likely fuel inflation.

To help further understand the phenomenon relating to the research objective, the

GMM results were re-estimated to understand the long-term impact of the significant variables on inflation. As observed in Table 1 (Model 1), all significant variables (GDP, M2, unemployment, exchange rate, and policy rate) were re-estimated using Equation (2) above to determine their long-term effect on inflation.

The long-run two-step system GMM again showed that the significant variables from Model 1 were equally significant, and each variable maintained its previous coefficient sign. The coefficients from the long-run analysis suggest that the explanatory variables strongly correlate with the dependent variable (CPI) in both the short and long term.

Table 1. Impact of policy rate on inflation in sub-Saharan African countries (two-step system GMM)

VARIABLES	(Model 1)	(Model 2)
	CPI Short-run	CPI Long-run
CPI _{-1log}	-0.136** (0.054)	
GDP _{log}	0.172* (0.101)	0.1512* (0.089)
Unemployment _{log}	-0.180* (0.099)	-0.159** (0.083)
Exchange Rate _{log}	-0.119** (0.060)	-0.105** (0.050)
M2 _{log}	0.150*** (0.034)	0.132*** (0.028)
Policy Rate _{log}	0.429*** (0.105)	0.378*** (0.096)
Real interest rate _{log}	0.019 (0.557)	
Constant	1.106 (1.850)	

VARIABLES	(Model 1)	(Model 2)
	CPI Short-run	CPI Long-run
Observations	172	
Number of years	11	
AR(1)	0.0168	
AR(2)	0.179	
Hansen	0.770	
Sargan	0.718	

Note: The dependent variable is the Consumer Price Index. The first model shows the impact of the policy rate on inflation in the short run. The second model shows the long-run analysis using the significant values from Model 1. All the estimations are based on the two-step system GMM covering 2010-2021. *Statistically significant at 10% **Statistically significant at 5% ***Statistically significant at 1%

Source: calculated by authors

To show how sensitive and robust the results from Table 1 were, the results were simulated in this section using two different regression models, the fixed effects model and the OLS regression, to substantiate the strength of the primary model estimations. As can be seen in Table 2, two of the explanatory variables have consistently proven to be solid and robust in the latest estimations (OLS and Fixed Effects). GDP was positive and significant at 1% in both Model 1 and 5% for Model 2 from Table 2. This outcome further supports the evidence that sustained economic growth will likely fuel inflation, especially in the long run.

The policy rate again was positive and significant at 1% from Table 2 for both OLS and fixed effect regressions. As the primary

variable of interest in support of the research objective, this result proves that the central bank monetary policy rate strongly impacts inflation. In sub-Saharan African countries, however, the impact had been positive for the periods under study, implying that an increase in policy rate has not been an effective tool in controlling inflation in these economies.

Somewhat surprisingly, the robustness check showed that real interest was negative and significant at 5%, suggesting that this variable helps to reduce inflation in sub-Saharan African countries. This result runs contrary to the results from the primary model, where real interest was insignificant and positive. Further research into these inconsistent results seems worthwhile.

Table 2. Impact of policy rate on inflation: sub-Saharan African countries

VARIABLES	(Fixed Effect)	(OLS)
	CPI _{log}	CPI _{log}
GDP _{log}	0.154*** (0.0390)	0.142** (0.0564)
Unemployment _{log}	-0.0913 (0.0521)	-0.0761 (0.0500)
Exchange Rate _{log}	-0.0492 (0.0287)	-0.0434 (0.0282)
M2 _{log}	0.0638 (0.0670)	0.112 (0.0838)
Policy Rate _{log}	0.503*** (0.0599)	0.508*** (0.0479)
Real interest Rate _{log}	-0.166** (0.0671)	-0.192** (0.0930)
Constant	1.198*** (0.302)	1.106** (0.510)
Observations	186	186
R-squared	0.577	0.549
Number of years	11	11
Number of countries	31	31

Note: The dependent variable is the consumer price index. The first model is the fixed effect regression model, while the second is the OLS regression. All estimations covered the period 2010-2021.

*Statistically significant at 10% **Statistically significant at 5% ***Statistically significant at 1%

Source: calculated by authors

Conclusions and Recommendations

This paper explored monetary policy rate as an effective tool for taming inflation in sub-Saharan Africa over the period 2010-2021. The system GMM estimator was employed to ascertain both the short and long-run dynamics due to its ability to deal with endogeneity and produce efficient results. The results confirmed that expected inflation, GDP growth rate, unemployment, the exchange rate, broad money supply, and policy rate significantly explain inflation within the SSA region. The fixed effects

and ordinary least squares models were used to verify the robustness of our results. One may observe that the monetary policy rate positively affects inflation, and the magnitude thereof is highly significant. This goes to explain that a contractionary monetary policy has a destabilising consequence on inflation. Although these results are supported by certain other papers (Cioran, 2014; Afonso, Alves and Balhote, 2019), still other studies (Emerenini and Eke, 2014; Cavoli, Gopalan and Rajan, 2023) provided contrary evidence in Nigeria and other emerging and developing economies.

Finally, when it comes to policy recommendations, although it is generally believed that restrictive monetary policy stabilises inflation, this is not the case in SSA. This means that central banks within the region should consider reducing policy rates as an inflation-targeting tool to enhance capital formation and growth. Furthermore, the credibility and accountability of the monetary policy authorities should be improved by setting targets appropriate to their institutional capacity and meeting them. This can be supported by sound fiscal policy to ensure the optimal management of the economy through price stability and sustainable growth. It is also necessary for central banks to re-evaluate the monetary policy rates and the design of policy rates to make them more effective. Further research should consider other measures of sustaining and managing inflation, such as fiscal policy, since fiscal policy tools to address inflation in SSA were beyond the scope of this paper. Empirical evidence suggests that the traditional means of controlling inflation have not been effective in recent years.

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Appendices

Appendix A

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
CPI _{log}	355	2.104	.556	-2.253	3.558
GDP _{log}	372	4.91	.57	4.129	8.033
Unemployment _{log}	372	1.667	.948	-1.139	3.513
Exchange rate _{log}	371	5.418	1.881	.358	9.253
M2 _{log}	308	3.531	.467	-.047	6.23
Policy rate _{log}	305	1.766	.812	-.693	3.367
Real interest rate _{log}	238	3.387	.325	-.148	3.981

Source: Authors’ calculation

Appendix B

Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) CPI	1.000						
(2) GDP	0.353	1.000					
(3) Unemployment	0.125	0.129	1.000				
(4) Exchange rate	-0.224	0.170	-0.504	1.000			
(5) M2	0.106	0.042	-0.062	-0.118	1.000		
(6) Policy rate	0.704	0.339	0.044	-0.261	0.211	1.000	
(7) Real interest rate	-0.065	-0.134	-0.074	0.055	-0.050	0.109	1.000

Source: Authors’ calculation

Appendix C

Variance inflation factor

	VIF	1/VIF
Exchange rate _{log}	2.648	0.378
Unemployment _{log}	2.325	0.43
Policy rate _{log}	1.543	0.648
GDP _{log}	1.401	0.714
Real interest rate _{log}	1.069	0.935
M2 _{log}	1.009	0.991
Mean VIF	1.666	.

Source: Authors’ calculation

Appendix D

Definition of variables

Variable Name	Description	Source	Exp. Sign
Dependent Variable			
Consumer Price Index	Average change in price paid by consumers over a period	IMF /IFS	
Independent Variables			
GDP	Year-over-year economic growth	IMF/IFS	+/-
Unemployment	Year-over-year unemployment rate	IMF/IFS	-
M2	Money supply, including cash, cheque deposits etc.	IMF/IFS	-
Exchange Rate	The rate of local currency relative to the dollar	IMF/IFS	+/-
Policy Rate	The rate at which central banks lend to commercial banks	IMF/IFS	+
Real Interest Rate	Interest charged by commercial banks to credit customers	IMF/IFS	-

Source: Author

Knowledge acquisition and organisational performance: An empirical study of National Teachers' Colleges (NTCs) in Uganda

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Abstract

DOI: 10.23762/FSO_VOL11_N01_10

The role of knowledge as an essential source of competitive advantage in organisations has become critical. To operate effectively in today's economy, it is necessary to become a knowledge-based organisation. The purpose of this research, therefore, is to assess the impact of knowledge acquisition on the organisational performance of National Teachers' Colleges (NTCs) in Uganda. Using a questionnaire, from a target population of 221, data were collected from a sample size of 141 respondents from the five National Teachers' Colleges in Uganda. The data were analysed using descriptive statistical techniques, which included frequencies and percentages, and inferential statistical techniques, which included Spearman's correlation, the coefficient of determination, and regression analyses to determine the impact of knowledge management as an independent variable on the performance of the NTCs. The findings show a moderate positive relationship ($\rho = 0.670$) between knowledge acquisition and the performance of NTCs in Uganda. The coefficient of determination ($\rho^2 = 0.449$) shows that knowledge acquisition accounted for 44.9% of the change in the performance of the NTCs in Uganda. The significance value ($p = 0.000$) was less than .05. Hence, the hypothesis that knowledge acquisition has a significant positive impact on the performance of NTCs in Uganda was accepted. This study will guide the NTCs to integrate their knowledge and assets such as databases, people and their experience and expertise, systems, policies, and procedures into knowledge management in order to improve performance. The results of this research will be used to improve the management of

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knowledge at the NTCs in Uganda, which may lead to an improvement in the way NTCs make themselves relevant to the society in which they operate.

Key words

knowledge acquisition, organisational performance, higher education institutions (HEIs).

Introduction

Increasing competition and the growing complexity of the environment force organisations to search for organisational solutions that are more effective, as only such an approach enables them to survive and thrive on the market. The result of this search is the concept of knowledge management.

There are many definitions of knowledge management in the literature. For example, according to the definition of Swan et al. (1999), knowledge management consists of all processes and activities related to the creation, acquisition, extraction, exchange, and use of knowledge, which influences the efficiency, effectiveness, and learning capacity of the organisation. Furthermore, according to Davenport and Prusak (2000), knowledge management is a set of specific activities and initiatives that organisations undertake to increase organisational knowledge. Finally, according to Paliszkievicz (2007), knowledge management can be defined as a systematic and organised process of locating, acquiring, transferring, using, and retaining knowledge, using the appropriate technologies and cultural environment, the purpose of which is to improve the performance of the organisation. Organisations vary, but the basic principles of knowledge management apply equally to all. Organisations must systematically locate, acquire, transfer, utilise and retain knowledge, wishing to accomplish their tasks in the context of an ever-changing environment. On the other hand, it therefore suffices to recognise organisational performance as the

ability of an organisation to reach its goals and optimise results. In the context of today, organisational performance can be defined as the ability of a company to achieve its goals in a state of constant change.

The purpose of this research is to assess the impact of knowledge acquisition on the organisational performance of the five National Teachers' Colleges in Uganda, which are higher education institutions (HEIs) where teachers for lower secondary education are trained. The paper is constructed as follows: firstly the literature review is described, and subsequently the methodological part and the research results are presented. Finally, the conclusions, limitations and future directions for research are provided.

1. Literature review

A large stream of literature has emphasised the role of knowledge management as central to the success of any business. Research on knowledge acquisition and organisational performance at higher education institutions (HEIs), however, is still needed.

Higher education institutions (HEIs) are required to generate knowledge from internal and external sources so that they can use it strategically to improve and maintain competitiveness on a global scale (Ouma, Muthith and Nzioki, 2022). Therefore, HEIs perceive knowledge acquisition as an institutional strategy used to improve their quality of learning and novelty value, to advance better decision-making and improve the

performance of their academic staff and students as well as their general performance as HEIs (Wanderage et al., 2021; Amayah, 2020; Wanjiku, 2017). Knowledge acquisition at HEIs pertains to how they are involved in identifying, generating and creating the required knowledge used to achieve set objectives (Gakuo and Rotich, 2017). The manner in which this process is conducted determines the extent to which HEIs successfully impart ideas that inspire the discourses of scholars.

HEIs have adopted various approaches and models to improve the quality of lectures as well as the academic leaning experience of students (Shahzad, 2020). For example, some of the most popular and effective teaching and learning approaches utilised by HEIs include working group presentations, collaborative problem solving, as well as online and classroom discussions for acquiring knowledge for improved and effective teaching and learning processes (Rono, 2017). Notwithstanding the above process of acquiring knowledge, the improvement of HEI performance is highly dependent on the behaviour and attitude of each lecturer and student, as well as the technological and scientific innovations that are utilised to carry out the knowledge acquisition methods and approaches explained above (Zhou and Li, 2012).

In the context of higher learning, HEIs are considered sources of academic and non-academic knowledge obtained through human effort, research works and other academic works designed for consumption by various HEI stakeholders that include faculty members, students, as well as the national, regional and international communities (Ouma et al., 2022). As stated by Ramakrishnan and Yasin (2018), in order to guarantee that HEIs are successful in their educational activities, the acquired knowledge is required to contribute to the success of the overall performance of HEIs. The acquisition of knowledge should therefore be

seen as an urgent strategy that is necessary for institutions to remain competitive and attractive in the national, regional and international academic markets. Moreover, this process of acquiring knowledge will mean that HEIs are more likely to achieve their desired goals in a more sustainable manner.

Acquisition of knowledge, however, remains a limited research area in the context of HEIs in Uganda. Poonkothai (2016) explained that the success of HEI excellence around the world generally focuses on academic classroom performance as the main method of performance evaluation; little attention has been paid to the acquisition of knowledge itself. Webster, Hammond and Rothwell (2014) were of the view that in general, knowledge acquisition should focus more on market fit compared to the current state of assessment and other academic performance measures utilised by many HEIs.

The resource-based theory (RBT) developed by Penrose in 1959 (Sousa et al., 2021) was used in this study to explain how knowledge acquisition impacts the performance of NTCs in Uganda. The theoretical assumption of RBT is that not only are organisational characteristics modified but an organisation must adjust its overall direction if it is to succeed and gain a sustainable competitive advantage (Barney, Ketchen Jr. and Wright, 2021; Chen, Michel and Lin, 2021; Craighead, Ketchen and Darby, 2020; Davis and DeWitt, 2021). The principal paradigm of organisational performance proposes that internal organisational factors, such as capabilities and resources, determine the competitiveness of the organisation. In other words, the RBT asserts that having valuable capabilities and resources gives an organisation a golden opportunity to develop competitive advantages over its competitors (Molloy, Chadwick, Ployhart and Golden, 2011; D'Oria, Crook, Ketchen, Sirmon and Wright, 2021; Felin and Zenger, 2009; Gerhart and Feng, 2021). These

competitive advantages can also help the organisation to enjoy more benefits, especially in the long run. Valuable capabilities and resources are expensive, rare, difficult to imitate and are irreplaceable.

The RBT as applied in the context of HEIs states that knowledge acquisition is one of the most critical assets of a firm. Differences in organisational performance occur when they have valuable capabilities and resources that other firms do not have, allowing them to maintain their quasi-monopoly status (Barney et al., 2021; Gibson, Gibson and Webster, 2021; Greve, 2021). According to Penrose and Pitelis (cited in Ahmed, Kristal and Pagell, 2014), RBT is a modern way of analysing the knowledge acquired for the lasting benefit of the organisation. In this way, the theory has been useful in explaining the internal capabilities and resources of the HEIs, focusing on the ability to formulate strategies for the success of academic performance in a sustainable way. The RBT provides an important framework for explaining and predicting the underpinnings of organisational performance and competitive advantage. The RBT is an approach considered influential to strategic management as it is widely used as a management framework by means of which to determine a company's critical capabilities and resources to gain a sustainable competitive advantage (Lieberman, 2021; Priem and Butler, 2001).

The seminal work on valuable resources by Barney (1991) was an essential contribution to RBT, leading the conceptual transformation from the resource-based view to the theory developed as RBT (Hitt, Xu and Carnes, 2016; Chen, Michel and Lin, 2021; Craighead, Ketchen and Darby, 2020). Traditional RBT, however, does not explain how and why some organisations gain a competitive advantage in unpredictable resources, but also by developing new capabilities through learning, skill acquisition, and knowledge accumulation over time. The

logic of RBT suggests that if capabilities and resources are owned by organisations, those who have the ability to control those capabilities and resources can generate a sustainable competitive advantage (Setia and Patel, 2013; Davis and DeWitt, 2021; D'Oria, Crook, Ketchen, Sirmon and Wright, 2021; Felin and Zenger, 2009). Therefore, organisations can take advantage by continuously combining or configuring various types of capabilities and resources to create a new way of acquiring knowledge to meet market needs (Sousa et al., 2021; Gerhart and Feng, 2021; Gibson, Gibson and Webster, 2021; Greve, 2021).

In addition to being used in strategic management, RBT has been accepted and used both quantitatively and qualitatively in other areas of business management. In the present day, the use of RBT has been extended to a range of business studies such as entrepreneurship (Molloy et al., 2011; Lieberman, 2021), information systems (Priem and Butler, 2001; Setia and Patel, 2013), supply chain management (Ahmed et al., 2014), economics (Ahmed et al., 2014), operations management (Hitt et al., 2016) and marketing (Kozlenkova, Samaha and Palmatier, 2014; Amis, Barney, Mahoney and Wang, 2020; Barney, 2020; Burt and Soda, 2021). Several studies have focused on examining the connection between RBT and its implementation of various business goals.

2. Methodology

The methodological section includes the research design, the research approach adopted, the sample and sampling technique used, the data collection method and instrument, the procedure of data collection, data analysis and ethical considerations.

2.1. Research design and approach

A cross-sectional descriptive survey design was adopted, as the data was collected over a short span of time across the five National

Teachers' Colleges; given the nature of the data, a deductive approach was adopted as recommended by Amin (2005).

2.2. Sample and sampling technique

There are five National Teachers' Colleges (NTC) in Uganda: NTC Muni, NTC Unyama, NTC Kaliro, NTC Mubende and NTC Kabale. The NTCs are higher institutions of learning that train and produce certified teachers in Uganda. Data was collected from a sample of 141 teaching staff, including 29 from Muni NTC, 18 from Unyama NTC, 30 from Kaliro NTC, 32 from Mubende NTC, and 32 from Kabale NTC. Each of the lecturers had an equal opportunity to be selected using simple random

sampling. They are the focus of this study with regard to knowledge management.

2.3. Data collection method and instrument

The research, having adopted a purely quantitative approach, used a questionnaire to collect data that was analysed using both descriptive and inferential data analysis techniques.

2.4. Validity

A closed-ended questionnaire was created by the authors. The researchers subjected the data collection instrument to two raters in order to determine that the instrument would collect the data that it purported to. The results are shown in Table 1.

Table 1. Validity of the data collection instrument

Raters	Relevant items	Non-relevant items	Total
Rater 1	22	4	26
Rater 2	19	7	26
Total	41	11	52

$$CVI = 41/52 \approx .788$$

Source: Primary data

Amin (2005) recommends a CVI of 0.7. This means that the instrument used for the data collection was capable of collecting valid data. Therefore, the findings were considered reliable.

Reliability

To ensure that the data collection instrument was capable of collecting reliable data, the researcher performed a reliability test using SPSS to determine Cronbach's alpha. The results are as in Table 2.

Table 2. Reliability of the data collection instrument

Variable	Cronbach's alpha	N of Items
Knowledge acquisition	0.823	15
Performance of NTCs	0.743	11

$$\text{Average Cronbach's alpha} = .783$$

Source: Primary data

Amin (2005) recommends a CVI of 0.7 and above. This means that the instrument

used for the data collection was capable of collecting data consistently, since for the

independent and dependent variables, the Cronbach's Alpha was .823 and .743 respectively, which are above the level recommended. Therefore, the findings were considered reliable.

2.5. Data collection procedure

The researcher contacted each National Teachers' College involved in the study and sought permission from the principal of each college to administer the questionnaire to the teaching staff of the college in accordance with the study design.

2.6. Data analysis

The results are original in that primary data sources were exclusively relied upon in this research. These primary data sources involved gathering first-hand information directly from those who participated in this research, unlike secondary data sources, which involve gathering information that has already been compiled by another (Prada-Ramallal et al., 2018). This implies that the information analysed in this research was originally collected directly from the participants.

Data was analysed using quantitative analysis. Quantitative data was entered into the computer programme Statistical Package for Social Sciences (SPSS), which makes it possible to analyse large amounts of data in a shorter time, as suggested by Hazarika (2019). The same programme helped to compute univariate and multivariate statistics. Univariate statistics are in the form of descriptive statistics performed on the variable, as explained by various scholars (e.g. Allen, 2017; Canova, Cortinovis and Ambrogi, 2017; Zhang, 2016). Such descriptive statistics include frequencies and percentages, which are necessary in order to understand how participants in this study have responded to statements for the variable. The reason for relying on frequencies and percentages in this research is that the responses to the items/questions in the questionnaire were

measured using an ordinal scale (in other words, respondents selected one discrete response suitable to the item/question) as suggested by Canova et al. (2017). The frequencies and percentages are followed by multivariate statistics, which involved performing inferential statistics in the form of Spearman's correlation, the coefficient of determination, and regression results that helped to address the objective of this research, as advocated by McQuitty (2018).

2.7. Ethical consideration

In terms of the consideration of ethics, before the researchers arrived at each college to undertake data collection, they explained the purpose of the research to the principal, as head of the institution. Upon obtaining permission, they then approached the teaching staff to explain the purpose of the research and offered assurances that all data collected would be treated with the utmost confidentiality and the questionnaires were anonymous. The researchers further informed the respondents that they were under no obligation to participate in the study, and furthermore that any of them were free to withdraw at any point if they so wished. By doing so, they ensured that the research process was conducted ethically.

3. Research results

This section presents the empirical findings, and is divided into two major sections. The first section presents the demographic data, while the second section presents the results pertaining to the impact of knowledge acquisition on the performance of the NTCs in Uganda.

3.1. Background information

The NTC teaching staff were asked about the NTCs at which they were employed, as well as their gender, age and the length of time they had been working at the NTC. The demographic data are presented in Table 3.

Table 3. Demographic data

Institution	Frequency	%
Muni NTC	29	20
Unyama NTC	18	13
Kaliro NTC	30	21
Mubende NTC	32	23
Kabale NTC	32	23
Total	141	100
Gender of teaching staff	Frequency	%
Male	128	91
Female	13	9
Total	141	100
Age of teaching staff	Frequency	%
20-29 years	12	9
30-39 years	96	68
40-49 years	19	13
Over 49 years	14	10
Total	141	100
Length of time worked at the NTC	Frequency	%
Fewer than 5 years	38	26
5-10 years	98	70
11-15 years	5	4
Total	141	100

Source: Primary data

The findings in Table 3 show that 20% of the teaching staff members who participated in this study were from Muni NTC, 13% were from Unyama NTC, 21% were from Kaliro NTC, 23% were from Mubende NTC, and 23% were from Kabale NTC, giving broadly equal levels of representation among the five NTCs. Further, the data shows that more male teaching staff members (91%) participated in this study than their female counterparts (9%). In addition, the majority of the teaching staff members (68%) were aged between 30 and 39, with 13% of teaching staff members aged between

40 and 49, 10% aged over 49 years and 9% aged between 20 and 29. Lastly, the majority of the teaching staff had worked at the NTCs for between five and 10 years, while 26% had worked with them for fewer than five years and 4% for 11 to 15 years. All this meant that the respondents were capable of providing valid and reliable data.

3.2. Impact of knowledge acquisition on the performance of NTCs in Uganda

It is recommended that descriptive statistics for each variable of the objective investigated in a study be presented before the

inferential findings. Therefore, in this section, descriptive findings related to knowledge acquisition at NTCs and those related to the performance of NTCs are presented

3.3. Descriptive findings related to knowledge acquisition at NTCs in Uganda

Knowledge acquisition at NTCs in this study was measured in terms of data/information searching, data/information analysis, and data/information validation. The teaching staff members were requested to respond

separately. These are then followed by inferential findings related to knowledge acquisition and the performance of NTCs.

to a statement on each of these three measures of knowledge acquisition using a five-response Likert scale ranging from ‘never’ to ‘very often’, as shown in Table 4.

Table 4. Descriptive findings related to knowledge acquisition at NTCs in Uganda

Statement about data/information searching	N	VR	Total	R	O	VO	Total
There is sufficient time for the academic community at this institution to engage in knowledge-seeking activities	13%	37%	50%	7%	22%	21%	43%
There are sufficient funds to enable the academic community at this institution to engage in knowledge-seeking activities	22%	43%	65%	6%	17%	12%	29%
The academic community at this institution engages in the search for new ideas to address problems of concern	18%	40%	58%	6%	15%	21%	36%
The academic community at this institution generates a new understanding of problems of concern	17%	43%	60%	5%	14%	21%	35%
The academic community at this institution studies problems to discover new facts about them	25%	39%	64%	5%	18%	13%	31%
Statement about data/information analysis	N	VR	Total	R	O	VO	Total
There is sufficient time for the academic community at this institution to analyse the newly acquired knowledge	22%	32%	54%	2%	22%	22%	44%
There are sufficient funds to enable the academic community at this institution to analyse the newly acquired knowledge	26%	40%	66%	9%	19%	6%	25%
The academic community at this institution critically analyses new ideas	13%	42%	55%	8%	12%	25%	37%
The academic community at this institution critically analyses the new understanding of problems of concern	21%	40%	61%	9%	15%	15%	30%
The academic community at this institution critically analyses the new facts discovered pertaining to problems	18%	42%	60%	6%	17%	17%	34%

Statement about data/information validation	N	VR	Total	R	O	VO	Total
There is sufficient time for the academic community at this institution to validate the newly acquired knowledge	18%	38%	56%	6%	25%	13%	38%
There are sufficient funds to enable the academic community at this institution to validate the newly acquired knowledge	18%	36%	54%	4%	21%	21%	42%
The academic community at this institution critically validates new ideas	14%	38%	52%	13%	17%	18%	35%
The academic community at this institution critically validates the new understanding of problems of concern	21%	40%	61%	3%	22%	14%	36%
The academic community at this institution critically validates the new facts discovered pertaining to problems	16%	35%	51%	12%	21%	16%	37%

Note: N = Never, VR = Very rarely, R = Rarely, O = Often and VO = Very often

Source: Primary data

In order to facilitate the analysis of the results in Table 4, a sum of the percentages for “Never” and “Very rarely” was computed to indicate teaching staff members who responded “*less favourably*” to the statements. In addition, a sum of the percentages for “Often” and “Very often” was computed to indicate teaching staff members who responded “*more favourably*” to the statements. On the other hand, the percentages for “Rarely” were left as they were, and were treated as though teaching staff members had responded fairly to the statements.

Therefore, the findings in Table 4 related to data/information searching show that the most frequent response according to the range of percentages (that is, the range of responses from lowest to highest in percentage terms) in terms of the five statements was that of teaching staff members who responded unfavourably to the statements (50% to 65%). This was followed by the group of teaching staff members who responded favourably to the statements (29% to 43%), while the least populous group was comprised of teaching staff members who responded fairly to the statements (5% to 7%). Therefore,

the interpretation from this analysis is that most of the teaching staff members were of the view that data/information searching was poor at the NTCs, while approximately a third of them were of the view that it was good, and very few of them were of the opinion that it was fair.

The findings in Table 4 related to data/information analysis show that the most frequent response according to the range of percentages (that is, the range of responses from lowest to highest in percentage terms) in terms of the five statements was that of teaching staff members who responded unfavourably to the statements (54% to 66%). This was followed by the group of teaching staff members who responded favourably to the statements (25% to 44%), while the least populous group was comprised of teaching staff members who responded fairly to the statements (2% to 9%). Therefore, the interpretation from this analysis is that most of the teaching staff members were of the view that data/information analysis was poor at the NTCs, while approximately a third of them were of the opinion that it was good, and very few of them were of the opinion that it was fair.

The findings in Table 4 related to data/information validation show that the most frequent response according to the range of percentages (that is, the range of responses from lowest to highest in percentage terms) in terms of the five statements was that of teaching staff members who responded unfavourably to the statements (51% to 61%). This was followed by the group of teaching staff members who responded favourably to the statements (35% to 42%), while the least populous group was comprised of teaching staff members who responded fairly to the statements (3% to 13%). Therefore, the interpretation from this analysis is that most of the teaching staff members were of the view that data/

information validation was poor at the NTCs in Uganda, while approximately a third of them were of the view that it was good, and very few of them were of the view that it was fair.

3.4. Descriptive findings on the organisational performance of NTCs in Uganda

The organisational performance of NTCs in this study was measured in terms of impact (visibility) performance, transparency (openness) performance and excellence. The teaching staff members were requested to respond to statements on each of these three measures of performance of NTCs using a five-response Likert scale ranging from ‘never’ to ‘very often’, as shown in Table 5.

Table 5. Descriptive findings on the organisational performance of NTCs in Uganda

Statement about impact (visibility) performance	N	VR	Total	R	O	VO	Total
The institution has been recognised globally for educating graduates with the skills and knowledge needed by society	18%	38%	56%	6%	25%	13%	38%
The institution has been recognised globally for engaging research/innovations that have been useful to the community	18%	36%	54%	4%	21%	21%	42%
The institution has been recognised globally for helping the country to address developmental challenges	14%	38%	52%	13%	17%	18%	35%
Statement about transparency (openness) performance	N	VR	Total	R	O	VO	Total
The institution has been recognised globally for having published works that are accessible	21%	40%	61%	3%	22%	14%	36%
The institution has been recognised globally for employing international academic staff in various fields of expertise	16%	35%	51%	12%	21%	16%	37%
The institution has been recognised globally for enrolling international students in various fields of expertise	13%	42%	55%	8%	12%	25%	37%
The institution has been recognised globally for publishing a large volume of research on various platforms	21%	51%	72%	3%	11%	14%	25%

Statement about excellence	N	VR	Total	R	O	VO	Total
The institution has been recognised globally for carrying out world-class research in various fields of expertise	13%	42%	55%	8%	13%	24%	37%
The institution has been recognised globally for having high-quality teaching in various fields of expertise	18%	38%	56%	8%	25%	11%	36%
The academic community at the institution has been recognised globally for winning Nobel Prizes and Fields Medals	13%	42%	55%	8%	12%	25%	37%
The academic community at the institution has been recognised globally for producing frequently cited research publications	18%	38%	56%	8%	25%	11%	36%

Note: N = Never, VR = Very rarely, R = Rarely, O = Often and VO = Very often

Source: Primary data

The findings in Table 5 related to impact (visibility) performance show that the most frequent response according to the range of percentages (that is, the range of responses from lowest to highest in percentage terms) in terms of the five statements was that of teaching staff members who responded unfavourably to the statements (52% to 56%). This was followed by the group of teaching staff members who responded favourably to the statements (35% to 42%), while the least populous group was comprised of teaching staff members who responded fairly to the statements (4% to 13%). Therefore, the interpretation from this analysis is that most of the teaching staff members were of the view that the impact (visibility) performance of NTCs in Uganda was poor, while approximately a third of them were of the view that it was good, and very few of them were of the view that it was fair.

The findings in Table 5 related to transparency (openness) performance show that the most frequent response according to the range of percentages (that is, the range of responses from lowest to highest in percentage terms) in terms of the five statements was that of teaching staff members who responded unfavourably to the statements

(51% to 72%). This was followed by the group of teaching staff members who responded favourably to the statements (25% to 37%), while the least populous group was comprised of teaching staff members who responded fairly to the statements (3% to 12%). Therefore, the interpretation from this analysis is that most of the teaching staff members were of the view that the transparency (openness) performance of NTCs was poor, while approximately a third of them were of the view that it was good, and very few of them were of the view that it was fair.

The findings in Table 5 related to excellence show that the most frequent response according to the range of percentages (that is, the range of responses from lowest to highest in percentage terms) in terms of the five statements was that of teaching staff members who responded unfavourably to the statements (55% to 56%). This was followed by the group of teaching staff members who responded favourably to the statements (36% to 37%), while the least populous group was comprised of teaching staff members who responded fairly to the statements (8%). Therefore, the interpretation from this analysis is that most of the teaching staff members were of the view that the excellence of

NTCs in Uganda was poor, while approximately a third of them were of the view that it was good, and very few of them were of the view that it was fair.

3.5. Inferential findings on knowledge acquisition and the performance of NTCs in Uganda

Inferential findings were used to address the objective of this study, which was to assess the impact of knowledge acquisition on the performance of NTCs in Uganda. The inferential analysis involved computing

Spearman’s correlation, the coefficient of determination and multiple regression. The results are presented in the following paragraphs.

The hypothesis which was tested stated that “*knowledge acquisition has a significant positive impact on the performance of NTCs in Uganda*”. The results of Spearman’s correlation and the coefficient of determination for knowledge acquisition and the performance of NTCs in Uganda are presented in Table 6.

Table 6. Correlation and coefficient of determination for knowledge acquisition and the performance of NTCs in Uganda

	Knowledge acquisition in NTCs
Performance of NTCs in Uganda	$\rho = 0.670$ $\rho^2 = .449$ $p = 0.000$ $n = 141$

Source: Primary data

Table 6 shows a moderate positive relationship ($\rho = .670$) between knowledge acquisition and the performance of NTCs in Uganda. Since the hypothesis emphasises the “*impact*” rather than the “*relationship*” itself, a coefficient of determination ($\rho^2 = .449$) was computed in order to address the research objective. This shows that knowledge acquisition accounted for 44.9% of the change in the performance of NTCs in Uganda. Testing this finding revealed that the significance value in Table 4 ($p = .000$) was less than the recommended .05. Because of this, this finding was accepted, leading to the acceptance of the hypothesis. Therefore, it was concluded that knowledge acquisition had a significant positive impact on the performance of NTCs in

Uganda. The positive nature of the impact indicated that poor knowledge acquisition contributed to the poor performance of NTCs in Uganda, while better knowledge acquisition contributed to better performance. The moderate nature of the impact indicated that a unit change in knowledge acquisition contributed to a moderate change in the performance of NTCs in Uganda.

The regression analysis was important in this study as it enabled the researchers to determine how the three measures of knowledge acquisition, namely data/information searching, data/information analysis and data/information validation, impacted the performance of NTCs in Uganda. The relevant findings are presented in Table 7.

Table 7. Regression findings for knowledge acquisition and the performance of NTCs in Uganda

<i>Multiple Regression Statistics</i>					
R	0.682				
R-Squared	0.466				
Adjusted R-Squared	0.454				
Standard Error	1.760				
Observations	141				

<i>ANOVA statistics</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Sig F</i>
Regression	3	370.0	123.3	39.8	0.000
Residual	137	424.6	3.1		
Total	140	794.6			

<i>Coefficients statistics</i>					
	<i>Coefficients</i>	<i>Standard Error</i>	<i>Beta</i>	<i>t Stat</i>	<i>p-value</i>
Intercept	2.89	.80		3.60	0.000
Data/information searching	0.22	0.04	0.38	5.73	0.000
Data/information analysis	0.16	0.04	0.27	3.87	0.000
Data/information validation	0.23	0.04	0.35	5.21	0.000

Source: Primary data

Table 7 shows a moderate linear relationship ($R = .682$) between the combined measures of knowledge acquisition (data/information searching, data/information analysis and data/information validation) and the performance of NTCs in Uganda. The adjusted R-squared (.454) shows that the combined measures of knowledge acquisition (data/information searching, data/information analysis, and data/information validation) accounted for 45.4% of the change in the performance of NTCs in Uganda. Testing

this finding using ANOVA statistics shows that the significance value (Sig F = .000) of Fisher's ratio ($F = 39.8$) was less than the recommended significance value of .05. Because of this, this finding was accepted.

Statistics pertaining to the coefficients were used to determine how each of the measures of knowledge acquisition (data/information searching, data/information analysis and data/information validation) impacted the performance of NTCs in Uganda. The findings show that all three

measures of knowledge acquisition (data/information searching, data/information analysis and data/information validation) had significance values ($p = .000$) of less than .05. This indicated that they all impacted the performance of NTCs in Uganda. However, the value of the t-statistic for data/information searching (5.73) was highest, followed by data/information validation (5.21) and data/information analysis (3.87), respectively. This indicated that data/information searching had the greatest impact on the organisational performance of NTCs in Uganda, followed by the impact of data/information validation and then data/information analysis.

4. Discussion

This study established that knowledge acquisition accounted for 45.4% of the change in performance of the NTCS in Uganda, whereby poor knowledge acquisition contributed to the poor performance of NTCs while better knowledge acquisition contributed to better performance. This result indicates that knowledge acquisition is important for NTCs in Uganda, which consistently endeavour to be equipped with the most up-to-date information that can be transferred to their students. This finding is supported by various studies. For example, the results of this study are consistent with those of Jyoti and Rani (2017), Hussinki, Ritala, Vanhala and Kianto (2017), and Ahmad, Lodhi, Zaman, and Naseem (2015), who contend that organisations that promote knowledge acquisition among their employees perform better.

Similarly to the present study, Matin and Sabagh (2015) also investigated the connection between knowledge management abilities and the performance of Iranian export firms. Their research centred on different aspects of knowledge management, such as knowledge acquisition, knowledge transfer, knowledge protection, and knowledge

application. By means of path analysis, they discovered that a strong and meaningful correlation exists between knowledge acquisition and organisational performance.

In addition, a study conducted by Nnabuike, Onwuka, and Ojukwu (2015) also supported the results of this research. Their study investigated the relationship between knowledge management and organisational performance in selected commercial banks located in Awka, Anambra State, Nigeria. The primary focus was on the impact of knowledge acquisition on organisational performance. By utilising Pearson's correlation, the data indicated that there is a positive connection between knowledge acquisition and organisational performance. However, while Pearson's correlation was used for testing the hypothesis in the study in Nigeria, the researchers in this study used Spearman rank-order correlation because of the ordinal nature of the data.

The findings of Nyaboke (2019), who conducted a case study on the effect of knowledge management on the performance of the KEMRI research institution in Kisumu County, Kenya, also support the results established in this study. Their regression analysis indicated that knowledge acquisition correlates positively with performance, as $\beta = 0.921$, leading to the conclusion that an increase in knowledge acquisition led to improved performance at KEMRI.

Agbim (2014), who assessed the effect of knowledge acquisition on competitive advantage based on a knowledge-based and resource-based study, also concurred with the findings of this study, finding that knowledge acquisition was significantly related to competitive advantage.

Conclusion

This study was conducted to investigate the impacts of acquisition processes (including data/information searching, data/

information analysis, and data/information validation) on the performance of NTCs in Uganda. Using a quantitative survey method, the results demonstrate that knowledge acquisition positively impacted the performance of NTCs in Uganda. Therefore, in order for the NTCs to improve their performance, the administrators need to improve on their knowledge acquisition by improving data/information searching, data/information analysis, and data/information validation.

Recommendation

In line with the findings, the study recommends that the NTCs vigorously adopt knowledge acquisition, as it will directly lead to improved performance. Administrators and leaders of educational institutions can use these results to consult with investors about implementing knowledge acquisition projects at their institutions.

Contribution to science

The major reason for conducting this research is to utilise the findings to propose a new approach to organisational norms and values for the NTCs in Uganda to support knowledge management, which will help to improve their performance. This approach focused on how the NTCs can integrate their knowledge assets, including databases, people and their experience and expertise, systems, policies, and procedures into knowledge management to improve performance.

Socio-economic effects of the research and the impact of the research results

Higher education institutions play a critical role in facilitating the socio-economic development of a country in various ways, such as channelling people who have been equipped with knowledge to the labour force, contributing to innovation, and conducting research to address social problems. Such contributions are part of the measurement of

the performance of the NTCs. Moreover, the various ways in which NTCs facilitate the socio-economic development of the country are anchored in the effectiveness of knowledge management. Thus, the results of this research are likely to be used to improve knowledge management at the NTCs in Uganda, which may lead to an improvement in the way NTCs make themselves relevant to the society in which they operate.

Limitations and future directions of the research

This study has some limitations which may open the doors to future studies. First, the study targeted only teaching staff members from the NTCs in Uganda. Further research may also include other employees of higher education institutions, such as members of the administration. Secondly, the study was conducted exclusively on NTCs in Uganda. A study expanded to other developed countries may lead to more insights into the impact of knowledge acquisition on the performance of NTCs. Furthermore, the study also utilised quantitative analysis. It may not be clear as to whether the findings would be the same if the study had used mixed methods research. Last but not least, opportunities exist for more research to explore a moderator analysis based on respondent demographics such as position.

Directions of future research

According to the definition of Swan et al. (1999), knowledge management consists of all processes and activities related to the creation, acquisition, extraction, exchange, and use of knowledge, which influences the efficiency, effectiveness, and learning capacity of an organisation. This study focused on knowledge acquisition and organisational performance. The researchers therefore wish to recommend that future research be conducted on knowledge creation, extraction, exchange, and use, and how they impact organisational performance.

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