



Digital Transformation of Business Processes: Data Analysis and Visualization with VOSVIEWER

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ABSTRACT

This paper examines the possibilities of integrating digital technologies to improve the efficiency of a company's core business processes. The focus is on implementing innovative solutions, process automation, and data analysis. To identify key areas and trends, the software VOSviewer is used to visualize scientific data, analyze relationships, and identify areas for digitalization. The aim of the study is to propose recommendations that will contribute to creating the competitiveness of enterprises in the context of digitalization.

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1. Introduction

Digitalization is becoming a key factor in the success of modern businesses. The effective implementation of digital technologies can not only automate core processes, but also significantly reduce costs, improve product and service quality, and increase customer satisfaction. The use of data visualization tools such as VOSviewer opens up new perspectives for analysis and strategic planning. The integration of digital technologies plays a key role in improving the efficiency of companies' core business processes [1].

In this research, we will focus on analyzing and identifying effective strategies for implementing digital technologies in organizational work processes using modern visualization tools. Through a systematic review of scientific publications, keywords and dominant groups were identified that provide valuable insights into current trends and areas of interest in the field. VOSviewer was used to visualize these results, allowing a clear understanding of relationships and patterns in the data.

2. Research methodology

Metadata from 11801 publications were exported from the Web of Science (WoS) database using the following query: "TITLE: ("Digital Technologies" OR "Business Process Optimization" OR "Core Business Processes" OR "Organizational Effectiveness" OR "Digital Transformation" OR "Process Improvement" OR "Business Process Reengineering " OR "Improvement Processes" OR "Effectiveness"), time frame: 2021 – March 2025. Indices: SCI - EXPANDED, SSCI, CPCI - S, ESCI, quotes in management. Building keyword appearance networks and their clustering using VOSviewer 1.6.20 [2].

The minimum number of keywords selected for consideration was ten. And full number of keywords in the 11801 publications analyzed (authors and keywords Plus generated by WoS) is 10089. The number of keywords that appear at least 10 times is 945, and these were analyzed further.

3. Research results

Figure 1 shows the distribution of publications for 2021 – March 2025, found based on the same criteria in the WoS database. A total of 11,801 cited publications in the field of management were found, divided into the following categories: Business Administration, Operations Research, Management Science, Industrial Engineering, Information Science, Economics, Information Systems, Computer Science, Applied Psychology, Library Science, Environmental Science and Engineering.

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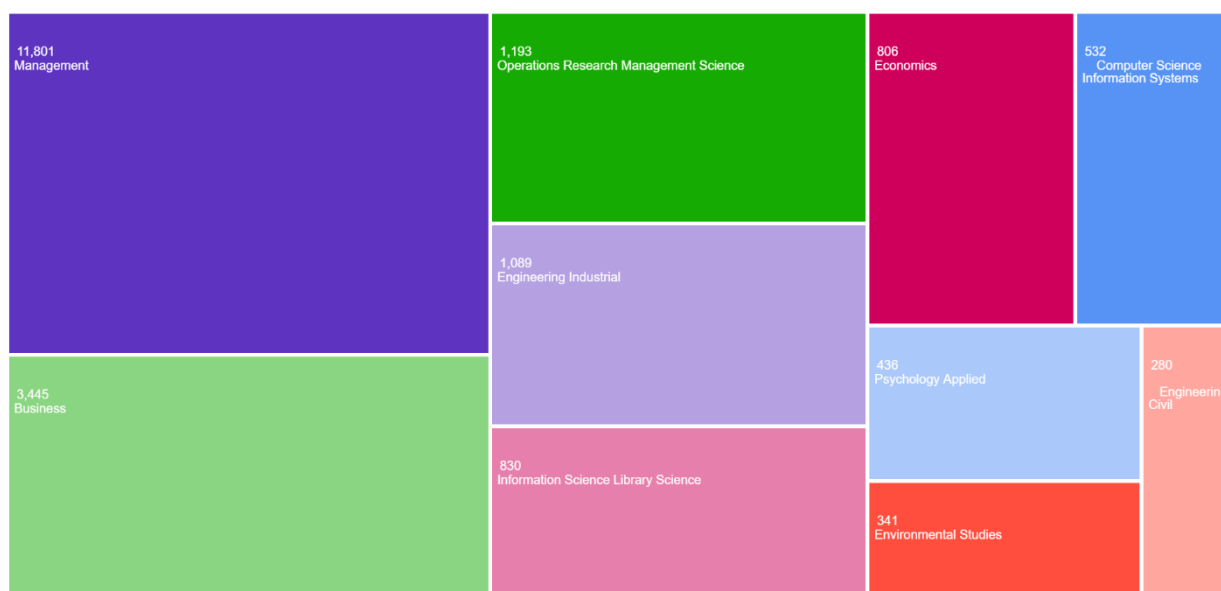


Figure 1. Number of publications in the most important knowledge areas in WoS

Source: authors adapted from WoS

During the analysis, the spelling of the keywords was not translated into Romanian to preserve their original meaning. To reduce the number of clusters in which the keywords are aggregated, an additional limitation was introduced, namely that the total link strength must be at least 100.

Table 1 presents the integration of digital technologies to increase the efficiency of the company's core business processes, with a particular focus on analysis and development of effective solutions using modern approaches and technologies, visualized with the help of VOSviewer.

Table 1. The 40 most frequently occurring keywords in a sample of 11801 metadata

No.	Keyword	Occurrences	Total link strength	No.	Keyword	Occurrences	Total link strength
1	performances	1838	10887	21	capabilities	334	2089
2	impact	1657	9437	22	work	370	2064
3	management	1607	8852	23	design	402	2051
4	innovation	1291	7553	24	business	325	2034
5	technology	1007	5797	25	Big data	323	2020
6	model	1091	5381	26	transformation	317	2005
7	framework	664	3674	27	implementation	331	1876
8	Information technology	514	3430	28	organizations	294	1763
9	knowledge	536	3274	29	determinants	286	1706
10	information	574	3205	30	Mediating roles	252	1693
11	Dynamos capabilities	455	3000	31	technology	279	1639
12	Systems	523	2904	32	trust	272	1632
13	strategy	424	2594	33	firms	265	1606
14	adoption	402	2395	34	Internet	261	1603
15	Firm performance	368	2385	35	Moderating roles	258	1562
16	perspectives	367	2324	36	satisfaction	250	1496
17	challenges	394	2259	37	quality	286	1482
18	future	379	2179	38	governance	264	1441
19	behavior	375	2126	39	strategies	251	1412
20	antecedents	319	2113	40	perceptions	240	1408

Source: drafted by the authors based on materials from the WoS

The dominant keywords involve performance, impact, management, innovation, technology, model, framework, information technology, knowledge, information, dynamic capabilities, system, strategy, organizational performance, perspective, challenge, future, behavior and antecedents.

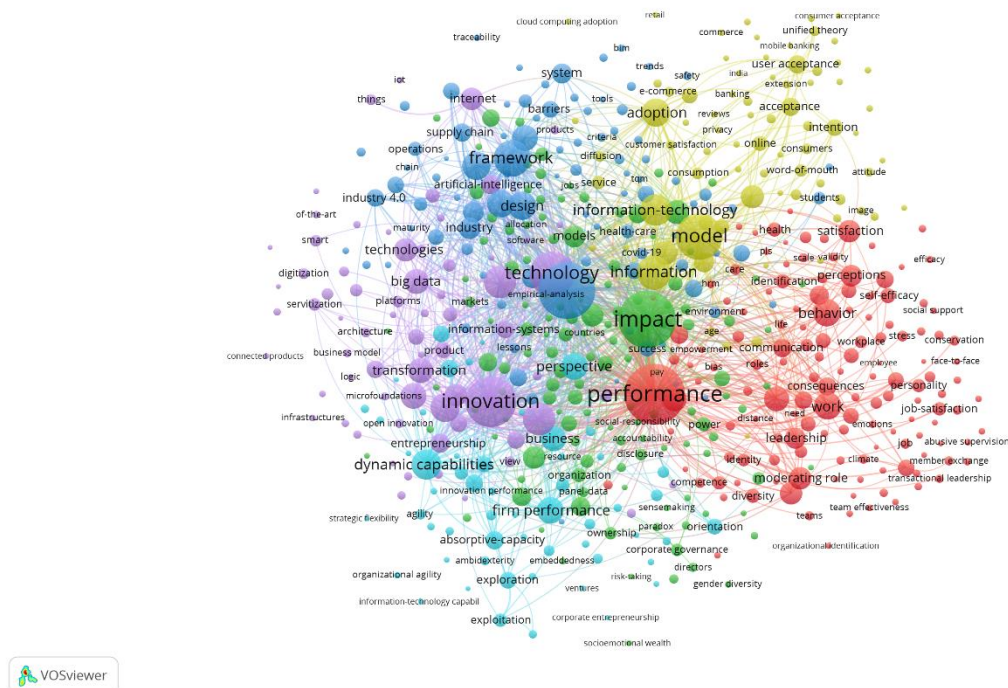


Figure 2. Map of visualization of keyword co-occurrence network
Source: drafted by the authors based on materials from WoS using VOSviewer v.1.6.20.

Based on the results of the keyword analysis, a relationship diagram between the digital transformation concept and business processes was created, allowing the identification of six scientific research clusters. In Figure 2, they are marked with blue, yellow, green, red, purple and light blue. It is also worth noting that a larger circle diameter indicates a higher frequency of mentioning the relevant concept as a keyword along with digital transformation in scientific articles indexed by the database WoS over the past five years.

The summary of the results of the content and background blocks of the bibliometric analysis shows that the scientific research focuses on identifying the relationship between digitization and business processes, company performance, work, behavior and leadership (red cluster), model, adaptation and information (yellow), technology, design, industry 4.0 and framework (blue), innovation, transformation, big data (purple) and dynamic capabilities, absorptive capacity, perspectives and firm performance (light blue). Along with this, it should be noted that there are intersections and interrelations between the identified clusters. The closeness of the relationship between concepts is also analyzed based on the distance between the circles, which characterizes the frequency of co-occurrence of the concepts.

As part of the expansion of the evolutionary-temporal perspective of this study, it is appropriate to analyze the results of the context-time blocks of the bibliometric analysis. It classifies the most important content determinants of research on digital transformation of business processes in the period from 2021 to March 2025.

In Figure 3, the color gradient changes from purple (oldest publications, indexed in the scientometric database WoS) to yellow (modern works). The results of the analysis based on the context and time period of the research on digital business transformation show that there are five stages of changes in emphasis in this field. Thus, in the period 2021–2022.8 scientists examined the relationship between business models, cooperation, architecture and workplace satisfaction, and business process improvement.

During 2022.8–2023, research interest was directed towards identifying competition outcomes, competitive advantages, strategies, research and development, and big data analysis.

During 2023–2023.2, research focused on work, behavior, media role, perceptions, system, trust, and future, while in 2023.2–2023.4, researchers' attention was directed towards performance, model, innovation, technology, and information.

After 2023.4, the vector of research by scientists has changed in terms about the link that connects digital transformation and dynamic capabilities, artificial intelligence, financial performance, antecedents, sustainability, intention, and diversity.

As part of the temporal perspective of the bibliometric examining digital transformation, a spatial decomposition is also possible, as shown in Figure 5. According to the spatiotemporal bibliometric analysis, the intensification of global digital transformation research will occur in six consecutive time intervals from 2021 to March 2025, each with its own geographical center.

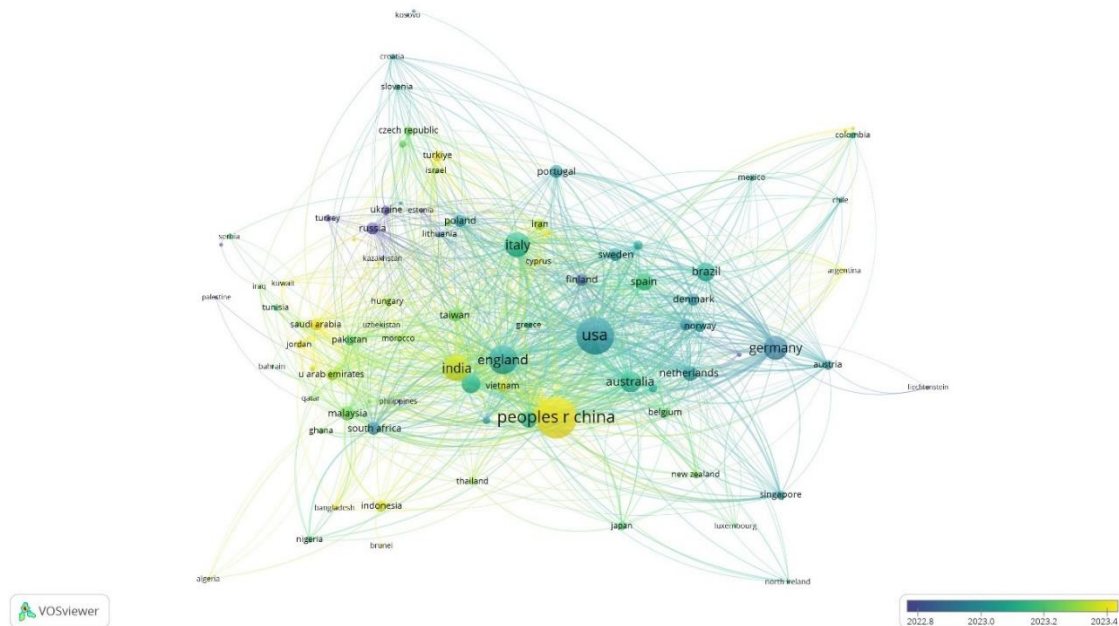


Figure 5. Visualization of spatiotemporal analysis of research on digital transformation of business processes published in 2021 – March 2025 in the WoS

Source: drafted by the authors based on materials from the WoS using VOSviewer v.1.6.20.

In general, the following pattern can be observed: previous studies of various aspects of digital transformation took place in the countries of Russia, Turkey, Finland, Ukraine and Sri Lanka. Later, research was carried out by the countries of the European Union and the USA, while in the most recent period of time studied, their geography extends to Asian countries. At the same time, not only the spatio-temporal analysis of publishing activity on digital transformation, but also the analysis of direct geographical relationships in this area, which are presented in Figure 5, is of particular scientific interest.

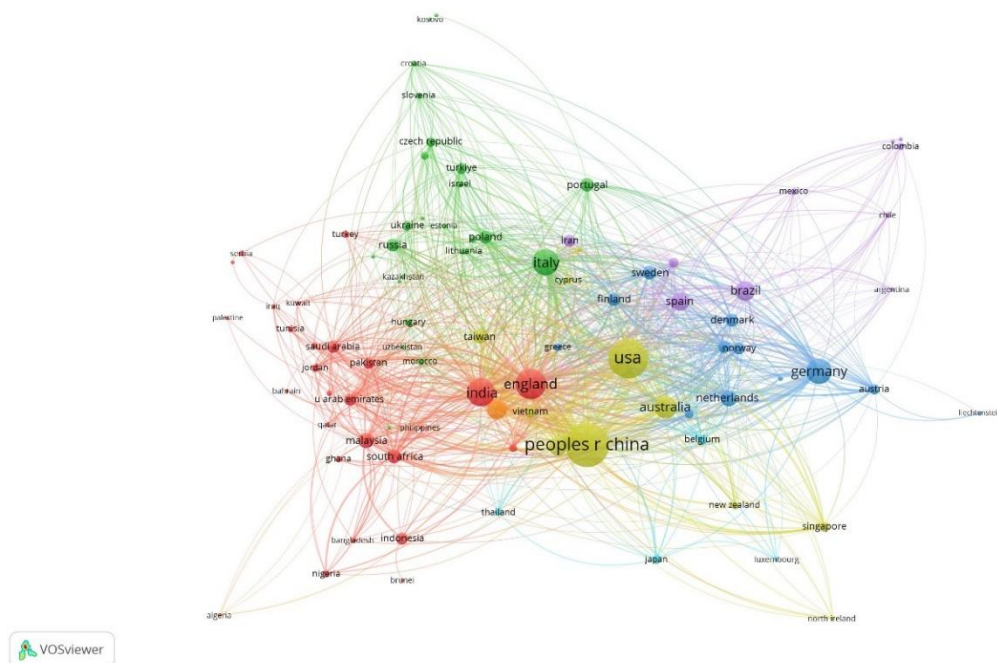


Figure 6. Map of visualization of co-authorship of scientists (criterion - country specified in affiliation), whose joint publications were indexed in the WoS in 2021 – March 2025

Source: drafted by the authors based on materials from the WoS using VOSviewer v.1.6.20.

Based on the results of spatial clustering, seven groups of countries were identified, among which researchers have common publications on digital transformation issues.

Thus, the first cluster includes 26 countries, being the largest cluster and includes countries in Asia, with a predominance of countries in West Asia (Bahrain, Bangladesh, Brunei, India, Indonesia, Iraq, Jordan, Kuwait, Pakistan, Malaysia, Palestine, Oman, Qatar, Philippines, Saudi Arabia, Turkey – partly in Asia, with a small part in Europe and the United Arab Emirates), as well as countries in Africa (Egypt, Ghana, Nigeria, South Africa, Tunisia) and Europe (Bosnia and Herzegovina, Serbia, England – part of the United Kingdom, Wales – part of the United Kingdom).

The second largest cluster includes 24 countries, with a predominance of countries in Asia, such as Azerbaijan, Israel, Kazakhstan, Uzbekistan, Turkey (partly in Asia, with a small part in Europe), and from Europe, with a predominance of countries in Southeastern and Eastern Europe, including Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Kosovo, Latvia, Lithuania, North Macedonia, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, Italy, Ukraine, and Morocco in Africa.

The third cluster consists of European countries, with a predominance of countries from Central and Northern Europe, including Austria, Denmark, Finland, Germany, Greece, Ireland, Liechtenstein, the Netherlands, Norway, Sweden, Switzerland, and Sri Lanka in Asia.

The fourth cluster consists of countries in Asia and Oceania, such as Australia, Cyprus, Lebanon, China (People's Republic of China), Singapore, South Korea, Taiwan, Vietnam, and North America, with the predominance of the countries Canada and the United States of America (USA) and Northern Ireland in Europe.

The fifth group includes the Central (Mexico) and Southern (Chile, Colombia, Argentina, Brazil, Ecuador, Peru) subregions of the Americas and Europe, dominated by the Southwestern European countries (Spain) and the UK (Scotland), as well as Iran in Asia.

The sixth cluster consists of four countries, from Europe (Belgium, Luxembourg) and Asia (Japan, Thailand). And the seventh cluster includes countries from Africa (Algeria) and Europe (France).

Thus, the analysis carried out highlighted the existence of connections between researchers on digital transformation issues, mainly due to geographical proximity, it should be noted that the clusters also bring together representatives of the scientific community from different continents.

In this context, it should also be noted that of the total volume of scientific publications indexed by the scientometric database WoS on relevant topics, the largest number of works for the period 2021 - March 2025 was recorded in China (2401 scientific articles), USA (1968), UK (1129), India (966), Italy (866), Germany (817), Australia (627), France (527), Brazil (489), Spain (447), Canada (401), and the Netherlands (328), while in other countries the number of publications during the analysis period does not exceed 300.

4. Conclusions

This analysis provides an overall picture of the current state of research on integrating digital technologies to improve the efficiency of a company's core business processes, using modern approaches and technologies. Using VOSviewer, we visualized the topic landscape in this area and identified dominant keywords and clusters [3]. Our findings offer important insights into key themes and trends in the field, including digital transformation, innovation, digital technologies, futures, technology, productivity, design, dynamic capabilities, sustainability, information technology, organizational performance, strategy, artificial intelligence, frameworks, capabilities, and business models. [4].

The results of this study can be used to develop future research initiatives and support the development of systematic reviews of specific topics, such as the impact of digital technologies on organizational effectiveness [5]. We believe that this research contributes to a deeper understanding of the complex relationship between modern methods, technologies, and management optimization in digital transformation and can be used to develop effective solutions to improve a company's core business processes. [6].

Studying digital technologies and their influence on business efficiency is a highly interdisciplinary field that draws on insights from management science, information systems, and organizational behavior [7]. The use of data analytics and machine learning algorithms can also help optimize business processes and improve organizational efficiency [8]. In addition, the introduction of modern technologies such as AI and blockchain can help transform business models and improve corporate competitiveness. Finally, the development of digital platforms and ecosystems can help improve the performance and yield of business processes and reduce the risk of failure and disruption. Integrating information technologies with existing networks and processes could also help improve user experience and customer satisfaction [9].

Bibliometric analysis using VOSviewer allowed us to determine the main trends in the field of business digitalization and identify best practices.

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