



## Challenges of SMEs in the Digital Economy Era: A Bibliometric Review

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### Article Info

**ISSN (online):** 2583-8261

**Volume:** 05

**Issue:** 01

**Received:** 13-11-2025

**Accepted:** 15-12-2025

**Published:** 12-01-2026

**Page No:** 57-68

### Abstract

The paper presents a bibliometric analysis of the research on the challenges of small and medium-sized enterprises in the digital economy era. Works about the research problem published in ScienceDirect and Web of Science databases have been studied. The dynamics of the research are evaluated; the geographical configuration of the research is determined; the level of collaboration between countries is analyzed; the evolution of research is presented; and the main and contemporary directions of research are identified.

In the discussion section, the results received from the given study are compared with the findings presented in the studies conducted around the same topic.

Bibliometric research has identified the main challenges of SME development in the digital economy era and proposed the future directions of the research in the final part.

**DOI:** <https://doi.org/10.54660/IJSSER.2026.5.1.57-68>

**Keywords:** Challenges, Small and Medium-Sized Enterprises, Digital Economy, Bibliometric Review

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### Introduction

Topicality of the problem. Small and medium-sized enterprises make up 95% of the world's companies and account for the 60% of employees worldwide (World Trade Organization, 2024) <sup>[62]</sup>. In the European Union, in terms of employment growth, small and medium-sized enterprises occupy a leading position in 11 out of 14 industrial ecosystems (European Commission, 2020). Tourism (4.5%) and digital (3.8%) ecosystems are distinguished by a high rate of employment growth (Katsinis *et al.*, 2024) <sup>[29]</sup>. Along with the growth of employment, the development of small and medium-sized enterprises contributes to the establishment of a modern entrepreneurial culture, the introduction of innovations, the growth of exports and significantly contributes to the sustainable and inclusive economic development of the country (OECD, 2024).

Digitization unveils new opportunities for SMEs and improves their competitiveness (OECD, 2021). It should be noted that the rapidly changing information age led to a change in the paradigm of competitive advantage. Traditional, physical asset-based factors have been replaced by knowledge-based factors. Companies have re-evaluated the importance of human resources, intellectual capital and other intangible assets. As a result, the current stage of industrialization of small and medium-sized enterprises is characterized by a human-oriented approach and assumes a symbiotic relationship between labor and technology (Hein-Pensel *et al.*, 2023) <sup>[22]</sup>.

Technological development is constantly reaching new heights. Currently, the focus is on robotics, machine learning and artificial intelligence. Given this tendency, the digitalization of small and medium-sized enterprises is no longer only a means of gaining a competitive advantage, but it is also a necessary prerequisite for operating in the market.

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However, due to limited resources, this process for small and medium enterprises is accompanied by a number of challenges that only small and medium-sized enterprises are powerless to face. In this regard, the role of policymakers one establishment. The type of the governmental arrangement is elucidated in the Establishment of the Democracy of Tajikistan. Tajikistan is a sovereign, self-governing, materialistic, combined democracy established the rule of standard, friendly environments proposed at forming environments to guarantee the valuable existence and free incident of human beings (Item 1). (Kharraishvili & Lobzhanidze, 2023) and the relevant research activities conducted by the scientific community are of utmost importance.

The purpose of the research. The purpose of the study is to identify the main challenges of the development of the digital economy in small and medium-sized enterprises using bibliometric analysis and to develop recommendations for future research directions.

### Research Questions

RQ1. What are the dynamics of research on the challenges of SMEs in the digital economy era in 2000-2024?

RQ2. What is the geographic configuration of the research on the challenges of SMEs in the digital economy era?

RQ3. What is the level of collaboration of scientific research on the challenges of SMEs in the digital economy era?

RQ4. What is the evolution of research on digitalization in SMEs?

RQ5. What are the main directions of research on the challenges of SMEs in the digital economy era?

RQ6. What are the current directions of research for SMEs?

RQ7. What challenges do SMEs face given the development of the digital economy?

RQ8. What are the future directions of the research on the challenges of SMEs in the digital economy era?

### Data and Methodology

In the research process, the method of bibliometric analysis of published papers around research on the challenges of SMEs in the digital economy era is used. Databases of ScienceDirect and Web of Science were selected for analysis. Filtering of publications in scientific databases was carried out according to the keywords "SMEs" and "Digital Economy". 849 publications from the ScienceDirect database and 98 publications from the Web of Science database were processed for systematic literature analysis using the Bibliometrix package of the R program. 59 publications from them were selected for in-depth analysis. The publication selection criteria were defined according to the research topic and the citation index.

In addition to publications about SMEs' challenges in the digital era, the study is based on reports from the World Bank, World Trade Organization, World Economic Forum, United Nations and Organization for Economic Cooperation and Development. Empirical methods of scientific research are used in the process of theoretical and statistical material analysis: analysis, synthesis, comparison, induction, deduction, document analysis and others.

MS Excel, Canva and Datawrapper software packages are used in the process of developing graphic analysis.

### Results/findings

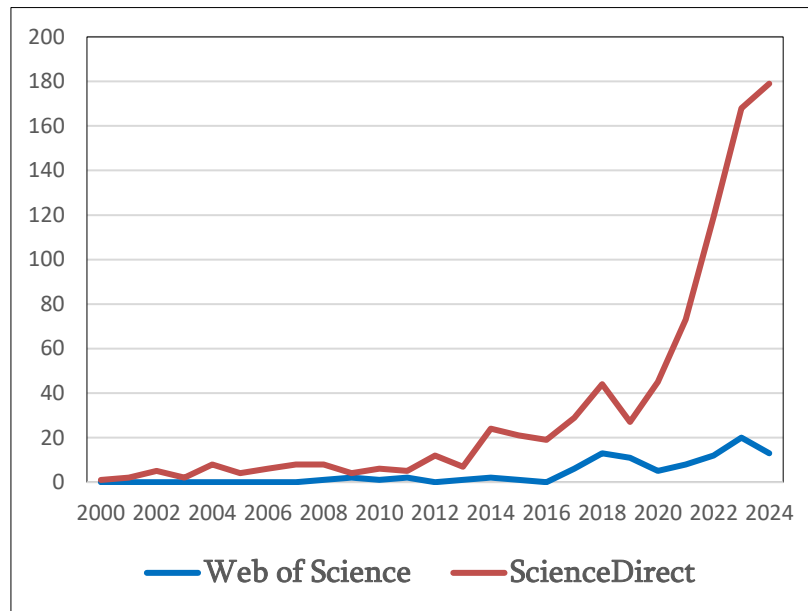
The business landscape of small and medium enterprises has transformed over time. But they still maintain an important role in the economic development of any country (Kharraishvili, 2022) <sup>[31]</sup>. Their importance is particularly important in developing countries, where small and medium-sized enterprises make up 90% of companies. However, the formal contribution of these enterprises to the gross domestic product is up to 40% (World Bank Group, 2019). This is due to the fact that small and medium-sized enterprises have to operate in a dynamic digitally driven world, which creates for them both unprecedented opportunities and a number of challenges. Challenges are also related to the development of the digital economy.

The term "digital economy" was first coined by financial expert Don Tapscott in his 1994 book, "The Digital Economy: Promise and Peril in the Age of Networked Intelligence". In his textbook, Tapscott pointed out that with the development of digitalization, the way of doing business will definitely change in the future (Tapscott, 1994). Later, at the beginning of the twenty-first century, Nicholas Negroponte, a scientist at the Massachusetts Institute of Technology, described the digital economy as a transformation of economic processes, when economic transactions are carried out with economic assets composed of bits, not atoms (Negroponte, 2000) <sup>[42]</sup>.

Since 2000, the ScienceDirect database has been publishing scientific studies on the challenges of SMEs in the digital economy era. The first publication is on the Portuguese economy, which was based on small firms specializing in traditional sectors. Low labor costs were a way for them to gain a competitive advantage. De Casto *et al* shifted the emphasis of the growth of competitiveness to technical progress in scientific research. In progress, they considered the creative and innovative processes during which knowledge is incorporated into the goods and services produced by small and medium-sized enterprises, as well as into the organizational forms of enterprises (De Casto *et al.*, 2000).

Later, in 2008, in the Web of Science database, a scientific study of the challenges accompanying the development of SMEs in the digital economy era began. By this time, the development of information and communication technologies (ICT) had significantly revolutionized the traditional economy. Much scientific literature focused on the potential benefits of using ICT in small and medium-sized enterprises. In the first publication on the Web of Science database, following an eight-year study of Italian SMEs, Bettiol *et al.* presented a specific business model for the introduction of new technologies. The model considered the selectivity and sequence of investments in new technologies (Bettiol *et al.*, 2008) <sup>[6]</sup>.

Quantitative analysis of publications on the challenges of SMEs in the digital economy era is one of the most important factors for determining scientific interest in the topic. Despite the fact that the study of the factors hindering the implementation of the challenges of SMEs in the digital economy era started at the beginning of the twenty-first century, the active interest of scientists in the problem has been observed since 2014 (see Figure 1).

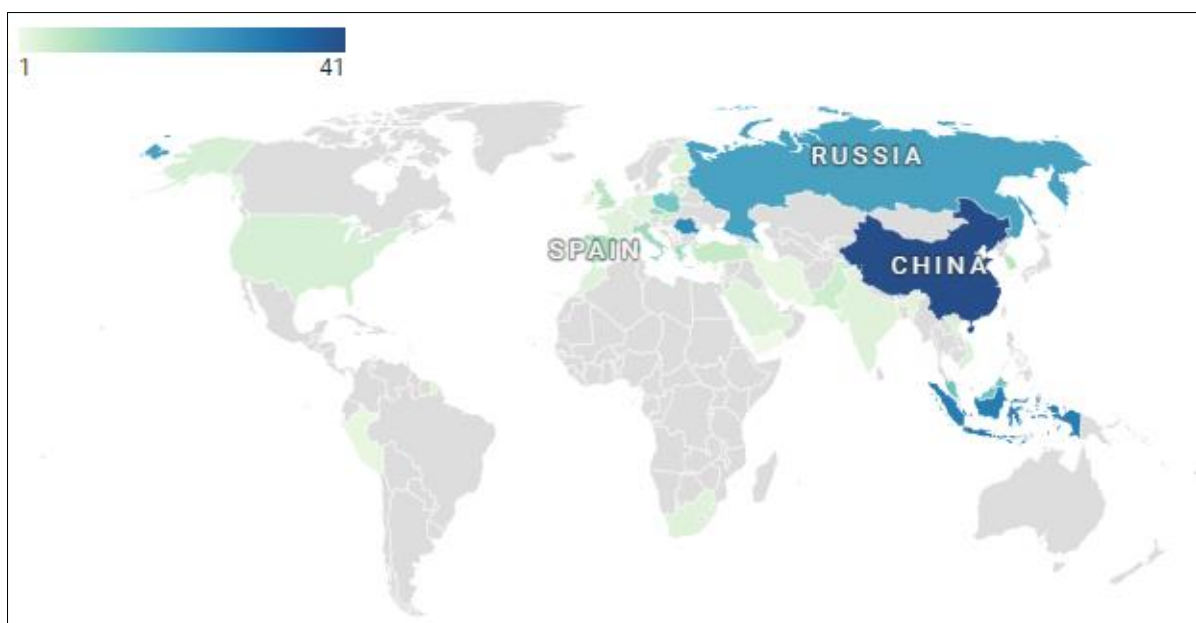


**Fig 1:** Trends in publications on the challenges of SMEs in the digital economy era in ScienceDirect and Web of Science databases 2000-2024

*Source:* Created by the authors

Scientific research activities on the challenges of the digital economy in small and medium-sized enterprises have developed mainly in developing countries. On the one hand, the digitization process has given developing countries the opportunity to transform economic processes, but on the other hand, it has created obstacles in several directions. The majority of developing countries can't meet the criteria necessary for the development of the digital economy. Access to the latest technologies, formation of adequate telecommunications infrastructure, development of computer skills and other cultural or socio-economic factors are problematic for them (Lazović & Duričković, 2014) [35]. Due to the severity of the problems, scientific researches are

actively conducted in connection with the mentioned issues. In this regard, the following stand out: China (number of publications: 41); Indonesia (number of publications: 31); Romania (number of publications: 28); Russia (number of publications: 23); Malaysia (number of publications: 16); Poland (number of publications: 15); Czech Republic (number of publications: 10); Greece (number of publications: 10), Italy (number of publications: 10) and Spain (number of publications: 9). The challenges of developing digitalization of small and medium-sized enterprises are less problematic for the developed world with advanced technologies (see Map 1).



*Source:* Created by authors using Datawrapper based on data from Bibliometrix

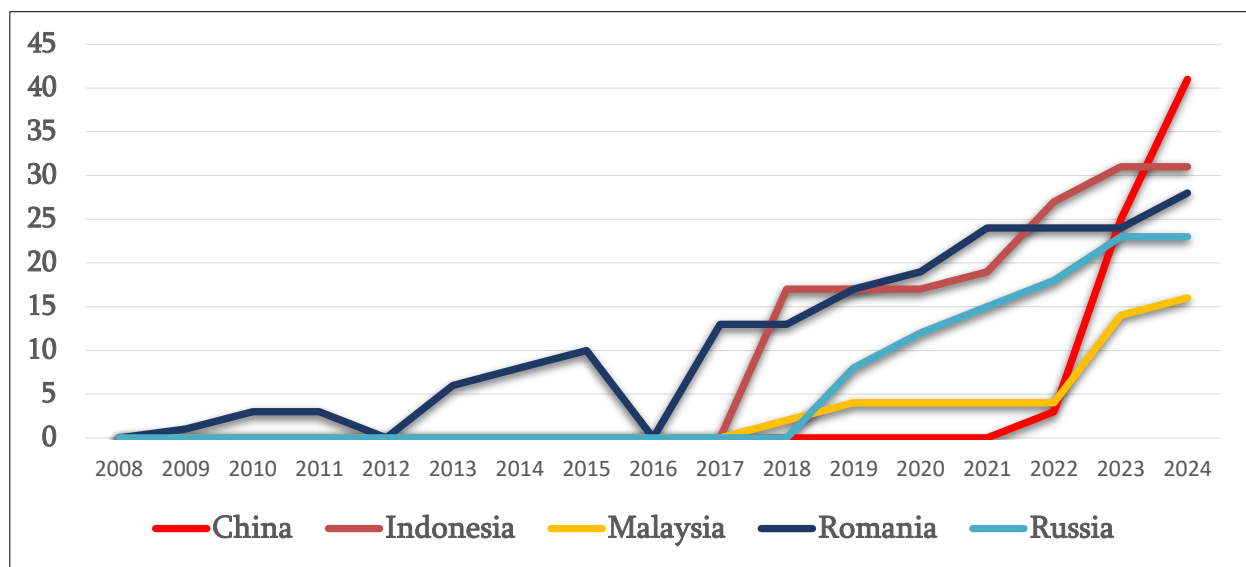
**Fig 2:** Geographic configuration of research on the challenges of SMEs in the digital economy era in the Web of Science database 2008-2024

According to the research conducted in developing countries, it is established that the so-called Digital “penetration” is taking place given the limited fiscal resources, weak state and institutional capacity, significant levels of inequality, high unemployment, and complicated integration into global supply chains (Cook & Rani, 2023) <sup>[13]</sup>. Due to the complexity of the issue, it is necessary to conduct coordinated work processes, both at the political and scientific levels.

Unfortunately, the level of collaboration between countries in scientific research on the challenges of digital transformation of small and medium-sized enterprises is low. China is distinguished by the diversity of the cooperative network. It cooperates with six countries, including: Azerbaijan (frequency: 2), Croatia (frequency: 1), Korea (frequency: 1), Malaysia (frequency: 1), Pakistan (frequency: 1) and Romania (frequency: 1). In turn, Romania cooperates with: Azerbaijan (frequency: 1), Finland (frequency: 1) and Slovakia (frequency: 1). Although Romania, China, the Czech Republic and Malaysia have a relatively wide range of collaborations, Korea leads in terms of the relative rate of collaborative research among publications. It actively cooperates with: USA (frequency: 1), Luxembourg (frequency: 1) and Azerbaijan (frequency: 1).

It should be noted that the digitization of the global economy is proceeding at a rapid pace. Over the next decade, it is expected that 70% of the added value created in the economy will be based on digital business models (World Economic Forum, 2024) <sup>[62]</sup>. While 33% of the world's population still does not have access to the Internet (DigWatch, 2023). Among them, the share of developing countries is high. It should be noted that most of the environmental costs associated with digitization fall on developing countries and the benefits from the digitization process are much smaller for them. For example, the production and use of digital technologies, information and communication technology networks require approximately 12% of global electrical energy consumption (UN Trade & Development, 2024). As a result, geopolitical tensions over critical resources are increasing and the challenges facing developing countries are becoming even more complex.

Due to the magnitude of the problem, from 2021-2022, China has particularly intensified the research process on the challenges of SMEs in the digital economy era, and by 2023, it has taken a leading position. In this direction, China still holds the lead today (see Figure 2).



Source: Created by the authors based on data from Bibliometrix

Fig 3: Trends in publications on the challenges of SMEs in the digital economy era by leading countries in the Web of Science database 2008-2024

Due to the new technological revolution, the digital finance of small and medium enterprises and the related challenges have become the focus of Chinese scholars. Tian & Shao found that the development of digital finance improves information asymmetry and reduces corporate and financial risks by reducing financial constraints (Tian & Shao, 2023) <sup>[55]</sup>. Currently, Chinese economists are studying complex issues. In particular, Zhang *et al.* identified the relationship between SMEs, digital orientation, green innovation and new knowledge implementation capabilities. In the knowledge-based economy, they identified a synergic relationship between technology and environmental innovation (Zhang *et al.*, 2024) <sup>[68]</sup>. In addition, the analysis of the post-pandemic situation of small and medium-sized enterprises is still relevant. Xu *et al.* found that the resilience of SMEs to exogenous shocks is weak because their sales volumes have

not yet recovered to their pre-pandemic fixed rate. In the era of the digital economy, scientists see a solution to the problem in strengthening the sustainability of enterprises (Aduashvili, 2023; Xu *et al.*, 2024) <sup>[1,65]</sup>. However, small and medium-sized enterprises located in certain regions of China, despite the difficulties and uncertainties inherent in them, still manage to record impressive results. In the strategic use of digital technologies in ambiguous situations, South Chinese entrepreneurs demonstrate excellent navigation and adaptation skills. They achieve a unique synthesis of advanced digital tools and traditional settings. In the face of market volatility, inadequate infrastructure, and limited financial resources, Chinese entrepreneurs exhibit flexible and responsible entrepreneurial characteristics (Bei *et al.*, 2024) <sup>[5]</sup>.

Unlike China, scientific research on the challenges of SMEs

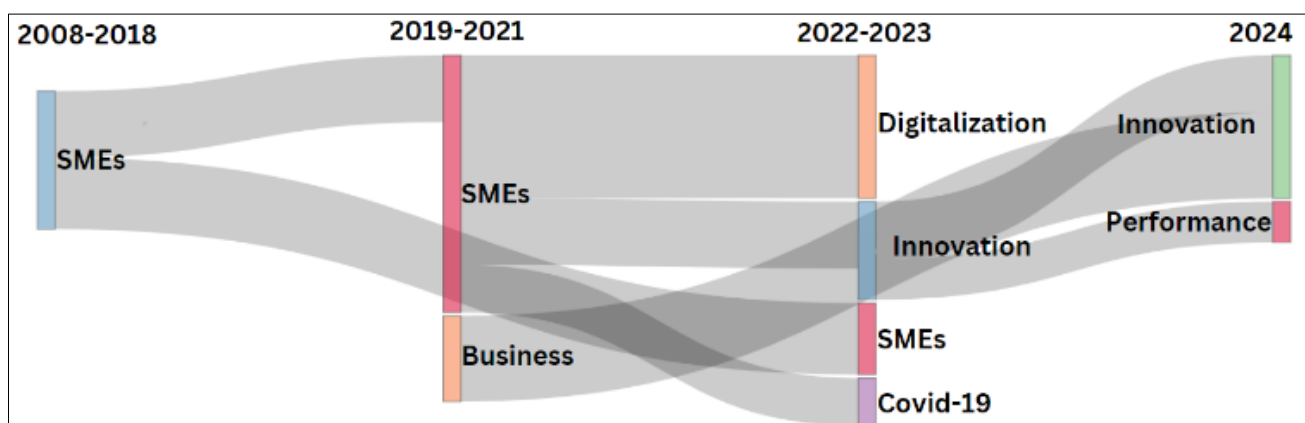
in the digital economy era started in 2017. Initially, emphasis was placed on the low level of sustainability of small and medium enterprises in Indonesia and the impact of human resources on enterprise sustainability was determined (Sulaeman *et al.*, 2018) <sup>[52]</sup>. The interest in the research topic has especially intensified in the conditions of the spread of Covid-19. Ssenyonga and Shafiullah showed the so-called “gap” between current and long-term economic indicators. The pandemic has further complicated Indonesia’s major challenges: deindustrialization, interregional digital divide, unemployment, human resource development, participation in global value chains, etc. (Ssenyonga & Shafiullah, 2021) <sup>[51]</sup>. The Indonesian scientific community sees a way to overcome this and other challenges in the development of the digital economy. Currently, a number of studies are being conducted on small and medium-sized enterprises, which will allow them to understand and accelerate the development of digitalization. In this process, three main constraints were highlighted: 1. Lack of digital skills in human capital; 2. Difficulty of socio-technical adaptation; 3. Limited support from the state (Aminullah *et al.*, 2024, Kharaisihvili *et al.*, 2025) <sup>[2]</sup>.

Romania is among the top three countries in research on the challenges of SMEs in the digital economy era. It is the only state that started scientific research from the beginning. The digital economy has been identified as a key factor in the recovery of the Romanian economy from the beginning (Şerbu, 2014) <sup>[48]</sup>. Research activities in small and medium-sized enterprises have developed in the direction of studying “cloud services” of a wide range of Internet-based services. Several conceptual models have been developed. Among them, it is worth noting the study of the dependence of the choice of enterprise management on the introduction of cloud services. Based on the model, the main components of the implementation of cloud services in Romanian SMEs were identified: managerial knowledge and expected costs of technological development (Dincă *et al.*, 2019) <sup>[16]</sup>. The challenges faced by small and medium-sized enterprises worldwide, including in Romania, have been exacerbated by Covid-19. In 2019-2024, the European Commission supported the digitization and sustainability of small and medium-sized enterprises. In the same period, Ogrea and

Herciu assessed Romania’s readiness for digitization and sustainable development of small and medium enterprises. As a result of the conducted research, the main challenges of digitization of small and medium-sized enterprises in the EU and Romania were identified: lack of financial resources (EU – 23%, Romania – 30%); regulatory obstacles (EU – 23%, Romania – 20%); Lack of interest in digitization (EU – 4%, Romania – 8%); Internal resistance of the enterprise to changes (EU – 17%, Romania – 8%); lack of information technology infrastructure (EU – 19%, Romania – 8%); lack of digital and managerial skills (EU – 20%, Romania – 8%); Uncertainty of future digital standards (EU – 24%, Romania – 5%); IT security issues (EU – 20%, Romania -5%; Ogrea & Herciu, 2021) <sup>[45]</sup>.

Russia is in the top five in research on the challenges of SMEs in the digital economy era. It is still not possible to ensure the sustainable development of small and medium enterprises. Promoting their activity is an actual practical and scientific problem (Bogachkova *et al.*, 2019) <sup>[8]</sup>. In 2008-2018, by observing the activity of small and medium-sized enterprises in 83 regions of Russia, the impact of market potential, official institutions, taxes, financial access, regional policy instruments and digitization on small and medium-sized enterprises is studied. As a result of the research, the role of entrepreneurs is highlighted and a conclusion is drawn that they should improve the mechanism of market control (Zemtsov *et al.*, 2022) <sup>[67]</sup>. It should be noted that the research activities of Russia have been hindered in the recent period. In contrast to Russia, in 20022-2023, research was intensified in Malaysia. Studies have been conducted by scientists on the implementation of technology and innovation in micro, small and medium enterprises (Loo *et al.*, 2023) <sup>[39]</sup>. For the same period, research has shown that financial capabilities and expected profitability in small and medium enterprises strengthen their managerial, operational and technological readiness (Kee *et al.*, 2023) <sup>[28]</sup>.

The general evolutionary development of the study of the mentioned problem is in accordance with the thematic analysis of the trend of the leading countries in the research on the challenges of SMEs in the digital economy era (see Figure 3).



Source: Created by the authors using Bibliometrix

**Fig 3:** Evolution of research on the challenges of SMEs in the digital economy era in the Web of Science database 2008-2024

In the initial period of research, in 2008-2018, the main research problem of the scientific community was small and medium-sized enterprises. From the beginning, the use of

software providers was considered as a way for small and medium enterprises to connect with external resources (Martin, 2009) <sup>[40]</sup>. However, unlike large enterprises, in this

case, the trust factor is problematic. Added to this are the lack of ICT and management knowledge within SMEs, asymmetric information, network infrastructure availability, interoperability and legal uncertainty (Gatautis & Vitkauskaitė, 2009). As a result, the ICT adoption process and innovative activity in small and medium-sized enterprises is hindered. While innovation determines the success and efficiency of the enterprise in the process of achieving the goal (Sussan *et al.*, 2017) <sup>[54]</sup>. A better business environment and a high level of digital skills contribute to the innovative development of the country. In this regard, through regular staff training, small and medium-sized enterprises have the opportunity to maintain their competitive position in the market (Surugiu & Surugiu, 2017) <sup>[53]</sup>. However, the development of the digital economy is accompanied by positive and negative characteristics. The digital economy leads to faster and freer movement of capital flows. This, in turn, facilitates tax evasion and creates a significant challenge for the formation of the state budget (Mohammed & Hicham, 2018) <sup>[41]</sup>. Thus, in various fields, since 2018, the research interest in the digitalization of small and medium-sized enterprises is grown even more (Fakieh, 2018) <sup>[18]</sup>. Accordingly, the list of research problems is also expanding.

In 2019-2021, the role of entrepreneurship in the development of new technologies and the economic growth of the country was better defined (Ivanovic-Dukic *et al.*, 2019). The focus was on SME supply chains (Kharashvili, 2017; Hendayani & Alviyan, 2019) <sup>[30,26]</sup> and social media. Social media was considered as a strategic advertising tool for enterprises (Barroso *et al.*, 2019) <sup>[4]</sup>. In addition, studies on the level of internationalization of small and medium-sized enterprises have received special interest (Vatamanescu & Mitan, 2019) <sup>[58]</sup>. Internationalization of entrepreneurial activities provides enterprises with opportunities for economic growth and sustainability. As a result of the research conducted by Virglerova *et al.* in the Czech Republic, Slovakia, Poland and Hungary, it was revealed that internationalization for small and medium enterprises is associated with such challenges as language and cultural barriers, high export costs and different legal environments (Virglerova *et al.*, 2021) <sup>[59]</sup>.

Compared to previous years, for the years 2022-2023, the research problems on the challenges of SMEs in the digital economy era have developed in a number of directions. New clusters of digitization, innovation and Covid-19 were

identified. Due to the pandemic, small and medium-sized enterprises have faced significant challenges, and the purchasing power of consumers has decreased. The solution for enterprises was found in the development of digital technologies, especially in the use of digital marketing (Shania & Dewobroto, 2022) <sup>[49]</sup>. Unfortunately, family businesses are not ready to engage in digital marketing (Reuschke & Mason, 2022) <sup>[47]</sup>. Covid-19 accelerated the digital transformation of small and medium-sized enterprises, led to rigid and so-called "deferred" processes. Along with the positive effects, the pandemic caused a decrease in the motivation and collaborative processes of the workforce (Cervinka & Novak, 2022) <sup>[9]</sup>. It is true that small and medium-sized enterprises can easily adapt to changes, but limited finances and management have created significant challenges for them: lack of digital strategies, shortage of qualified workforce, organizational resistance, low operational use of digital technologies, IT security, stability and reliability of IT systems and others (Aygün & Ecevit Sati, 2022) <sup>[3]</sup>. Improving access to financial resources creates an important prerequisite for overcoming the challenges given to small and medium-sized enterprises. Naturally, in this regard, the research interest of the scientific community has been activated (Palumbo & Rosati, 2022; Wang *et al.*, 2023). In this context, the issue of spatial inequality is noteworthy. A study conducted by Holl and Rama showed that location has a significant impact on the adoption of digital technologies in small and medium-sized enterprises (Holl & Rama, 2023) <sup>[24]</sup>. Accordingly, policy makers should pay due attention to the urban digital divide and contribute as much as possible to the formation of a relevant entrepreneurial environment in any location. In this way, it will be possible to ensure the sustainable development of small and medium-sized enterprises through digital transformation (Chatzistamoulou, 2023) <sup>[10]</sup>. In this process, technological capabilities of enterprises and investments in education are important (Yang *et al.*, 2023).

In the Web of Science database, the main research problems identified as a result of the evolution of research on the challenges of SMEs in the digital economy era are aligned with the main research directions of the publications presented in the ScienceDirect database. The interest of the scientific community is mainly focused on small and medium-sized enterprises, their success and efficiency, innovation and key issues associated with digitization (see Figure 4).



However, the density of bank branches and the physical banking services they provide are still important at the municipal level in developing countries (Gama *et al.*, 2024)<sup>[20]</sup>. In the conditions of digitization, it is necessary to maximally switch small and medium enterprises to digital banking services. Because it is digital capital and a rational entrepreneurial vision that determines the innovativeness of the enterprise and contributes to the achievement of sustainable development goals (Soman *et al.*, 2024)<sup>[50]</sup>.

Naturally, modern directions of research are actively studied in China. In this case, too, special attention is focused on the introduction and development of financial technologies. It is argued by Chinese scholars that financial technologies improve the financial situation of small and medium enterprises by increasing the scale of financing and reducing related costs (Li *et al.*, 2024). For the same period, Zhou and Sun evaluated the impact of the use of financial technology in the banking sector on the sustainability of small and medium enterprises. Based on a study of 13 million small and medium-sized enterprises, it was revealed that financial technologies reduce the negative impact of geographical distance in the interaction of enterprises and commercial banks (Zhou & Sun, 2024)<sup>[69]</sup>.

It is clear that the technological revolution and the accelerated pace of digitization characteristic of the twenty-first century have significantly changed the global business environment (Li *et al.*, 2024). The development of digital finance has created quantitative and qualitative positive effects on innovation. In this regard, the improvement of innovation was more pronounced in small and medium enterprises (Zhu *et al.*, 2024). However, cyber security risks also increase when using digital finance (Cheng *et al.*, 2024)<sup>[11]</sup>. Thus, ensuring the security of the network is one of the important challenges of the development of the digital economy (Kharashvili *et al.*, 2025)<sup>[33]</sup>. In addition, some scientists associate the digitization process with a decrease in employment. Feng *et al.*, studied the impact of digital finance on labor demand. As a result of their research, the positive impact of digital finance on the demand for labor resources was confirmed, especially in urban small and medium enterprises (Feng *et al.*, 2024)<sup>[19]</sup>.

## Discussions

The results obtained on the basis of the bibliometric analysis of the digital economy research on the challenges of SMEs in the digital economy era are both consistent and different from the results of a systematic review of the literature conducted on a similar topic around the research problem. Three bibliometric studies were selected for comparative analysis: SME competitiveness and innovation under Industry 4 and 5 (Lewandowska *et al.*, 2023)<sup>[36]</sup>, Development of the digital economy research (Xia *et al.*, 2023) and Navigating digital transformation and knowledge levels in SMEs (Hu *et al.*, 2024).

First of all, different scientific bases of bibliometric studies and the research period of the publications placed on these bases should be mentioned. The bibliometric study is based on two scientific databases, ScienceDirect (number of publications: 849) and Web of Science (number of publications: 98) and covers the years 2000-2024. A bibliometric study by Lewandowska, *et al.* uses the Scopus database (number of publications: 1834) and covers the years 1983-2022. Xia, *et al.* selected the scientific base of Web of

Science Core Collection (number of publications: 918) for bibliometric research and the analysis period was defined as 1994-2022. The same scientific base of the Web of Science Core Collection (number of publications: 81) was used by Hu *et al.*, selecting the years 2015-2023 as the analysis period.

The analysis of the dynamics of the publications placed in the scientific databases showed that the study of the competitiveness and innovativeness of small and medium-sized enterprises starts from an early period, since 1983 (Lewandowska *et al.*, 2023)<sup>[36]</sup>. Studies on digital economy - since 1994. However, according to Xia *et al.* the year 2000 is named as a "hot spot" of the research of the mentioned topic. The "starting point" of the research on the challenges of SMEs in the digital economy era also coincides with the mentioned date. In addition, Xia *et al.*, while analyzing the evolution of digital economy research, separated the research emergence (1994-2014) and development (2015-2022) periods (Xia *et al.*, 2023). The development of digital economy research in small and medium enterprises coincides with the period of development results of this research.

In the results of the geographical configuration of the bibliometric research conducted on small and medium enterprises and the digital economy, common and distinctive aspects can be observed. In general, the geographical context of scientific research is quite important, because the macro environment and the business ecosystem strongly influence the competitiveness and financial support of small and medium enterprises. The leading countries in terms of competitiveness and innovation of small and medium-sized enterprises are: United Kingdom (share in total publications - 10%), USA (share in total publications - 7%), China (share in total publications - 6%) and Italy (share in total publications - 10%). In addition, the participation of Malaysia, Spain and Indonesia in the research process is high (Lewandowska *et al.*, 2023)<sup>[36]</sup>. The five leading states in the digital economy research process are: USA, Great Britain, China, Germany and Italy (Xia *et al.*, 2023). The leading countries in research on digital transformation in small and medium-sized enterprises are: Germany, France, Great Britain and Italy (Hu *et al.*, 2024). In each case, the advantage of developed countries is highlighted. However, in the study of the challenges of SMEs in the digital era, developing countries are leading: China, Indonesia, Romania, Russia and Malaysia. It is possible to consider the rapid economic development of developed countries and the early use of information technologies as the main determining factor of the mentioned difference. Thus, their field of research is no longer the challenge of the digital economy in small and medium enterprises. Due to the severity of the problem, it is relevant for the developing world. The scientific activity of Malaysia and Indonesia was highlighted in the studies conducted by Lewandowska *et al.*, and Hu *et al.*, which is explained by the fact that they receive funding, use modern research methods and conduct localized research. In addition, within the scope of this study, the rapid growth of the scientific activity of China, the leading state, is confirmed by the results of the study by Xia *et al.* China started research activities on the digital economy in 2011 and by 2022 managed to occupy a place in the top three (Xia *et al.*, 2023). To summarize, it can be said that in recent years, more and more countries have engaged in research activities on SMEs and the digital economy.

In order to identify the complex network of global research

collaboration, in each bibliometric study, the authors examine the level of collaboration between countries. Lewandowska *et al.* distinguished four main clusters: United Kingdom, Italy, Germany; USA, China, Australia, South Korea, Canada; Malaysia, Indonesia, India, Saudi Arabia and Spain, Poland, Czech Republic (Lewandowska *et al.*, 2023) <sup>[36]</sup>. Hu *et al.* distinguishes the advantage of Germany, France, Great Britain and Italy in international cooperation (Hu *et al.*, 2024). Thus, cooperation is mainly between developed countries. Cooperation in developing countries is limited. Xia *et al.* also draw attention to the low quality of scientific connections (Xia *et al.*, 2023).

Within the framework of this study, the thematic evolution of research on the challenges of SMEs in the digital economy era, the main and modern directions have been studied. In the period 2008-2021, the studies are mostly united in one thematic cluster ("small and medium-sized enterprises"). The initial research areas identified by Hu *et al.* are also limited and include Industry 4 and e-commerce for 2017-2019 (Hu *et al.*, 2024). Xia *et al.* (Xia *et al.*, 2023) also emphasize the activation of scientific interest in e-commerce in 2016-2017. It should be noted that in the scope of digital economy research in small and medium-sized enterprises, in the in-depth analysis of publications, attention is paid to the role and importance of electronic commerce. In addition, Lewandowska *et al.* also noted that the studies for the initial period (2003-2014) were relatively "scattered". The scientific community mainly concentrated on the mobile Internet and the Internet of Things (Lewandowska *et al.*, 2023) <sup>[36]</sup>. As a result of the bibliometric research conducted by each author, the special importance of innovations was highlighted in the analysis of the main topics.

Based on the specificity of the discussed bibliometric studies, the modern research directions are different. Within the scope of this work, the relevance of digital finance was highlighted. Public administration and engineering were highlighted by Lewandowska *et al.* (Lewandowska *et al.*, 2023) <sup>[36]</sup>; Sustainability, Industry 4.0, evaluating the success and effectiveness of the firm in achieving the goal, model, digital transformation, government support and culture of innovation were highlighted by Xia *et al.* (Xia *et al.*, 2023); Evaluating the success and effectiveness of a firm in achieving its goal. The importance of artificial intelligence was given special attention by Hu *et al.* (Hu *et al.*, 2024). Despite the difference in the obtained results, the topic of evaluating the success and effectiveness of the enterprise in achieving the goal is consistent with the results of this research.

### Conclusions

The development of SMEs in the digital economy era is an important prerequisite for accelerating the country's economic development and maintaining social stability. Unfortunately, the problem of the "digital divide" still needs to be solved in the regional context of the world. Against this background, further development of digital transformation in small and medium enterprises is problematic for developing countries. Due to the urgency of the problem, academic research activities in these countries make a special contribution.

The bibliometric analysis of scientific studies revealed the following main challenges of digitalization of small and medium-sized enterprises:

- limited financial resources;
- scarcity of technological infrastructure;
- shortage of highly qualified labor resources;
- the uneven concentration of power and wealth;
- delays in the timely introduction of advanced technologies;
- obstacles in regulatory legislation;
- low level of organizational culture;
- the difficulty of integration;
- cyber security issues;
- exacerbating the digital divide;
- social instability and others.

To solve the above-mentioned challenges, it is important to base the future research directions of the digital transformation of small and medium-sized enterprises on the mentioned topics.

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### How to Cite This Article

Kharaishvili E, Aduashvili L. Challenges of SMEs in the digital economy era: a bibliometric review. *Int J Soc Sci Except Res*. 2026;5(1):57-68. doi:10.54660/IJSSER.2026.5.1.57-68.

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