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ERP Systems as a Part of Business Digitalization Systems as a Part of Business Digitalization

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Abstract. *Enterprise Resource Planning systems (ERP systems) represent integrated IT systems that have the role of incorporating a series of modules and functions necessary for the development of the organization's activity. The digitalization process took off about ten years ago, when more and more organizations were looking for IT solutions to make their activities more efficient. The need arose as a result of the large volume of information that had to be processed daily and for which the time allocated for solving these tasks was much too large. The current work aims to analyze the digitalization method of the business using integrated ERP systems, based on the bibliometric analysis of the processed information from the specialized literature. The bibliometric analysis is based on a statistical (quantitative) analysis of written publications that address the two key concepts: ERP systems and business digitalization. Bibliometrics aims to "count" the scientific publications or the authors who wrote about the two concepts. The obtained results show that ERP systems can represent a source for digitalizing the processes of a business, integrating the organization's activity in ERP systems with the help of modules that can be implemented. ERP system modules can be implemented for each department, integrating all processed information in a single database common to all departments, access to sensitive information being controlled by each category of users. The digitalization process offers the possibility of the organization to develop sustainably, thus being able to obtain a series of financial advantages as a result of the implementation of a sustainable plan at the level of the organization.*

Keywords: ERP systems, digitalization, digital, business process, modules, efficiency, bibliometric analysis.

Introduction

Every business wants to make its activity as efficient as possible with the aim of improving its entire business process, but also the main financial and non-financial indicators. In order to make the activity more efficient, a large number of organizations have decided to approach a business digitalization plan, looking for effective IT solutions.

Business digitalization means "a process of transforming information into a digital format, converting specific products (documents, photos, audio or video recordings) from analog to digital" (NextUp, 2022). Business digitalization can be achieved using an IT system that integrates all functions within the organization. Everything is based on the robotization and automation of processes using these IT systems. Bloomberg (2018) and Bialas et al. (2023) define digital business as "creating a new business design by blurring the digital and physical worlds".

Business digitalization can be achieved through IoT, cloud computing, big data, and artificial intelligence that can be used using new tools that integrate these technologies.

The purpose of this article is to see if ERP systems can represent one of the components of the digitalization of processes.

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The article is structured in the following parts: a section for the review of the literature with the aim of following how the main key concepts of the work are defined in the specialized literature, a section that represents the research method used, a section dedicated to the analysis of the results obtained as a result of the research and a section dedicated to the main conclusions of the article.

Literature review

Digitalization is considered ubiquitous, and "new achievements in information technology can be observed, leading to the establishment of new businesses" (Buck and Eder, 2018). According to Kapoor et al. (2022), digitalization refers "to increased use of digital elements and is therefore related to social science", and all these terminologies complement each other, and automation cannot take place without the help of digital elements. Brennen and Kreiss (2016, cited by Ritter and Pedersen, 2019), digitalization can be defined as "the way many domains of social life are restructured around digital communication and media infrastructures". By the term digitalization it is meant "the use of new technologies, robotization, cloud services, intelligent systems and Big Data that have quickly entered the accounting area" (Boghian & Socoliu, 2020) which mainly contributed to increasing the efficiency of the activity carried out by companies and the accuracy of the data processed with this ERP system. ERP systems have the role of significantly influencing the company's performance and strategy through the digitization of as many activities as possible (Hietala & Päivärinta, 2021), as well as the advantages and disadvantages offered by data processing with these ERP systems (transparent data. complete and correct data, increased efficiency and effectiveness since all data is stored in a one database). The use of ERP systems leads to the digitalization of as many activities as possible, thus users "are less involved in manual data processing" (Galy & Sauceda, 2014; Al-Jabri & Roztocki, 2015; Rodriguez and Spraakman, 2012), giving the companies the chance to perform different analyzes based on the data processed with these systems and minimizing considerable possible human errors.

The business digitalization process appears when organizations decide to rethink the current business model in order to make the activity more efficient. As a consequence of the digital transformation, all organizations "have to adapt to the potential of digital approaches like Big Data, Internet of Things, Cloud and Mobile computing" (Harting et al., 2017; Ivanova et al., 2019; Mezghani & Aloulou, 2019; Matyi et al., 2020).

Digitalization is valuable to an organization if it reduces costs or creates concrete benefits like increased sales according to the definition offered by Salo (2006). Stoyanova (2020) considers that digitalization process "improve business models, work efficiency, innovation and the quality of management decisions, reducing costs, increasing company visibility and communication, putting the customer in the center of activities and many other positive effects are the benefits that organizations receive".

Digital transformation describes the paradigm regarding the adoption and integration of digital technologies of all functions of an organization, ensuring a sustainable business model, taking into account the digitalization process (Gimpel & Roglinger, 2015 cited by Buck and Eder, 2018). As defined in the literature, the concept of digitalization is considered as the transformation of analogical knowledge and information to be stored in a digital form. According to Markovitch and Willmott (2014), "operating models, organizational structures, skills and roles need to be redefined to match the reinvented processes and the data files should be adjusted and rebuilt to enable better decision making, performance analysis, and customer insights".

The advantage of digitalizing the business is that it ensures that the flow of information is carried out correctly within the organization and access to information is fast (Collin, 2015).

According to Kapoor et al. (2022), business processes are "aligned with technological advancements to meet global competitive levels".

Other substantial changes in the organization after the digitalization process are presented below (Stoyanova, 2020):

- Developing customer expectations
- Advanced technological opportunities
- A new generation of professionals
- Growth of start-up organizations in the sector
- Supportive legal structures
- Launching major infrastructure changes

The IT systems implemented and used by organizations have become part of the business digitalization process, reinterpreting the organization's governance practices. Table 1 shows the traditional and the future roles of different domains in the digitalization process.

Table 1. Traditional role and future role of different domains

EA Domains	Traditional role	Future role
1. Technology	● Closed platforms ● Physical	● Open platforms ● Virtualized
2. Applications	● Proprietary ● Siloed ● P2P integrations ● EAI technology ● Enterprise Systems ● Automating transactions	● Inter-organizational composite applications ● Software as a Service ● Service-Oriented Architecture ● Informing interactions
3. Information	● Structured data ● Data locked in system and database ● Operational and tactical Business Intelligence ● Proprietary data structures	● Data, information and knowledge mix ● Open data ● Big Data and analytics ● Information architecture
4. Business	● Procedural, linear, workflows ● Centralized control ● Transactional	● Network, dynamic business processes ● Distributed business process management

Source: Collin, 2015.

Hassan and Mouakket (2016), Tavana (2017) and Fiaz et al. (2018) believes that ERP systems are the most suitable to integrate information and functions from all departments in a unified system as follows:

- all transactions are entered, stored, handled and reported
- a much clearer vision of the business covering all departments and functions

Thus, information has become the strong point in terms of business competition as says Rajnoha et al., 2014 and Groșanu et al. (2020).

Automating proves to be extremely beneficial while performing recurring tasks and helps streamline processes. An Enterprise Resource Planning software is deployed to automate operational processes of any organization (Kapoor et al., 2022). ERP systems have performed over time, continuously improving their utilities, realizing correct and complete processing of information provided by users (Seethamraju & Sundar, 2013). Enterprise resource planning (ERP) systems are highly complex business information systems (Rajnoha et al., 2014). The ERP solution can be used to digitalize day to day activities of an organization and help integrate disparate data into a single database. According to Kapoor et al. (2022), this integration "will increase the

efficiency of the firm and make the data handling process more sophisticated". The ERP package will also assist with record-keeping and eliminates traditional way of storing data in hard copies (Kapoor et al, 2022).

Trașcă et al. (2019) and Tyuleneva (2020), consider that "the first wave of digitalization connected disparate operations, corporate processes, and reporting through enterprise resource platforms (ERP) and as a result of this consolidation, large investments in digital infrastructure have been made worldwide for communication in some cases in highly remote parts of production".

As the author Tyuleneva (2020) says that concepts "digitalization, automation, and new technologies can provide operators and technicians with quick access to important information about productivity, work conditions, and technical equipment". Also, this type of data speeds up decision-making, troubleshooting, increases efficiency, and provides better environmental protection. Advances in analytics help transform vast data sets into a representation of the probability of future events.

Managers of companies that have implemented ERP systems have seen a significant increase in the performance of the resource utilization efficiency and much better performance control due to process automation (Kanellou & Spathis, 2013; Făniță, 2020). The way of storing and sharing data processed with ERP systems offers a higher level of transparency of this information. In addition to data transparency, the systems also provide risk assessment capabilities. Control could be ensured by exercising and implementing mechanisms that lead to the regulation of user's actions in order to avoid the intentional or unintentional change of data stored in the application database.

Building a resilient and successful business can be achieved through digitalization. Digitalization presents a series of benefits such as those presented below:

- increasing revenues by penetrating new regional and global markets
- creating a favorable network with clients
- accelerating the market penetration process
- increasing profit based on improved revenues and optimized costs
- higher customer retention rate using easy and direct methods of approaching them
- higher employee retention rate due to increased overall satisfaction with the way the business is executed

Organizations that invest in IT technologies and solutions (example: ERP systems) tend to be more agile, because they notice market changes more easily, thus building resilience. In other words, digitalization implies the transformation of the entire organization, especially the operational methods.

The digital transformation of the organization will have the effect of developing the organization in a sustainable way. Thus, organizations will be able to have ecological and sustainable approaches to their organization by reducing the amount of waste. The main benefits of the sustainable transformation of the organization can be:

- reducing paper, carbon footprints, and waste
- faster and more efficient processes that use fewer resources

In the future, new generations of customers will want to collaborate with organizations that develop sustainably. From the perspective of image and reputation, increasing attractiveness for these potential clients and employees will contribute to maximizing profits in the future and increasing market share. Digitalized organizations that develop sustainably have better efficiency in planning and budgeting as a result of the use of ERP systems that centralize data correctly and completely, offering an overview of the organization's situation.

Methodology

The research question that formed the basis of the article was focused on how ERP systems can help a business become digital and what the benefits of using these systems are. The data used for this article were collected from the Web of Science platform, using the keywords "ERP systems" and "digital" to select the sample of articles. The sample of articles resulting from the two keywords was made up of 431 articles that were written between 1992 and 2023. Thus, these data were downloaded and bibliometrically analyzed using the VOS viewer application to identify the main relationship between the two concepts found in the selected articles.

The bibliometric analysis is based on a statistical (quantitative) analysis of written publications that address the two key concepts: ERP systems and business digitalization. Bibliometrics aims to "count" the scientific publications or the authors who wrote about the two concepts. The collection of information about articles took place on February 28, 2023.

Results and discussions

The findings of this study clearly show that ERP systems are very closely related to the business digitalization process.

Following the bibliometric analysis, 6 clusters and 837 links between the key concepts identified in the sample of selected articles were identified, the 6 clusters being presented in Figure 1.

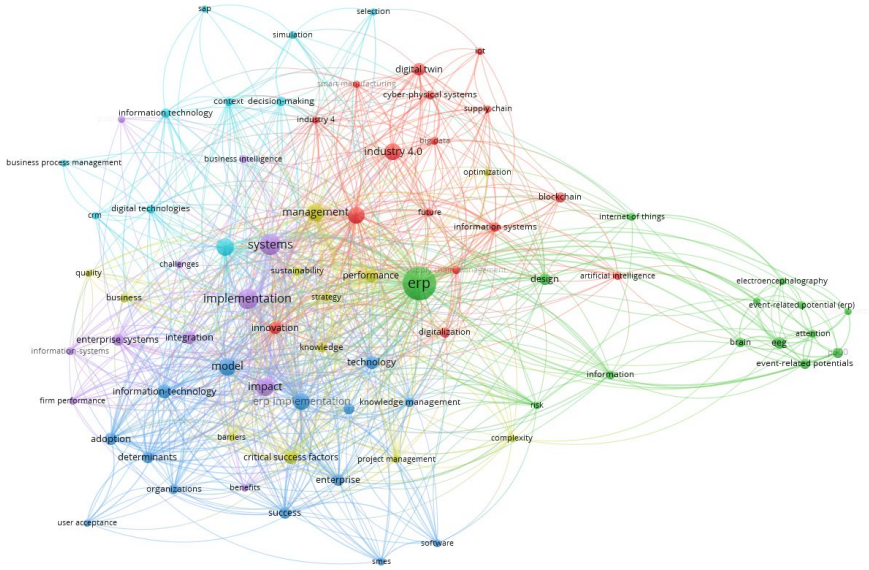


Figure 1. Relationship between the keywords ERP systems and digital (Co-occurrence & All keywords)

Source: Author's own creation based on information from Web of Science.

For each cluster, a color was associated to highlight the concepts with which the keyword "ERP systems" is related. Thus, the concepts identified for each cluster are presented in table 2.

Table 2. The keywords identified at the level of each cluster

	Cluster 1	Cluster 2	Cluster 3
Color:	**Red**	**Green**	**Dark blue**
Number of items:	15 items	13 items	14 items
Keywords:	• Artificial intelligence • Big data • Blockchain • Cyber-physical systems • Digital twin • Digitalization • Framework • Future • Industry 4 • Information systems • Innovation • Internet of Things • Smart manufacturing • Supply chain • Supply chain management	• Attention • Brain • Design • EEG • Electro-encephalography • ERP • Event-related potential • Information • Internet of Things • P300 • Perception • Potentials • Risk	• Adoption • Determinants • Enterprise • ERP implementation • Information-technology • Knowledge management • Model • Organizations • SMES • Software • Success • System • Technology • User acceptance
	Cluster 4	**Cluster 5**	**Cluster 6**
Color:	**Yellow**	**Mauve**	**Light Blue**
Number of items:	12 items	11 items	10 items
Keywords:	• Barriers • Business • Complexity • Critical success factors • Knowledge • Management • Optimization • Performance • Project management • Quality • Strategy Sustainability	• Benefits • Business intelligence • Challenges • Enterprise systems • Firm performance • Impact • Implementation • Information-systems • Integration • Public sector Systems	• Business process management • Context • CRM • Decision-making • Digital technologies • Digital transformation • Information technology • SAP • Selection Simulation

Source: Author's own creation based on information from Web of Science.

Through this sample, an attempt was made to observe the cited articles in which keywords dealing with the same subject or belonging to the same field were found. According to Rădulescu (2022), bibliometric tools are "used to study the flows of scientific publications, to rank the quality of works in a certain field, to evaluate the pace of its development, to identify specialists, institutions and countries recognized worldwide that have contributed to the development of science, by calculating in particular the number of publications and the number of citations".

First of all, the authors noticed that most articles focus on innovation, big data, blockchain, artificial intelligence, and the internet of things, but also on industry 4.0, which determined the emergence of digitalization. The concept of Industry 4.0 emerged after the digital revolution (industry 3.0, which appeared at the end of the 20th century), this concept being based on a strong relationship between interconnectivity, automation, and machine learning. The Industry 4.0 concept was first launched in 2011 due to the "strategic initiative of the German government" (Hsu et al., 2015; Greensoft, 2019; Ghobakhloo & Ching, 2019; Coskun-Setirek & Tanrikulu, 2021).

The purpose of this industry is to digitalize most of the activities performed by organizations, exploiting the potential of new technologies.

Industry 4.0 appeared between the years 2011 and 2015 and determined the emergence of the fusion of technologies in the physical, digital, and biological spheres, and the main role of this industry was to improve technology (Greensoft.ro, 2019).

Secondly, the articles focus attention on the adoption and implementation of ERP systems, as well as the human perception of ERP systems. Analyzing the articles in the sample, the authors identified that the users perceive ERP systems as tools necessary for automating and streamlining the activities carried out by the organization, as well as for faster data analysis.

As can be seen, ERP systems are the most recommended in the business digitalization process, due to their modular structure that fits very well with the functions and departments of the organization.

To better illustrate the relationship between the words identified in the 6 clusters, we analyzed the occurrence of these words, respectively, total link strength presented in Table 3.

Table 3. Occurrences and total link strength between among the words that define business digitization through ERP systems.

Cluster	Keyword	Occurrences	Total link strength
1	Artificial intelligence	6	20
	Big data	6	28
	Blockchain	10	25
	Cyber-physical systems	7	29
	Digital twin	14	32
	Digitalization	10	21
	Framework	24	95
	Future	6	27
	Industry 4	25	49
	Information systems	8	36
	Innovation	14	61
	Internet of Things	6	17
	Smart manufacturing	5	23
	Supply chain	5	20
	Supply chain management	6	25
2	Attention	6	19
	Brain	8	16
	Design	13	35
	EEG	12	20
	Electro-encephalography	5	13
	ERP	98	223
	Event-related potential	10	17
	Information	7	22
	Internet of Things	6	17
	P300	9	22
	Perception	5	13
	Potentials	5	10
	Risk	5	31
3	Adoption	14	74
	Determinants	13	55
	Enterprise	12	58
	ERP implementation	25	113

Cluster	Keyword	Occurrences	Total link strength
	Information-technology	17	80
	Knowledge management	8	42
	Model	26	91
	Organizations	8	35
	SMES	6	22
	Software	6	22
	Success	6	10
	System	38	142
	Technology	15	54
	User acceptance	5	17
4	Barriers	5	36
	Business	7	19
	Complexity	5	21
	Critical success factors	15	83
	Knowledge	7	34
	Management	28	131
	Optimization	5	10
	Performance	16	72
	Project management	6	30
	Quality	5	13
	Strategy sustainability	6	34
5	Benefits	5	21
	Business intelligence	6	19
	Challenges	5	11
	Enterprise systems	6	24
	Firm performance	5	27
	Impact	29	119
	Implementation	36	127
	Information-systems	6	23
	Integration	16	34
	Public sector systems	5	10
6	Business process management	5	6
	Context	7	36
	CRM	5	15
	Decision-making	8	26
	Digital technologies	7	27
	Digital transformation	27	78
	Information technology	17	80
	SAP	10	22
	Selection simulation	6	18

Source: Author's own creation based on information from Web of Science

In figure 2, the main relationship between the countries where the authors come from is presented:

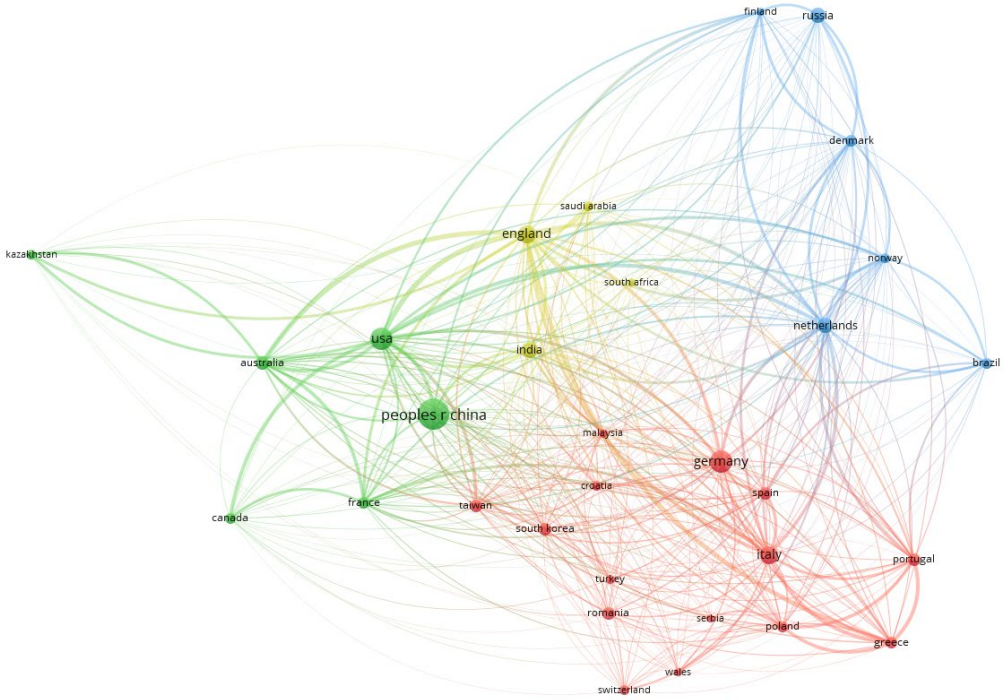


Figure 2. The countries where the authors come from

Source: Author's own creation based on information from Web of Science.

Most of the authors can be seen from countries such as China, England, Germany, the USA, India, with the articles being written by authors or co-authors from these countries. The reason why China is the country from which most articles on digitalization come, is that it is the one that offers the most IT services (applications and devices). Regarding the affiliation, it can be observed that there are still people who have the affiliation in China, more precisely at the Chinese Academy of Sciences as can be seen in Figure 3.

☐ CHINESE ACADEMY OF SCIENCES	8
☐ NAZARBAYEV UNIVERSITY	6
☐ AALBORG UNIVERSITY	5
☐ PLA INFORMATION ENGINEERING UNIVERSITY	5
☐ UNIVERSITY OF NOVI SAD	5
☐ UNIVERSITY OF PIRAEUS	5
☐ CARDIFF UNIVERSITY	4
☐ EGYPTIAN KNOWLEDGE BANK EKB	4
☐ MINISTRY OF EDUCATION SCIENCE OF UKRAINE	4
☐ RWTH AACHEN UNIVERSITY	4

Figure 3. Top 10 affiliation of the authors

Source: Web of Science, 2023.

Conclusion

Even if the concept of digitalization appeared once with the advent of industry 4.0, the evolution of recent years in the field of IT technology has had a significant impact on the digitalization process of the activities carried out daily by people. The digitalization concept is based on a strong relationship between interconnectivity, automation, and machine learning. The implementation of high-performance ERP systems by organizations is aimed at automating an increasing number of their activities, especially those that are repeatable, procedural, structured, or simple.

ERP systems offer numerous advantages, including processing a large volume of information, reducing repetitive activities, avoiding human errors and additional costs. The modular structure of ERP systems allows the digitalization of a very large number of activities, as a result of the fact that the functions offered by these systems fit very well with the activities carried out in the organization's departments.

As the two authors wrote in the article, digitization is a procedure by which data in analog format is converted into electronic format, practically creating a digital image or digital form of a report, object, photograph, audio material or signal.

The digitalization process offers the possibility for the organization to develop sustainably, thus allowing it to obtain a series of financial advantages as a result of the implementation of a sustainable plan at the level of the organization. Thus, organizations can be considered "green businesses", because they can use strategies and modern IT systems that allow reducing the inefficient consumption of resources.

The benefits brought by digitization offer a clearer vision of information, faster communication of information, increase work efficiency and performance as a result of the use of ERP systems, optimization of the organization's operational processes, and safer data saving as a result of the increased security that own ERP systems. The digitalization process helps the organization to fulfill its strategic objectives in the short, medium and long term, bringing added value within the organizations that implement ERP systems. This is only possible if the appropriate IT system is chosen, which ensures that all processed data are correct, complete and transparent. The limitations of this article were due to the low number of articles that present relevant information on the topic of business digitalization.

In the future, digitization will further improve the business process within the organization, through the many components or functions that will appear as a result of the evolution of science.

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