

## THE INTERDEPENDENCE BETWEEN INFORMATION TECHNOLOGY AND THE DIGITAL ECONOMY

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### Abstract

*The paper contributes to the current state of knowledge by providing the reader with evidence of how information technologies are influencing the development of digital data flows and how their increasing role and global exposure is influencing the digital economy. The research aims to link information technology and the digital economy to understand how they are interrelated. The realisation of the work implicitly involves the combined application of a number of research techniques and procedures, through which researchers seek to draw conclusions built on previous research and to complement it with their own experiences and results, formulating a final conclusion on the topic to be researched.*

**Keywords:** *digital economy; information technology; interdependence; Republic of Moldova; Romania*

**JEL Classification:** F60, L81, L86, L96, M40, O10, O33

### I. INTRODUCTION

The development of the IT sector has strengthened its identity, becoming a one that can have a direct and indirect impact on the economy, through economic growth and job creation, by stimulating innovation and contributing to social and sustainable development. The results of recent years demonstrate the significant contribution of the IT sector to the development of a digital economy, effectively ensuring access to the services that citizens need. The digital economy characterizes economic activities that use and rely on digital technologies, and the widespread adoption of technologies helps to shape and continuously evolve the digital ecosystem. Therefore, driving trends in the development of the digital economy requires the IT sector to continue to be high performing, competitive, but also sustainable, given that long-term performance depends on sustainability. This motivates IT companies to create solutions that respond to emerging digital needs and challenges.

Given IT's significant contribution to GDP, governments pay particular attention to it. For example, in the first quarter of 2023, the contribution of IT to GDP in Romania was of 8.2% and in the Republic of Moldova of 6.9%. Thus, the Romanian government has introduced a tax exemption for income from salaries as a result of software creation activity. The legislation of the Republic of Moldova has established the prerequisites for boosting the development of the IT industry by introducing a tax regime facilitating the residents of IT parks, which consists in applying a single tax of 7% of the taxable amount, encompassing several types of taxes and duties.

The IT field includes a wide range of entities, from large corporations to small businesses and start-ups, operating in different software domains, involved in designing, developing, maintaining and publishing software solutions for customers and users (Aramand, 2008).

The undeniable evolution of the field is accompanied by the abundance of new software products and IT services, despite the fact that companies in the field have been going through a period of crisis: the global COVID-19 pandemic has disrupted established supply chains, disrupted the way of daily life as well as business development, with major disruptive implications and effects for all companies (Socoliuc, 2020); the conflict in Eastern Europe has increased tension, and the shortage of materials has led to fewer software products and IT services being manufactured with higher production costs. It is certain that the IT activity continued with fewer challenges than those faced by other sectors, being qualified as "an activity for which the restrictions associated with this crisis were not a limiting factor, but an opportunity for development" (Ilucă & Costea, 2022). Therefore, as the IT field progresses, the demand of customers for financial-accounting information increases.

In this context, in order to be able to conquer new market segments, to increase their role and importance, IT companies are obliged to face the requirements imposed by the globalized market, made up of international investors who are increasingly interested in the information flows coming from it. Thus, particular interest is being focused on the role of economic and financial information, especially with regard to financial reporting, and on the ongoing concern for company image, which has become an increasingly important element.

The PwC Digital Factory Transformation 2022 survey that was based on a sample of 700 companies in at least 23 countries, found that globally, industrial companies are investing \$1.1 trillion per year in digital transformation solutions. Survey respondents were from six sectors: retail and consumer goods, high-tech and electronics, chemicals and process industries, pharmaceuticals and medical technology, automotive and transportation, and industrial manufacturing. As a result, 70% of the respondent companies had revenues of more than €3 billion (see [ThoughtLab, 2021](#)).

The aim of the research is to develop a complex analysis on the evaluation of the information technology and digital economy. In this sense, through the bibliometric analysis, the aim is to understand the evolution and impact of scientific research and to guide future research. In addition, through the literature review, it is desired to identify, examine and synthesize scientific works that address the researched topic through meta-analysis, combining and analyzing the results of multiple independent studies and providing a solid and objective approach to summarize existing research.

The topicality of the subject resides in the pervasive nature of the IT industry, its importance and propagation being also catalyzed by the extent to which the country supports this industry. Equally, the importance of the research theme is also reflected in the fact that IT is expanding into various sectors such as healthcare, finance, e-commerce, transport, video games, etc., becoming an important source of innovation and economic development, generating considerable revenue and providing career opportunities for IT specialists and software developers.

The study carried out by Hanganu and Socoliuc ([2023](#)) that was focused on the evaluation of the performance and resilience of the economic entities belonging to the transport sector in the Suceava county through the prism of the econometric modeling of the financial indicators derived from the financial reports of these entities, highlighted the fact that in the current economy, characterized by the emphasis on globalization and free international movement, the development and digitization of online commerce, the transport sector must also massively digitize in order to be able to adapt to this new business reality, but also to respond to the changing needs of consumers of such services.

The digital economy is therefore a key factor in increasing the competitiveness of entities, innovation and economic growth, and it is therefore timely to study the interdependence between information technology and the digital economy.

## II. LITERATURE REVIEW

The literature deals with the concept of information technology in different aspects: history and context of the information technology industry ([Popow, 2023](#)), international negotiations, the role of information technology on supply chain performance ([Alghofeli, 2023](#)), the effects of information technology capability on firm growth in the context of open technology innovation, etc. According to the authors ([Chae et al., 2023](#)), in shaping the perception and acceptance of a new information technology, individual creativity plays a crucial role. They "confirm that Amabile's three preconditions for creativity have a significant impact on the perception and attitude towards a developing technology" ([Chae et al., 2023](#)).

Today, advances in information technology have become not only the subject of international negotiations, but also an important channel through which the international negotiation process operates: regulating and governing e-commerce, technology transfer, cyber security and electronic communications ([Spector, 2022](#)). Therefore, the application of technology in e-commerce is one of the most important pillars of trade, especially nowadays. Generally, data or money is transferred through electronic network and there is some certainty that there can be fraudulent activities during electronic transactions. These difficulties are addressed through security policies and technology is promoted through social activities ([Binsaif, 2022](#)).

Research shows that "IT capability, including IT flexibility and integration, significantly influenced firm growth, and open technology innovation partially mediated the relationship between IT flexibility and firm growth and significantly mediated the relationship between IT integration and firm growth." The authors used a deductive approach to develop hypotheses and collected empirical data from 256 Chinese start-ups ([Yao & Li, 2023](#)).

Another study deals with the conceptual framework on the role of information technology in entrepreneurship formation. It is assumed that the development of information technology particularly favors new entrepreneurs with growth ambitions and high-growth firms by accelerating knowledge creation and allocation ([Johansson & Karlsson, 2022](#)). Therefore, advances in this area provide the necessary tools and platforms to develop and implement digital solutions, while also fostering the automation of business processes and increasing operational efficiency ([Burri, 2018](#)). In this context, opportunities within the digital economy can stimulate IT

sector-specific innovations. For example, new technologies can be developed for cybersecurity, Big Data management or digital process optimization. The Digital Economy Report 2021 examines the "development and policy implications of digital data flows at the frontier" which are "underlying all fast-evolving digital technologies such as data analytics, artificial intelligence (AI), blockchain, the Internet of Things (IoT), cloud computing and other internet-based services that have a significant impact on the way economic activities are conducted" (Trentini, 2021).

III. RESEARCH METHODOLOGY

With the help of analysis and synthesis methods, as well as by applying elements of comparison, induction and deduction, it was possible to record and highlight general aspects of the IT field in relation to the digital economy. As a result of this analysis, the importance and topicality of both the IT field and the digital economy were highlighted. The investigations were carried out based on literature sources. At the same time, in the exposition of the material, we opted for the descriptive method, by using the Web of Science search engine. In the present research, bibliometric analysis is used as a method of evaluation, analysis and interpretation of scientific production in the field of information technology and digital economy, at the same time, the method allowing to perceive the evolution and impact of scientific research, as well as to guide future research. For this purpose, the following research criteria were set: 1) identification of the phrase "Information Technology" and the phrase "Digital Economy" in the title of the scientific paper, 2) identification of the scientific papers published in the period of 2019-2023. The search resulted in a total of 4062 scientific papers, 2450 related to the phrase "Information Technology" and 1612 to the phrase "Digital Economy", these being published in the period 2019-2023.

Table 1. Evolution of scientific publications and citations in the field of research

Publication Years	Information Technology			Digital economy			Digital economy/ Information Technology
	Publications	Citations	Average per item	Publications	Citations	Average per item	
2019	606	197	0,33	307	64	0,21	0,50
2020	557	114	0,20	231	342	1,48	0,41
2021	510	2729	5,35	230	736	3,20	0,45
2022	481	3951	8,21	417	2801	6,72	0,87
2023	296	3856	13,03	427	6341	14,85	1,44
<b>Total</b>	<b>2450</b>	<b>10847</b>	<b>4,43</b>	<b>1612</b>	<b>10312</b>	<b>6,38</b>	<b>0,66</b>

Source: own processing

From the data presented in Table 1, we deduce that the year-on-year evolution is uneven and the number of papers indicates the interest of researchers at international level, as a positive trend can be observed. From a quantitative point of view, the most publications with the topic "Information Technology" were published in 2019 - 606 publications, followed by 2020 with 557 publications and 2021 with 510 publications. The most cited papers were in the year 2022 (3951 citations).

In the case of "Digital Economy", the dynamics is showing an increasing trend: in the year 2023 - 427 publications, followed by the year 2022 with 417 publications and 307 publications in the year 2019. The most cited papers were in the year 2023, namely 6341 citations. In addition, the ratio "Digital Economy"/"Information Technology" was calculated and it showed that the interest of researchers is divided, differing significantly by the Rioads analyzed. The highest ratio is in the year 2023 (1.44), which certifies that the authors focused more on the topic "Digital Economy."

According to the category of papers accepted by Web of Science, the most representative are the articles, fact that is shown in Table 2 below.

Table 2. Type of publications and countries on the topics analyzed in 2019-2023

Document types	Publication				Countries/Regions			
	Information Technology		Digital economy		Information Technology		Digital economy	
	nr.	%	nr.	%	Top 3 countries	nr.	Top 3 countries	nr.
Article	1660	67,76	1154	71,59	USA	618	China	709
Proceeding paper	449	18,33	330	20,47	China	472	Rusia	432
Other	341	13,91	128	7,94	India	130	USA	87
<b>Total</b>	<b>2450</b>	<b>100,00</b>	<b>1612</b>	<b>100,00</b>	<b>Total</b>	<b>1220</b>	<b>Total</b>	<b>1228</b>

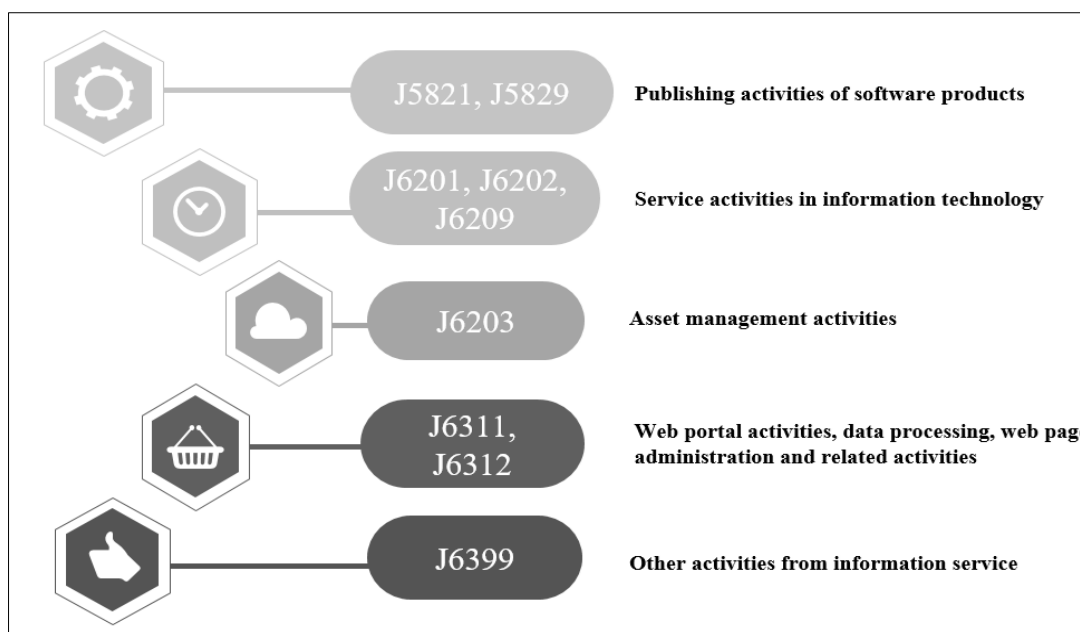
Source: own processing

The data show that articles predominate in the total research with a share of 67.76% (Information Technology) and 71.59% (Digital economy). Thus, we conclude that the majority of researchers try to publish their articles in high-level prestigious journals with high impact factor.

The information contained in Table 2 shows the countries with the highest productivity in the field of the researched topic. Among the most active countries with reference to "Information Technology" are the USA (618 papers), China (472 papers) and India (130 papers). "Digital Economy" ranks China with 709 papers, Russia with 732 papers and the USA with 87 papers. Researchers from these countries have shown an increased interest in analyzing aspects of information technology and digital economy and can serve as main sources for potential theoretical and practical research.

**IV. RESEARCH RESULTS**

Referring to the structure of the CAEN nomenclature (CAEN, 2023), Romania and CAEM (see BNS, 2023), the IT sector, implicitly the software and services industry, is one of the component sub-sectors of the Information and Communications macro-sector (section J), constituting the aggregate result of the following codes shown in Figure 1.



**Figure 1.** IT component sub-sectors  
Source: own processing

According to the Digital Economy and Society Index (DESI) ranking, "Romania ranks 27<sup>th</sup> out of 27 EU Member States in the 2022 edition of the Digital Economy and Society Index (DESI). We note that its relative annual growth is lower than that of similar countries, indicating that it is not converging with the rest of the Member States. The country lags behind on a number of human capital dimension indicators, with a very low level of basic digital skills compared to the EU average, but maintains its leading positions in terms of the share of female IT specialists in the labor force (2<sup>nd</sup> place) and the number of IT graduates (4<sup>th</sup> place)" (EC, 2023).

In this context, we mention that the Republic of Moldova is a non-EU country, which "has approved the Digital Transformation Strategy for 2023-2030 (DTSM 2030) for monitoring and evaluation, based on the Digital Economy and Society Index (DESI) that is also based on the DESI Methodology adapted for the Republic of Moldova, as well as other indicators that will be considered relevant. Therefore, it will measure progress, carry out evaluation of the effectiveness of investments and identify areas for improvement for further development of all digital dimensions" (Guvernul Republicii Moldova, 2023).

Bearing in mind that IT products, software and services are the result of human intelligence, human resources are of great importance in this field. Several specialists are involved in the development of software, some are involved in writing the software, others in testing, others in designing it, etc. It is important that resources are used efficiently, and that no stoppages are allowed, which inevitably lead to additional costs. Access to Human Capital focuses on contextualizing the labor market in the development of software products and IT services, analyzing on the one hand the relative performance of the labor force in the concerned country, and on the other hand the size of the specialized labor force in relation to the size of the national economy. Clearly, the workforce is the main source of competitive advantage in each country.

However, without investment in R&D and innovation and continuous workforce development, the production of software and IT services risks reaching a limit of growth potential. Economic practice shows that the cost of IT products and services is dominated by payroll costs, which represent the wages of each employee involved in several research, development and product development/IT service delivery contracts in the same management period.

Specific to IT companies, whose core business is software development, employee positions must correspond to the occupations listed in the legislative acts, and the positions must be part of a specialized IT department, as indicated in the employer's organization chart. The following is a list of occupations specific to software development activities.

**Table 3.** List of occupations specific to program delivery activities in Romania and the Republic of Moldova

No.	Document/occupations specific to program implementation activities	Romania	Republic of Moldova
1.	Confirmatory document	Annex to Order Annex to Order 1168/2017 / 492/2018 / 3024/2018 / 3337/2017	Law No 1164/1997, Annex 2
2.	Database administrator	+	+
3.	Network administrator	-	+
4.	Analyst	+	+
5.	Computer Systems Engineer	+	+
6.	Software systems engineer	+	+
7.	IT project manager	+	+
8.	Programmer	+	+
9.	Information systems designer	+	+
10.	Computer system programmer	+	-
11.	Help Programmer	+	-
12.	Help Analyst	+	-

Source: developed by the authors based on [Annex to Order 1168/2017 / 492/2018 / 3024/2018 / 3337/2017](#) and [Law No 1164/1997](#)

According to the statistics presented by the National Bureau of Statistics of the Republic of Moldova, in September 2023, the average net salary was about 11930 MDL, which is about 20% more than in the same period of 2022. The highest salaries are offered to employees in the IT sector, constituting 29,800 MDL, followed by employees of banks and insurance companies, reaching about 21,700 MDL. The lowest earnings are in agriculture, being seven thousand MDL, followed by arts, recreation and leisure activities where average salaries are about 8,500 MDL (BNS, 2023).

Average net earnings in Romania saw a significant increase in October 2023. The figures show an increase of 2.2% to RON 4,692 compared to the previous month, according to data recently published by the National Institute of Statistics (see INS, 2023). Average net earnings varied widely across sectors. The highest values were recorded in information technology service activities, reaching RON 11,127, while the lowest earnings were recorded in the hotels and restaurants sector, with RON 2,591.

IT disengagement positively influences innovation, facilitates access to information, global communication, collaboration, internet access, expanding markets through e-commerce, Big Data, e-government services, economic and productive paradigms such as Industry 4.0 and the wider digital economy. Countries are therefore affected to some extent by the digital divide, and cyber security should be a major priority as a key factor for the economy, society and government. Thus, securing the cyber domain through cybersecurity capacity building activities is essential, as it contributes to reducing problems such as the digital divide and cyber risks (ITU, 2023).

Table 2 shows the Global Cybersecurity Index 2020 score and ranking results for Romania and the Republic of Moldova, both taking part in the questionnaire.

**Table 4.** GCI results: Score and rankings

Country Name	Global score and rank		Europe region	
	Score	Rank	Score	Rank
<b>United Kingdom</b>	<b>99.54</b>	<b>2</b>	<b>99.54</b>	<b>1</b>
Romania	76.29	62	76.29	32
Republic of Moldova	75.78	63	75.78	33

Source: own processing

The following is the Global Cybersecurity Index 2020 (GCI) determined from data reported by a record level of participating countries - 150 countries - to the questionnaire proposed by the International Telecommunication Union (ITU). This report presents countries' commitments to cybersecurity and the gaps identified and provides useful information for countries to improve their cybersecurity positions. The GCI includes 82 questions on member states' cybersecurity commitments across five pillars: legal, technical, organizational, capacity building and cooperation measures.

The generalized cybersecurity data for Romania and the Republic of Moldova from the ITU survey is shown in Figure 2 below.

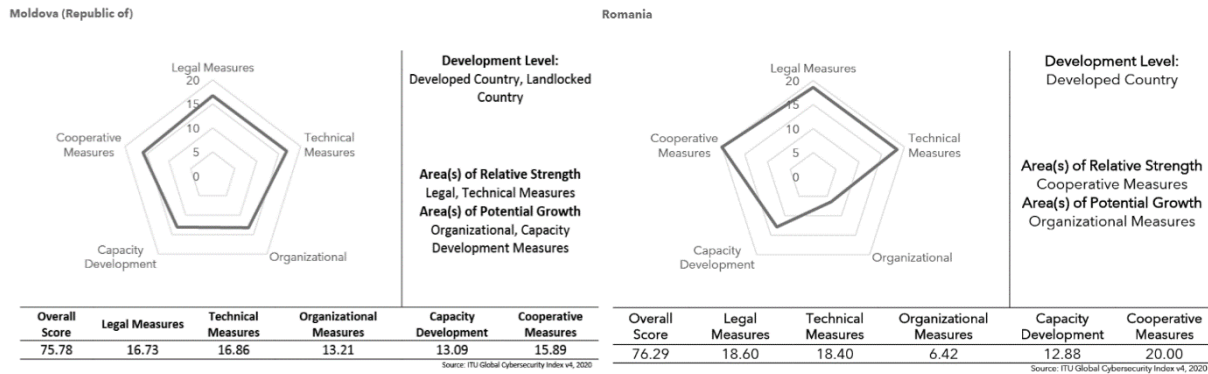


Figure 2. Global Cybersecurity Index 2020: Country profiles  
Source: ITU, 2023

From the information presented, we deduce that Romania and the Republic of Moldova are globally ranked 62<sup>nd</sup> and 63<sup>rd</sup>, and 32<sup>nd</sup> and 33<sup>rd</sup> in Europe (see ITU, 2023). With reference to the five pillars of the cybersecurity agenda, we note that there are no gaps between Romania and the Republic of Moldova, except for the measures of national strategies and organizations implementing cybersecurity (organizational measures). Some studies show that the development of technologies has led to losses and stress caused by cyber-attacks, which attempt to harm through unauthorized access (Debas et al., 2023). "E-commerce transactions are vulnerable to cyber-crime, leading to considerable losses of money and personal information. In companies, the use of accounting information and control functions can help prevent cybercrime in the accounting system by increasing the content of individual internal rules" (Yang & Yin, 2023). The IT sector is one of the basic pillars of the economic development of both Romania and the Republic of Moldova, which is steadily advancing and making relevant contributions to the state budget, but faces a shortage of work force. This can lead to a loss of competitiveness in the IT sector, with considerable effects on the national economy. At the same time, the development of a digital economy leads to increased demand for skilled IT specialists. Figure 3 shows the concept of the interdependence between information technology and the digital economy deduced by the authors.

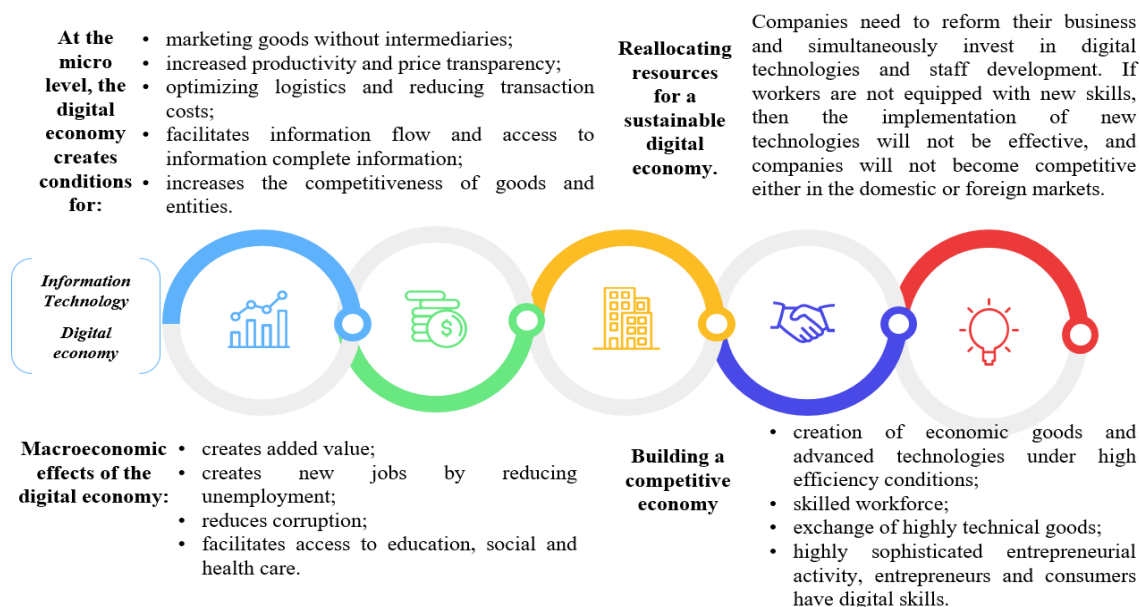


Figure 3. The concept of interdependence between information technology and the digital economy  
Source: own processing

Generalizing, we note that IT developments will continue to influence the way we interact digitally, affecting the demand for digital software products and services and sculpting the way they are delivered. Increasing technology skills will influence the workforce and help build professionals ready to work in the digital economy. Therefore, the accumulation and analysis of massive data through information technology contributes to a deeper understanding of consumer preferences, personalization of services and data-driven decision-making. With the increasing reliance on information technology, the focus is also on cyber security. Thus, the development of a digital economy requires robust measures to protect against cyber threats, thus ensuring trust in the online environment.

## V. CONCLUSIONS

The IT sector is one of the basic pillars of the economic development of both Romania and the Republic of Moldova, which is constantly advancing and making relevant contributions to the state budget. The paper argues the interdependence between information technology and the digital economy, which are mutually influenced and both contribute to the continuous evolution of the business environment and society as a whole. The component sectors of the IT domain that significantly influence various aspects of daily, economic and social life are highlighted. The research describes the rankings of the Digital Economy and Society Index and the Global Cyber Security Index. The bibliometric analysis shows an uneven development from year to year and the number of papers shows the interest of international researchers in "Information Technology" and "Digital economy" as there is a positive trend of their growth, which gives space for potential theoretical and practical research. It has been argued that IT is expanding into various sectors such as healthcare, finance, e-commerce, transport, video games, etc., becoming an important source of innovation and economic development, generating considerable revenue and offering career opportunities for IT specialists and software product developers. The digital economy is therefore the key factor in increasing the competitiveness of companies, innovation, economic growth, and so on.

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