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THE IMPACT OF DIGITAL TRANSFORMATION ON HIGHER EDUCATION IN THE CONTEXT OF THE SOCIO-ECONOMIC CRISIS IN UKRAINE

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ABSTRACT

This article examines the impact of digital transformation on economic processes in the higher education system in Ukraine. The process of digital transformation in higher education in Ukraine, which has been significantly intensified by the full-scale war, is accompanied by a number of economic effects that confirm its potential as a tool for stabilization and development in the context of the socio-economic crisis. The study aims to analyze and structure research trends related to the digital transformation of the higher education system in Ukraine using a bibliometric approach and to show the impact of their application on the economy. For this purpose, we used the VOSviewer software to assess academic publications in the Scopus database, allowing us to study and visualize the relationships between key terms in this field. Additionally, Google Trends was used to assess the popularity of key search queries, providing insights into public interest in the topic. The analysis is based on scientific publications indexed in Scopus. The analysis highlights a significant increase in scientific interest in the digital transformation of economic processes in universities in recent years worldwide. The research shows that Ukraine is a leader in the number of publications dedicated to digital technologies for education in wartime economies. The challenges faced by universities, starting from the COVID-19 pandemic and followed by the war, have significantly contributed to this increase in academic attention to improving the efficiency of higher education delivery. The data obtained indicates that, despite the current situation, Ukraine continues to implement digital transformation mechanisms at both the state and private institutional levels. This study lays the groundwork for future research on the digital transformation of education during crises and post-war economic recovery.

Keywords: transformation of economic processes, economic impact of digitalization, transformation of higher education, socio-economic crisis, digital technologies, bibliometric analysis

JEL Classification: H56, I23, O33

INTRODUCTION

The process of digital transformation of higher education in Ukraine has economic effects. They confirm its potential as a tool for stabilization and development in the conditions of socio-economic crisis. The economy of Ukraine has noted serious structural changes that require new management approaches, in particular in education as a key component of human capital formation. The recovery of the economy depends on how well higher education can adjust to the needs of the digital economy. This includes teaching new skills and using modern tools for analysis, management, and decision-making.

The introduction of digital solutions in the education management system helps reduce administrative costs, make it easier to access funding, and improve productivity in the education sector. All of this supports the broader recovery and development of the post-war economy.

University management in the context of digital transformation is undergoing fundamental changes. It is adapting to the modern challenges of globalization and techno-

logical development. Digitalization encompasses key aspects of management, from automating administrative processes to implementing innovative educational platforms and analytical systems for decision-making. Universities that implement digital management tools have recorded up to a 30% reduction in time spent on administrative processes (Cassidy Macias, 2022). This allows resources to be directed towards academic development.

Global spending on educational digital technology has increased from USD 227 billion in 2019 to a projected USD 404 billion in 2025 (HolonIQ, 2021). This nearly doubles the investment in six years. This figure highlights the rapid growth of digital transformation in education after COVID-19. Spending on digital infrastructure, such as learning management systems, educational analytics, and cloud services, has shown a significant jump and remains a key area of investment in the future development of educational models (Gary Moon, 2021).

Russia's full-scale war against Ukraine has created challenges for all spheres of life, including higher education. Universities, as centres of education, science, and human development, have found themselves in conditions requiring immediate adaptation to new realities (Osvita, 2024). One of the key tools that helped universities remain functional was digital transformation. Remote learning platforms, automated management systems, cloud services, and other digital solutions enabled universities to maintain stable operations even in the most challenging circumstances.

At the same time, it is important to address several problems in this area. Not all higher education institutions have enough resources to use modern digital solutions. In many regions of Ukraine, especially in areas with active hostilities, stable internet access is limited. This makes it harder for administrative staff to work and for students and teachers to communicate. Many universities have to create their own digital management strategies. This leads to a lack of standardization between educational institutions. The war causes stress for students, teachers, and administrators. This stress makes it harder to adapt to new digital tools and reduces the effectiveness of digital innovations. These problems need solutions to build an adaptive and sustainable management system of higher education. Such a system should work well during the war and continue to develop after the crisis.

LITERATURE REVIEW

The digital transformation of the system of higher education has become a critical research area due to global changes driven by information and communication technologies, crises like the COVID-19 pandemic, and wartime challenges. This article reviews key studies and highlights the role of digital technologies in education, the impact of martial law on the economy, the impact of war on the management system of higher education, and the application of bibliometric methods.

Researchers have extensively explored the integration of digital technologies into the management system of higher education. This includes automating processes, using e-learning platforms, and implementing strategies for digital transformation. For instance, Zagirnyak et al. (2022) examine challenges in organizing Ukraine’s higher education system. They emphasize that these challenges are even more pressing during post-war reconstruction, which requires advanced technological and innovative approaches. The study highlights digital transformation as a key factor in improving the management system of higher education, optimizing institutions, and implementing modern monitoring tools. Martynets et al. (2024) focus on digital technologies as a means to ensure the continuity of the management system of higher education during wartime. Similarly, Malysh et al. (2024) discuss strategies to enhance management efficiency, such as using digital platforms for coordinating resources and automating administrative tasks. These studies underscore the importance of digitalization in supporting education during crises (Verzhihovska et al., 2024; Hlazunova et al., 2024).

Bibliometric studies play a crucial role in understanding trends in the digitalization of the management system of higher education. They provide insights into scientific achievements, key development areas, and the evolution of approaches. For example, Muktiarni et al. (2023) explore the potential of the metaverse as a tool for digital transformation in education. Analysis of data from the Google Scholar database, covering 995 articles from 2013 to 2023, demonstrates a dynamic increase of interest in the topic. Türkistanli (2024) identifies leading countries, universities, and researchers contributing to the digitalization of education. The study confirms that the number of related publications is rapidly increasing, paralleling advancements in technology and industry. Additionally, Volk et al. (2024) examine the digitalization of financial education, linking it to broader trends in the management system of higher education. Their bibliometric analysis of publications from Scopus and WoS databases shows a surge in interest since 2020, fueled by global changes, the COVID-19 pandemic, and military conflicts. The keywords "e-learning" and "education AND digital technologies" are the most prominent in research, as evidenced by both the high number of publications and citations. The article also emphasizes that digital technologies contribute to the optimization of the management system of educational resources, expanding access to learning, and the integration of innovative methods.

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Thus, digital technologies have become a driving force for change in education management and the transformation of economic processes (Snejana, 2022). Universities must prioritize optimizing processes and incorporating digital tools into their operations (Borodiyenko et al., 2022).

Despite extensive research, there remains a need to scientifically define and analyze the impact of digitalization of the management system of higher education on the economic component.

AIMS AND OBJECTIVES

The study aims to analyze the impact and structure of research trends in the digital transformation of the system of higher education in Ukraine on the economy of martial law using a bibliometric approach.

The key objectives of the study are:

- a literature review on the digital transformation of management systems in higher education;
- a bibliometric analysis of publications in the Scopus database related to the digitalization of the management of higher education institutions during the war in Ukraine;
- identifying the main trends, key areas of research dealing with the challenges of digital transformation of management systems in socio-economic crisis situations using Google Trends;
- data visualization.

METHODS

The research focuses on a comprehensive bibliometric analysis. This allows for the exploration of key aspects of the implementation and use of digital transformation in universities during wartime.

The analysis is based on a sample of scientific documents indexed in the Scopus database. This approach allows for the identification of key research topics related to the digitalization of management systems in universities under socio-economic crisis conditions in a wartime economy. Initially, the research presents a quantitative analysis of scientific publications based on the keyword combinations: "digitalization", "digital transformation", "digital technologies", "education", "e-learning", "online learning", "teaching", "pedagogy", "university", "study", "management" (for the period 1951-2024) and the combination of "digitalization", "digital transformation", "digital technologies", "education", "e-learning", "online learning", "teaching", "pedagogy", "university", "study", "war", "conflict", "post-war recovery", "management", "Ukraine" (for the period 2020-2024). The Russian Federation is excluded from the search. In the authors' opinion, it is inappropriate to analyze materials from this country. The keyword combination is large because the search should cover most of the research. This analysis allowed for the identification of 15096 and 38 scientific papers, respectively as of December 31, 2024 (Table 1).

Table 1. Quantitative bibliometric analysis of scientific publications. *(Source: compiled by authors formed on the Scopus database)*

Research request	Number of works
("digitalization" or "digital transformation" or "digital technologies") and ("education" OR "e-learning" or "online learning" or "teaching" or "pedagogy" or "university" OR "study") and "management"	15096
("digitalization" or "digital transformation" or "digital technologies") and ("education" or "e-learning" or "online learning" or "teaching" or "pedagogy" or "university" or "study") and "management" and "Ukraine" and ("war" or "conflict" or "post-war recovery")	38

Subsequently, the study employs state-of-the-art tools such as VOSviewer v.1.6.20 for data visualization and Google Trends for analyzing global trends. VOSviewer created a network of relationships between keywords and allowed this study to perform a cluster analysis of the keyword network. Google Trends showed the dynamics of Internet searches for the keywords "digitalization", "digital transformation", "digital technologies", "education", "e-learning", "online learning", "university", "study", "war", "conflict", "post-war recovery", "Ukraine", "university management", "education management", "higher education management" and "personnel management" over the last 5 years in Ukraine and in the world.

RESULTS

The first keyword combination yielded 15096 publications, which is 397 times more than the number of publications for the second which comprised only 38 results. This significant difference can be attributed to factors related to the history of digitalization in education.

Digitalization in universities and educational institutions began to be actively implemented since the beginning of the COVID-19 pandemic, posing a global challenge to traditional educational models. During this period, digitalization in education gained widespread popularity in Ukraine and worldwide. Universities began to integrate innovative tools for automating processes, managing educational activities, and supporting online learning. Simultaneously, businesses and various sectors of the economy also utilized digital solutions. This has resulted in a large volume of research on this topic.

In contrast, the second combination has significantly fewer publications. This is because war is a more localized phenomenon compared to a global pandemic. The pandemic affected the entire world, while the full-scale war of Russia against Ukraine focused its destructive impact primarily on the territory of Ukraine. This topic is new and less studied. Researchers have only recently focused on the problems caused by the war: forced digitalization, adaptation of university management to crisis conditions, and ensuring the continuity of the educational process in the face of destruction.

Immediately following the full-scale invasion of Ukraine by Russian troops, the Ministry of Education and Science of Ukraine (2022) recommended suspending educational activities at all levels of educational institutions. They also proposed sending students and educators on a two-week vacation. This was done to allow universities to adapt to the new conditions and address management challenges, such as planning, organization, and motivation.

Since the beginning of the full-scale war and approximately until the end of March 2022, EdTech businesses based in Ukraine completely suspended their operations. In April 2022, the market began to revive, and by the end of the month, the demand for private education had almost returned to pre-war levels. Many people were forced to relocate to other cities and countries, where they were unable to find work in their field. Online learning allows them to quickly acquire new skills and work remotely.

Frequent changes across all industries, particularly during the war, create ongoing needs for new education – both personal and corporate. As a result, new products are emerging – from full-fledged multi-month courses to short intensives aimed at improving skills. This is what is currently helping EdTech companies not only stay afloat in the market but also grow, thereby confirming the economic effect generated by the implementation of new transformational technologies.

In the first half of the war, Ukrainian universities actively established international partnerships, received grants to provide access to foreign language education, and continued Erasmus+ programs on digitalization, as well as sent lecturers for internships abroad (Tavria State Agrotechnological University, 2023).

As early as spring 2022, higher education institutions resumed the educational process, primarily in a remote format (82%), with some institutions adopting a blended (in-person and online) format (18%) (Figure 1). At the beginning of the 2022/2023 academic year, 39% of institutions provided education online, 42% in a blended format, and 19% in-person (State Service for Quality of Education in Ukraine, 2023).

Given the rapid implementation of remote and blended learning formats in higher education institutions in Ukraine, the digitalization of the educational environment has begun to play not only an academic but also a significant economic role. The mass transition to digital platforms has led to an increased demand for educational technologies, the development of national IT solutions in the field of education, the creation of courses, and the activation of investments in digital infrastructure. This, in turn, has positively impacted related sectors of the economy, including the software industry, telecommunications, the production of digital devices, and support services. Such digital intensification leads to the creation of new jobs in the EdTech sector, contributes to increasing digital literacy among young people, and also creates conditions for scaling Ukrainian educational projects at the international level.

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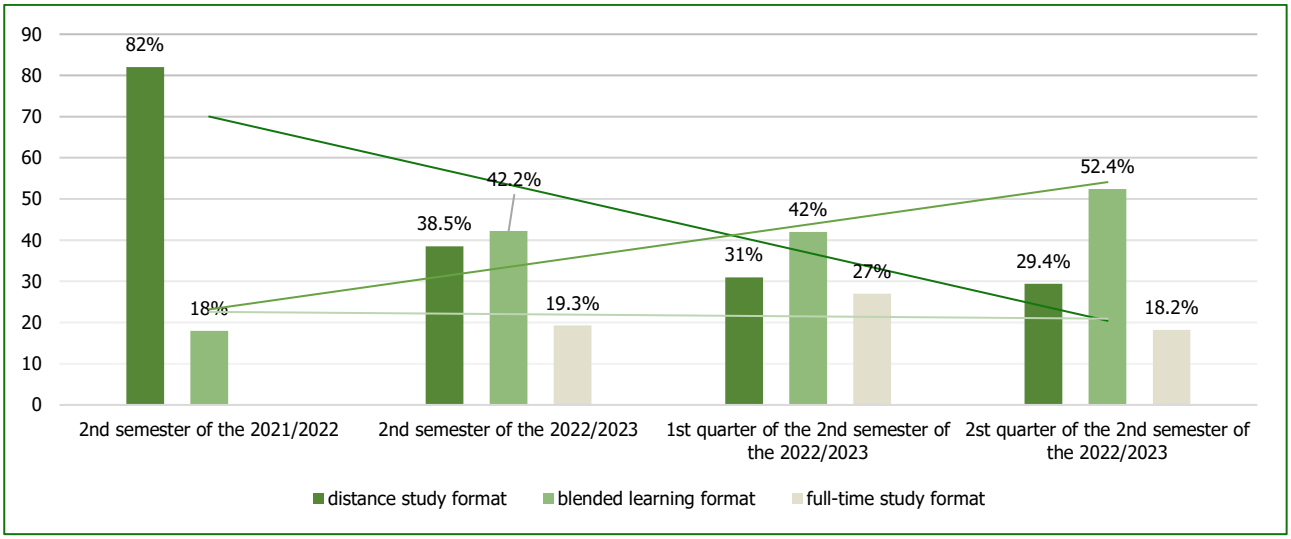

Figure 1. Formats of education in institutions of professional pre-higher and higher education in Ukraine for the period 2021-2023. *(Source: compiled by the authors based on data from the State Service for Quality of Education of Ukraine)*

In general, during the period of martial law, there is a decrease in the use of distance learning in all higher and vocational pre-higher education institutions in Ukraine. Preference is given to the blended format. It is close to full-time and allows you to effectively achieve the expected learning outcomes.

The State Service for Quality of Education in Ukraine (2023) conducted a survey on the organization of the educational process and the quality of education during wartime. The survey results indicate a satisfactory provision of educational services under difficult wartime conditions. The majority of respondents, both teachers (91%) and students (65%), positively assessed the organization of the educational process in the 2022/2023 academic year compared to the previous one.

Figure 2 shows the dynamics of the number of publications from 2020 to 2024 for the keyword combination "digitalization", "digital transformation", "digital technologies", "education", "e-learning", "online learning", "university", "teaching", "pedagogy", "study", "war", "conflict", "post-war recovery", "management", "Ukraine".

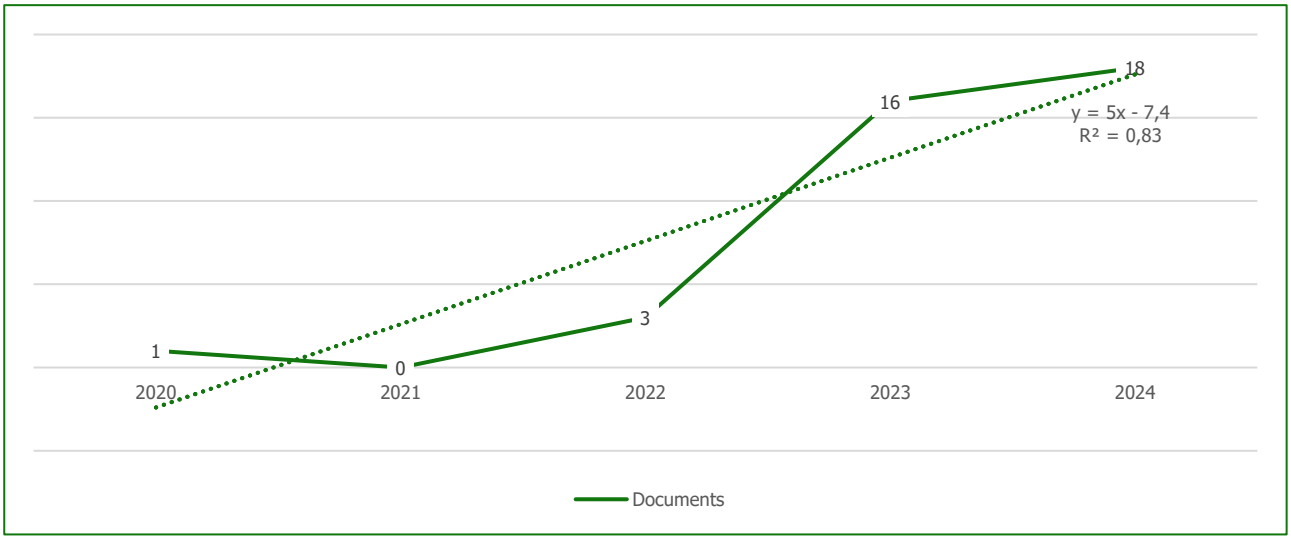

Figure 2. Dynamics of scientific publications 2020-2024 selected using keywords, indexed by the database Scopus. *(Source: compiled by authors formed on the Scopus database)*

The linear regression equation y=5x-7.4, with a coefficient of determination R^2=0.83, characterizes the dynamics of the number of publications over the years. The number of studies in this field is increasing by approximately 5 units each year. The coefficient of determination R^2=0.83 indicates that the model explains 83% of the data variation. It shows that time is an important factor, but there are other significant factors that influence the number of publications. This could be the subject of further analysis. Therefore, the chosen research topic is relevant and is undergoing intensive development.

In the Scopus database, Ukraine is the leader in terms of published scientific works with 30 documents. Poland is the second country with 3 documents, followed by Germany, Italy and Kyrgyzstan with 2 documents each (Figure 3).

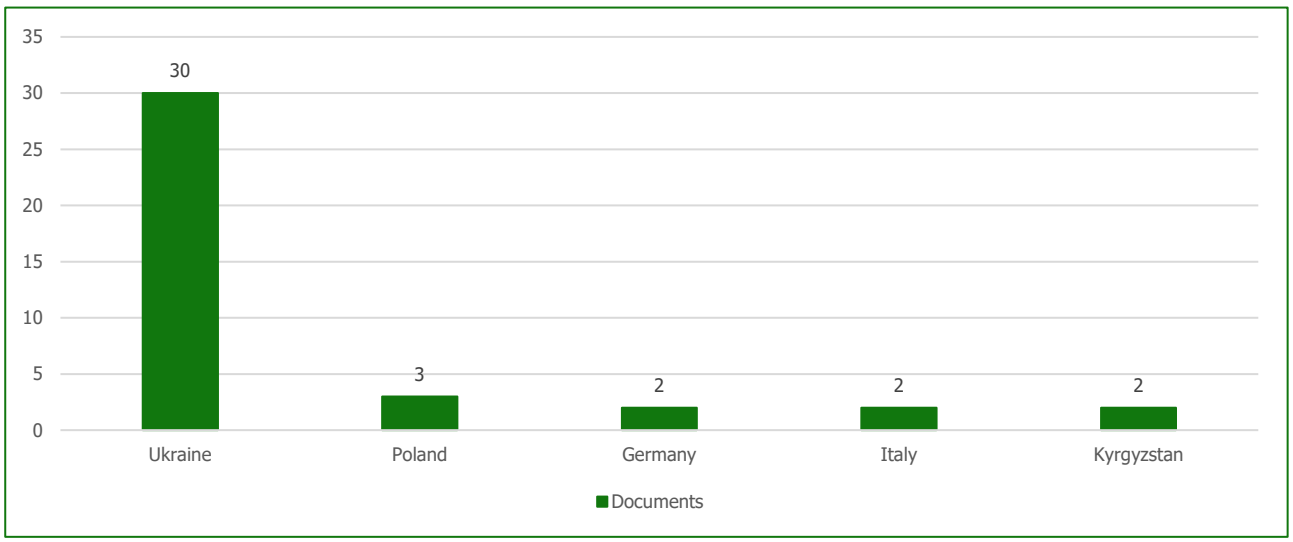

Figure 3. Publications within countries, indexed by the database Scopus (Top 5). *(Source: compiled by the authors formed on the Scopus database)*

Ukraine produced the highest number of publications related to the digitalization of the management system of higher education The full-scale war of Russia against Ukraine has significantly impacted the country's education system, forcing universities to rapidly adapt to new realities. The destruction of infrastructure, the displacement of faculty and students, and the need to ensure the continuity of the educational process during the crisis have served as a powerful impetus for the implementation of digital innovations (Levantovich & Kovaleva, 2023). In these circumstances, digitalization has become a crucial tool for preserving the country's educational and economic potential.

The significant interest in this topic in Ukraine can be explained by the considerable activity of researchers who are studying the impact of the war on the education system and developing solutions for its modernization. Publications highlight the issues of distance learning, the university management system during wartime, the application of new digital platforms, and the adaptation of educational infrastructure to socio-economic crisis situations.

The Verkhovna Rada of Ukraine adopted a law (2022) that initiates digital interaction between educational management bodies at all levels, institutions, and participants in the educational process. This is implemented through the software and hardware complex "Automated Information Complex of Educational Management" (AICEM). This law aims to accelerate the digital transformation of the management system of education and at the same time promote economic impact. AICEM simplifies the work of teachers with documentation and paper reporting. Automating processes such as reporting, monitoring the quality of education, and managing human and financial resources helps educational institutions use budget funds more efficiently and transparently. This complex also provides for the transfer of key management processes to an electronic format. Through information interaction, participants in the educational process can make timely and high-quality management decisions, form and implement educational policy, and address issues of distribution and redistribution of inter-budgetary transfers, ordering textbooks, educational documents, enrollment, dismissal, and transfer of students (Institute of Educational Analytics, 2022). Also, the state and businesses are creating new ways to work together in digital services and cybersecurity.

Thus, the full-scale war has become a catalyst for change in education and the economy and an increase in academic activity in the field of digital transformation research. This is reflected in the number of publications from Ukraine.

Before the war, Ukraine was a popular study destination for foreign students. According to the educational search platform Erudera (2022), in 2019, there were 80470 foreign students in Ukraine. After the full-scale invasion, universities abroad began to create various opportunities for Ukrainian students (Erudera, 2022). They offered support to Ukrainian universities, students, faculty, and researchers, proposed participation in various educational programs, and provided additional financial support (Nazarenko, 2022). In some countries, there were special programs, such as the "Solidarity with Ukraine" program (Nawa, 2022), which allowed students to continue their studies in Poland.

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A sectoral distribution analysis (Figure 4) highlights that research related to this topic spans several disciplines. The largest share of publications is in the field of Business, Management and Accounting (16%), showcasing the role of organizational studies in this field. Economics, Econometrics and Finance (14%) demonstrate the broader application of digitalization in the economic sector. Social Sciences contribute 14% of the publications, underlining the emphasis on the societal and managerial aspects of education.

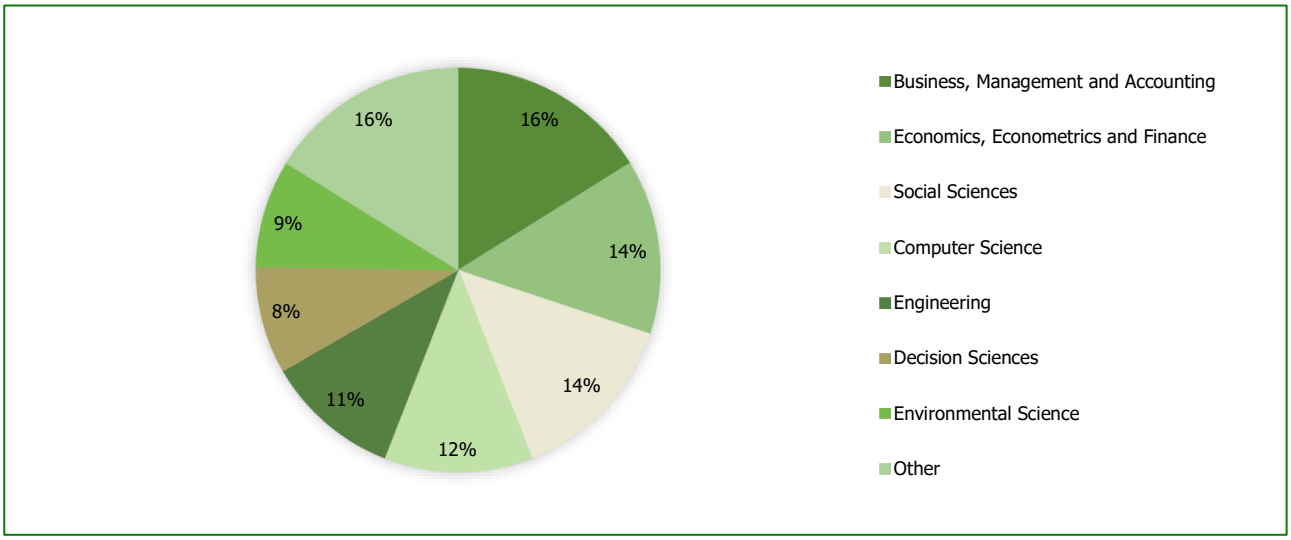


Figure 4. Distribution of scientific publications by sectors selected using, and indexed by the database Scopus. *(Source: compiled by the authors formed on the Scopus database)*

Figure 5 shows the distribution of indices by organizations and funding programs for research. These indices focus on the analyzed area of digital transformation of the management system in universities during wartime.

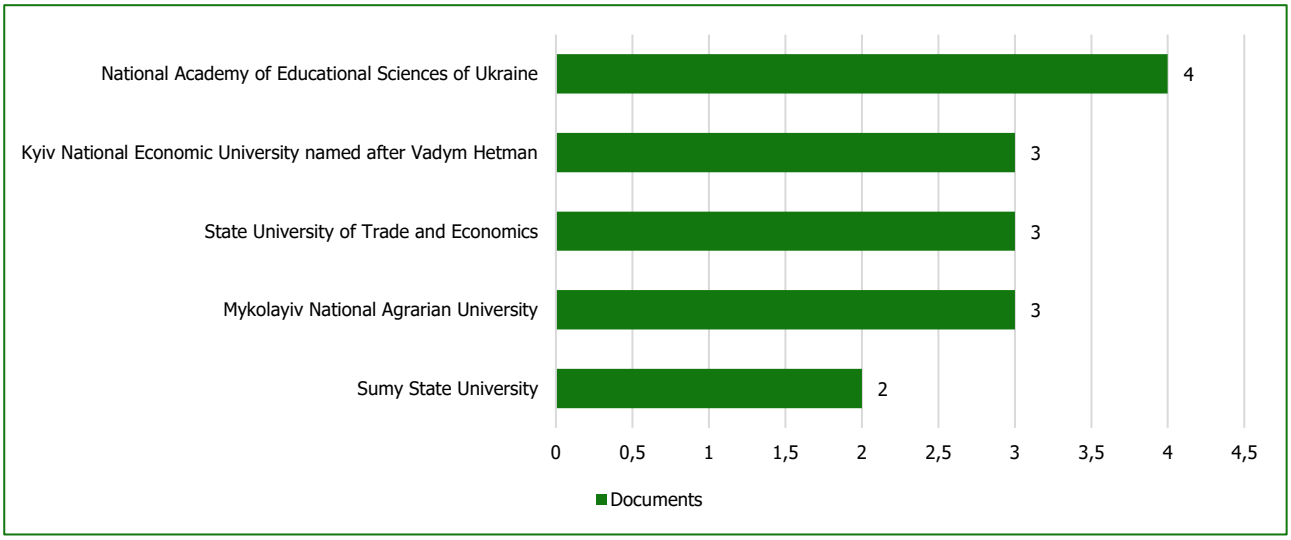


Figure 5. Documents by Funding Sponsor, indexed by the database Scopus. *(Source: compiled by the authors formed on the Scopus database)*

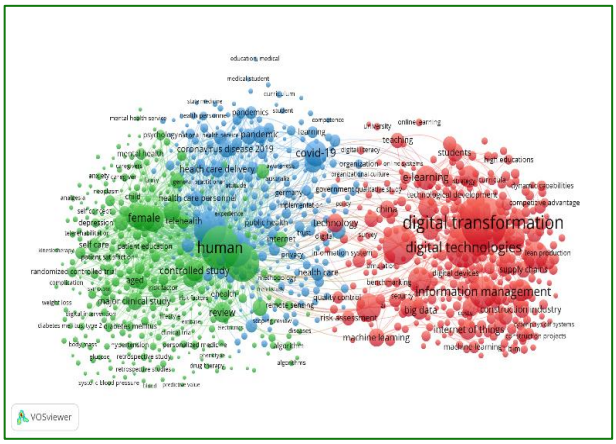
Sumy State University transitioned to online learning at the beginning of the full-scale war. On March 12, 2022, enemy aviation dropped five bombs near the university buildings. Over 100 windows were damaged. Staff and students quickly eliminated the consequences of the bombings. The university continues to operate. Bomb shelters for students, faculty, and city residents are located on the territory of Sumy State University. Since February 24, 2022, staff have sent more than 2000 targeted letters to international partners with truthful information about the war in Ukraine. All the university's social media networks are fully operational, informing people abroad. They also support all Ukrainians with patriotic content, and advice from psychologists and medical professionals (News.Sumdu, 2022).

Many universities during the war began to develop digital skills for the benefit of students and university staff. For example, on the initiative of the Kyiv School of Economics (2022), the Ukrainian Global University project was created. It aims to

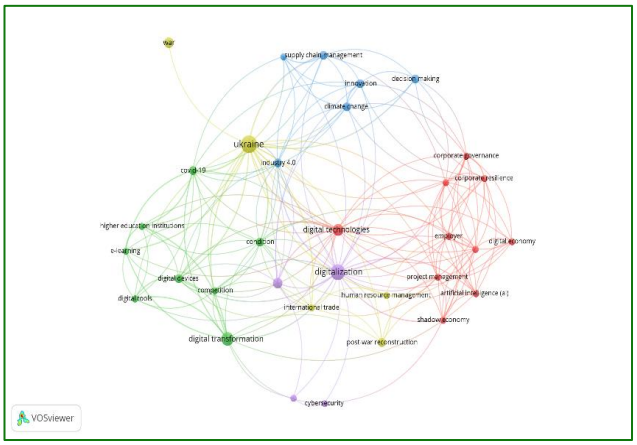
provide Ukrainian students, scientists, and faculty with the opportunity to join digital programs of foreign universities and institutions.

For example, the National University of Kyiv-Mohyla Academy announced the opening of its campuses in Europe and North America, where 500 students can study each semester (Nazarenko, 2022). The Kyiv-Mohyla Academy launched the Global Kyiv-Mohyla Academy project (2022). The goal of the project is to establish the Academy as a global open university, where courses and disciplines will be taught jointly with the best European and North American higher education institutions in a blended, online, and offline format. The first 20 students have already arrived to study at the University of Toronto.

The next stage of the study shows a visualization map of relationships using the VOSviewer 1.6.20 tool based on data selected from the Scopus database (Figure 6). For the visualization process, the authors performed an analysis of keyword co-occurrence. This reflects common terms in the titles and abstracts of publications. This helps to identify the most common topics and concepts.



a) ("digitalization" or "digital transformation" or "digital technologies") and ("education" OR "e-learning" or "online learning" or "teaching" or "pedagogy" or "university" OR "study") and "management"



b) ("digitalization" or "digital transformation" or "digital technologies") and ("education" or "e-learning" or "online learning" or "teaching" or "pedagogy" or "university" or "study") and "management" and "Ukraine" and ("war" or "conflict" or "post-war recovery")

Figure 6. Visualization of the network of keyword relationships according to the combination of words. *(Source: compiled by the authors formed on VOSViewer v.1.6.20)*

Figure 6a shows the growing interest of scholars in the digitalization of education, reflected through a dense cluster of terms related to "digital technologies", "e-learning" and "information management". This indicates the desire of researchers to find effective approaches to implementing digital tools in the educational process to ensure its continuity even in times of crisis. Particular attention is paid to the development of online learning methods, which emphasizes the relevance of distance education.

Figure 6b presents the interest in the digitalization of management in higher education. Researchers analyze how digital technologies can transform university management processes, increasing their efficiency and adaptability. Particular attention is paid to the integration of digital tools in personnel management, resource optimization and improving strategic planning in educational institutions. Such studies emphasize the importance of digital transformation for increasing the competitiveness of universities, as well as for creating flexible and sustainable management systems in conditions of constant change and challenges.

To ensure the relevance and accuracy of the research, the data underwent a cleaning process: duplicate keywords with similar meanings were merged, and those related to countries and medicine were excluded. The 980 and 33 keywords were grouped into clusters each according to the visualization in Figure 6a and Figure 6b. Table 2 presents these clusters.

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Table 2. Combinations of keywords in research clusters. *(Source: compiled by the authors formed on VOSViewer v.1.6.20)*

Clusters color	TOP Keywords a)	Number of terms	Explanation	TOP Keywords b)	Number of terms	Explanation
	Business model innovation, crisis management, digital innovations, digital transformation, e-learning, human resources management, university	360	This cluster reflects the connection between digital technologies, innovations, and their impact on the economy, education, and society, emphasizing the adaptation of educational technologies and e-learning to the conditions of Industry 4.0, war, and socio-economic transformations	Artificial intelligence (AI), digital economy, digital technologies, project management	10	This cluster demonstrates the growing scientific interest in the application of artificial intelligence and digital technologies in project management and the development of the digital economy. Attention is paid to the impact of digital innovations on economic models, which emphasizes the importance of adapting to new technological challenges
	Devices, digital technology, risk factors, smartphones	353	This cluster reflects the connection between the use of digital devices and technologies and potential risks	Covid-19, digital devices, e-learning, higher education institutions	8	This cluster highlights the relationship between the COVID-19 pandemic, digital transformation, and the shift towards e-learning, emphasizing its influence on education management, higher education management, and university management in adapting to new educational needs and challenges
	Article, communication skill, COVID-19 pandemic, financial management, information technology	267	This cluster highlights the global impact of the pandemic on the academic environment and research activity	Industry 4.0, innovation, supply chain management	6	This cluster reflects the relationship between the fourth industrial revolution, innovative approaches and supply chain management
	-	-	-	Human resource management, post-war reconstruction, Ukraine, war	5	This cluster reflects the scholarly interest in human resource management issues in the context of post-war reconstruction, particularly in Ukraine. Researchers analyze how the war affects the labour market, workforce adaptation, and economic recovery strategies
	-	-	-	Digitalization, public administration, sustainable development, cybersecurity	4	This cluster reflects the scientific interest in the digitalization of public administration as an important tool for achieving sustainable development

Figure 7 illustrates the density of research connections between keyword concepts based on publications in the scientometric database Scopus.

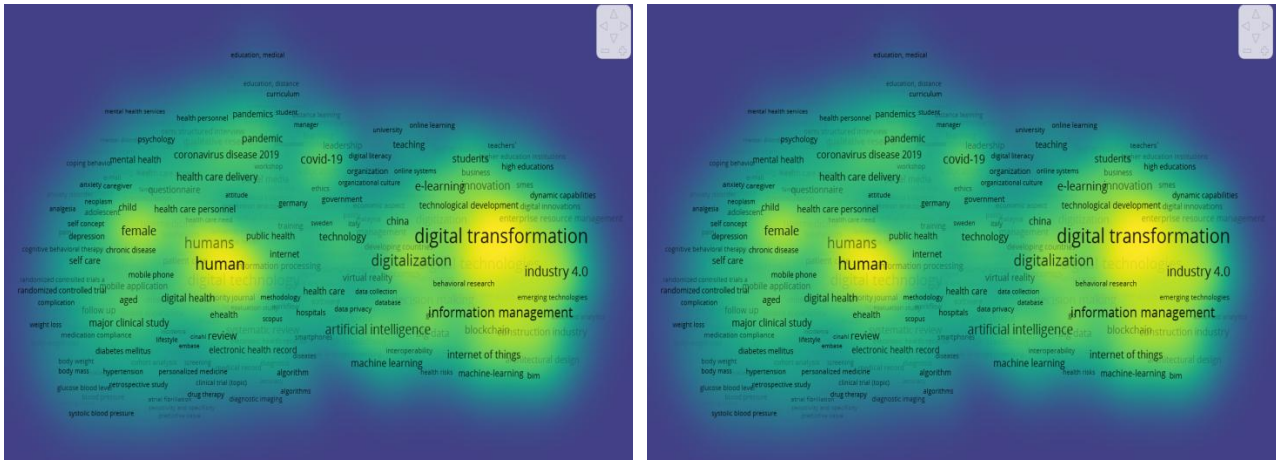
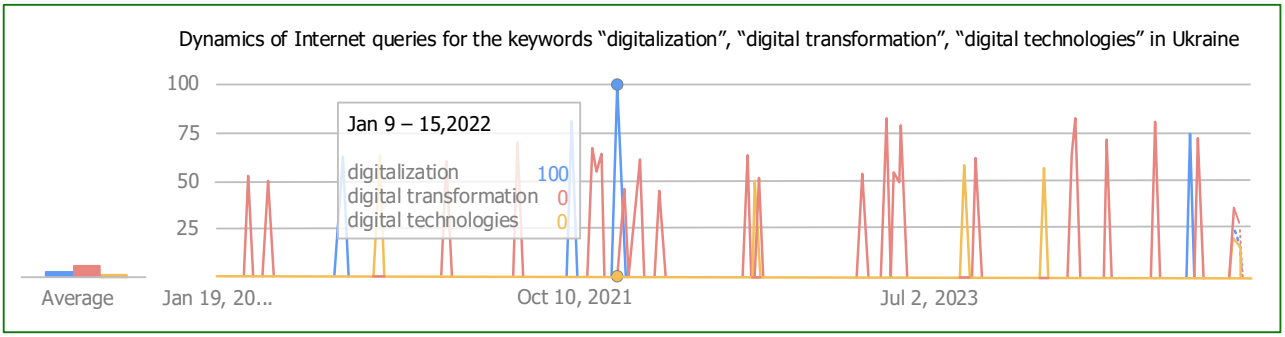
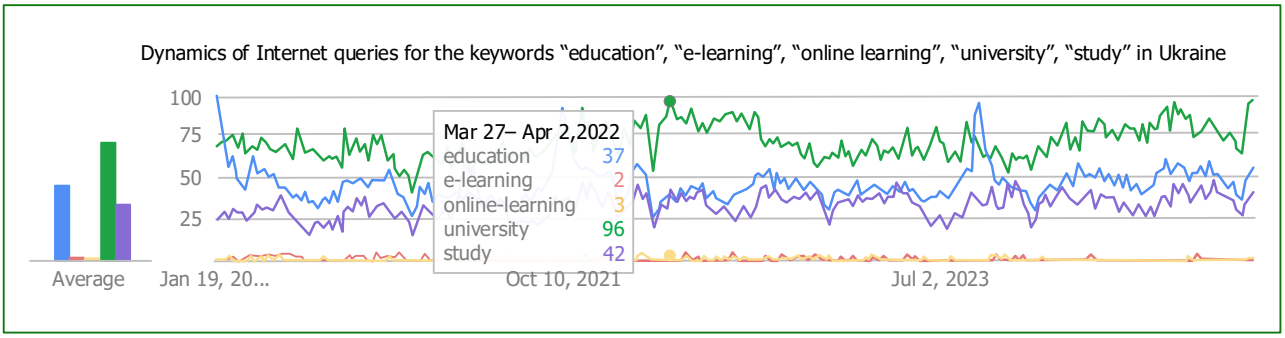


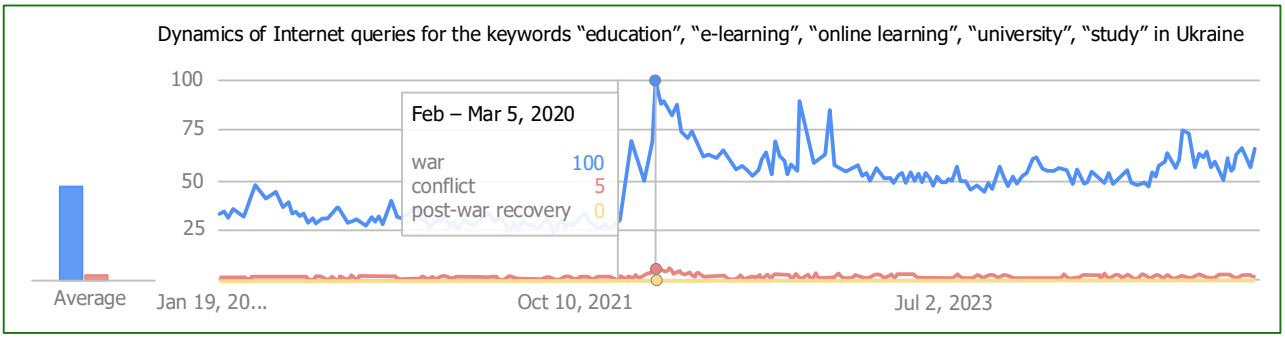
Figure 7. Density maps. *(Source: compiled by the authors formed on VOSViewer v.1.6.20)*

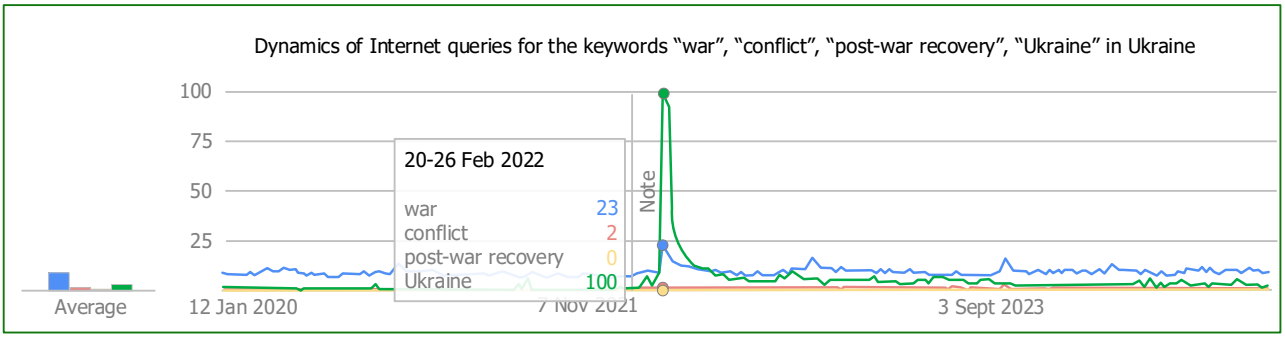
Consequently, the density maps illustrate that the concepts of yellow and pale yellow exhibit a strong correlation with the aforementioned clusters. This indicates a direct relationship.

Furthermore, to enrich the analysis, the Google Trends tool was employed. The study examined the co-occurrence of the terms "digitalization", "digital transformation", "digital technologies", "education", "e-learning", "online learning", "teaching", "university", "study", "war", "conflict", "post-war recovery", "Ukraine", "university management", "education management", "higher education management" and "personnel management" both in Ukraine and globally over the past five years (November 24, 2019 – October 16, 2024) to facilitate a more in-depth exploration. For further analysis, the keywords with the highest average scores were selected among related keywords. Both Ukraine and the global community demonstrated a surge in interest in "digital transformation" (blue line), "university" (red line), "war" (yellow line) and "Ukraine" (green line) specifically between February 27 and March 5, 2022 (Figure 8).









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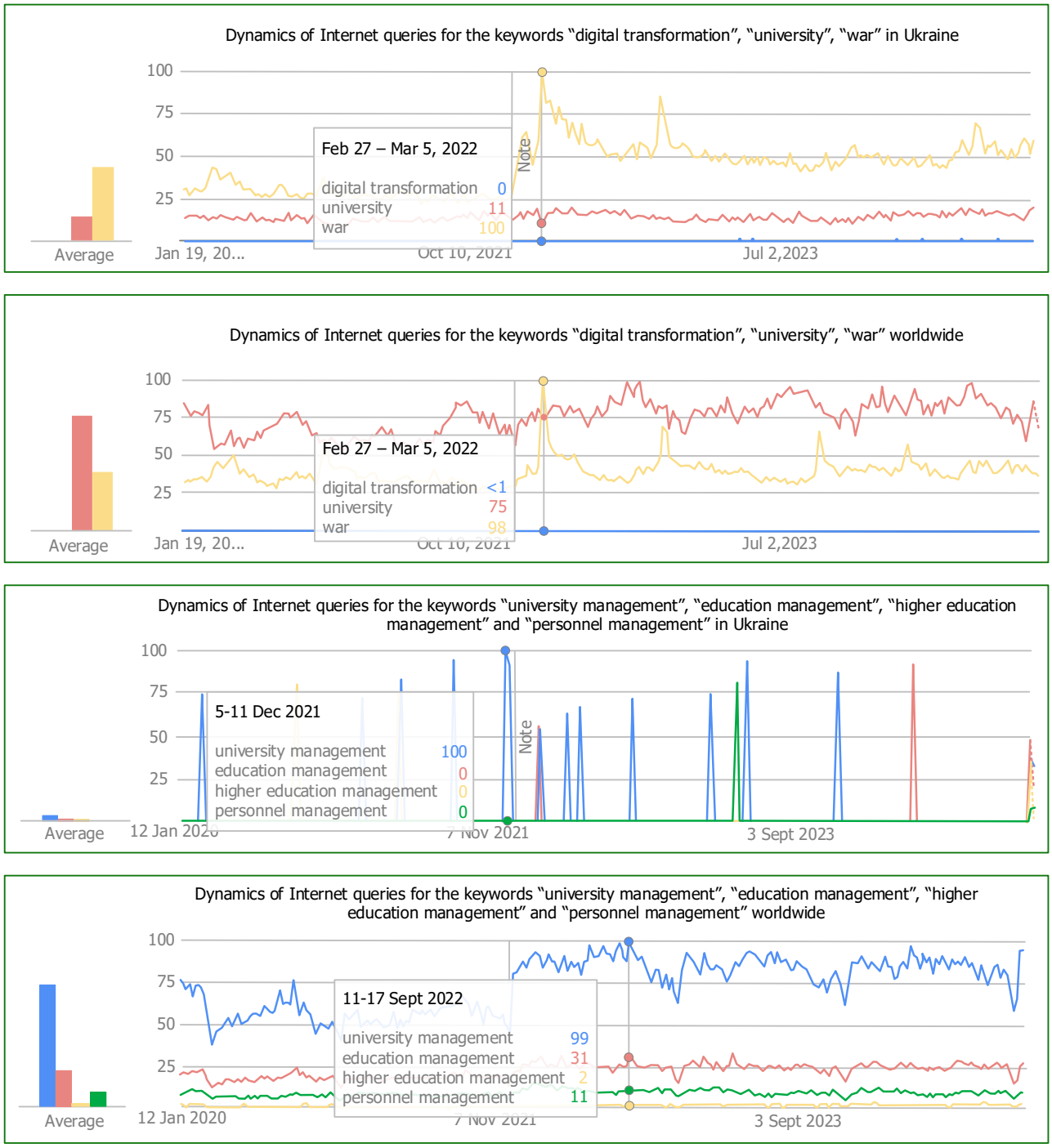

Figure 8. Dynamics of Internet keyword queries over the last 5 years. *(Source: compiled by the authors formed from Google Trends)*

The dynamics of internet queries for the keywords "university management", "education management", "higher education management", and "personnel management" reveal notable trends both in Ukraine and globally. In Ukraine, "university management" consistently dominates as the most searched term, reflecting heightened interest in digital management practices amidst the challenges posed by the war and socio-economic recovery efforts. Comparatively, global search trends show a similar pattern, with "university management" maintaining high search volumes, followed by "education management", which displays moderate but consistent interest. Searches for "higher education management" and "personnel management" remain relatively lower both in Ukraine and worldwide, but they demonstrate slight fluctuations in response to specific events or periods, such as the COVID-19 pandemic and geopolitical crises. These trends underscore the critical role of digital and strategic management systems in adapting to evolving educational and administrative needs.

DISCUSSION

Despite the relevance of the topic, the keyword combination "digitalization", "digital transformation", "digital technologies", "education", "e-learning", "online learning", "teaching", "pedagogy", "university", "study", "management", "war", "conflict", "post-war recovery", "Ukraine" yielded only 38 indexed in Scopus, highlights a gap in the intersection of digital transformation and management systems within higher education, indicating a need to bridge the knowledge deficit in world and in Ukraine.

Google Trends shows that people's internet search activity changes over time. The highest search volume occurred in 2022, during the early stages of Russia's full-scale invasion of Ukraine. This was a critical period as the global community and Ukraine's education system faced major challenges.

To keep education going despite the conflict, Ukrainian universities and schools quickly shifted to digital platforms. This change led to a spike in search queries related to both education and the war. Many people searched for information about online courses, video conferencing, and new tools for remote learning. At the same time, the war increased interest in topics like security, crisis management, and humanitarian aid. This period highlighted the strong connection between digital transformation and educational management during wartime, making it a key moment for studying how these processes interact.

The bibliometric analysis shows that combining digital technologies with the management system of higher education is strongly linked to addressing crisis management challenges. This aligns with Kuzheliev et al. (2023), who highlight that digitalizing the education sector is essential for adapting to wartime conditions. Many publications focus on key areas such as using distance learning platforms, improving digital skills for teachers and administrators, and ensuring information security. Similarly, Bakhmat et al. (2023) point out that digital transformation during crises strengthens the resilience of the education system. However, implementing these changes often comes with technical and financial difficulties. As technologies like artificial intelligence and cloud services advance, approaches to digitalization are also evolving. This observation agrees with Kosovets et al. (2024), who emphasize the importance of adapting digital strategies to new technological developments.

Future studies should explore how to integrate innovative digital tools to make the management system of higher education more adaptable, especially in the post-crisis period.

CONCLUSIONS

The study aimed to analyze and structure research trends in the digital transformation economic processes in the higher education management systems in wartime Ukraine through bibliometric analysis using the Scopus database, VOSviewer, and Google Trends. The analysis showed a direct connection between digital transformation and the management system of higher education and showed the impact of martial law on the economy at the state and individual university levels in Ukraine. At the beginning of the article, a quantitative analysis of scientific publications was conducted using the keywords "digitalization", "digital transformation", "digital technologies", "education", "e-learning", "online learning", "teach-ing", "pedagogy", "university", "study", "management", "war", "conflict", "post-war recovery" and "Ukraine". The bibliometric analysis of the digital transformation of higher education management systems was based on the analysis of 38 scientific articles selected by relevance and citation. Results show a positive trend in the number of publications between 2020 and 2024. The linear regression equation $y=5x-7.4$ and the coefficient of determination $R2=0.83$, based on the dynamics, showed an increase in scientific documents each year. An analysis of scientific publications confirmed a growing interest in the implementation of digital technologies in the management system of higher education starting in 2020. The COVID-19 pandemic and military operations played an important role in the growth of research dynamics. Ukraine leads in the number of related publications in the Scopus database. This leadership reflects the country's direct experience with these developments, as described by Ukrainian researchers. Further, the study structured publications by branching. The dominant place in terms of the volume of scientific publications in scientific fields is occupied by Business, Management and Accounting, Economics, Econometrics and Finance, and Social Sciences. The research showed the formation of a new educational-economic space, in which education is transforming into a self-sufficient industry with a high degree of integration into the digital economy. Digitalization not only reduces the operational costs of educational institutions but also opens new sources of income – from the sale of licenses for educational products to participation in international educational markets. Next, the study presents a visualized map of the relationships between the keywords using the VOSviewer tool. The map groups keywords into clusters, among which key areas are the development of online learning, the integra-

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tion of innovative platforms, adapting university processes to wartime conditions, and improving the economy and management efficiency through digital tools, which is especially crucial against the backdrop of a gap in the intersection of digital transformation and management systems within higher education, highlighted in the analysis of Scopus publications. An analysis using the Google Trends tool showed a trend in internet searches for the keywords among people around the world and in Ukraine. The peak of interest coincided with the period of February 27 – March 5, 2022. Analysis of search query dynamics using Google Trends confirmed the dynamics of the growth of public interest in the digitalization of the management system of higher education. Future studies could expand the analysis by including documents from other databases, such as WoS or Google Scholar, and by using other bibliometric software, as well as by extending the analysis period. This expansion will provide a more comprehensive understanding of the trends in economic processes of digital transformation across different educational contexts.

ADDITIONAL INFORMATION

AUTHOR CONTRIBUTIONS

All authors have contributed equally.

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CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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ВПЛИВ ЦИФРОВОЇ ТРАНСФОРМАЦІЇ НА ВИЩУ ОСВІТУ В УМОВАХ СОЦІАЛЬНО-ЕКОНОМІЧНОЇ КРИЗИ В УКРАЇНІ

У статті розглянуто вплив цифрової трансформації на економічні процеси в системі вищої освіти України. Процес цифрової трансформації вищої освіти в Україні, значно активізований повномасштабною війною, супроводжується рядом економічних ефектів, які підтверджують її потенціал як інструмента стабілізації та розвитку в умовах соціально-економічної кризи. Ця робота має на меті проаналізувати та структурувати дослідницькі тенденції, пов'язані з цифровою трансформацією системи вищої освіти в Україні, використовуючи бібліометричний підхід, і показати вплив їх застосування на економіку. З цією метою було використано програмне забезпечення VOSviewer для оцінки академічних публікацій у базі даних Scopus, що дозволило вивчити й візуалізувати взаємозв'язки між ключовими термінами в цій галузі. Крім того, Google Trends використано для оцінки популярності ключових пошукових запитів, що дало розуміння суспільного інтересу до теми. Аналіз базується на наукових публікаціях, індексованих у базі даних Scopus. Аналіз підкреслює значне зростання наукового інтересу до цифрової трансформації економічних про-

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цесів в університетах у всьому світі за останні роки. Дослідження показує, що Україна є лідером за кількістю публікацій, присвячених цифровим технологіям навчання в економіках воєнного часу. Виклики, з якими зіткнулися університети, починаючи з пандемії COVID-19 і закінчивши війною, значною мірою сприяли зростанню уваги науковців до підвищення ефективності надання вищої освіти. Отримані дані свідчать про те, що, незважаючи на поточну ситуацію, Україна продовжує впроваджувати механізми цифрової трансформації й на державному, і на приватному інституційному рівні. Це дослідження закладає основу для майбутніх досліджень цифрової трансформації освіти під час кризи та післявоєнного економічного відновлення.

Ключові слова: трансформація економічних процесів, економічний вплив цифровізації, трансформація вищої освіти, соціально-економічна криза, цифрові технології, бібліометричний аналіз

JEL Класифікація: H56, I23, O33