

RESEARCHING THE DIGITAL ECONOMY: A BIBLIOMETRIC ANALYSIS OF ARTICLES INDEXED IN SELECTED SCIENTIFIC DATABASES

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ABSTRACT

Networking, datafication and platformization are irreversible and ubiquitous processes that have fundamentally changed the conditions and the ways that the economy functions, nowadays called the digital economy (4.0). Digital economy as a relatively new phenomenon is a cognitively interesting object of research conducted in Poland and abroad. The aim of this paper is to present areas of research conducted in the field of digital economy during the last eleven years. An additional result of the research is an attempt to conceptualize and operationalize the concept of digital economy. The research was based on bibliometric analysis of scientific articles indexed in selected journal databases. They play a significant role in learning about the results of research conducted in various national and foreign research centers, hence their analysis was considered an appropriate scientific method to achieve the indicated purpose.

Key words: digital economy, scientific databases, bibliometric analysis, research areas

JEL codes: O10, P10

INTRODUCTION

The digital economy as a research subject needs to be conceptualized and operationalized. Attempts to define the concept of digital economy have already been made by several authors. The economy itself is most often interpreted as “the total of conditions under which economic processes take place” [Kryczka 2018], as well as a system, i.e. “an ordered arrangement of elements consisting of economic subjects, resources and adopted ways of solving problems in production, distribution, exchange and consumption” [Kryczka 2018]. These are the basic approaches to the category that the science of economics treats as the central focus against which various phenomena are studied both at the micro and macro scale.

Samuelson and Nordhaus [1989] support the system approach in defining and studying the economy, while they emphasize that “the economic system is a system of relations and organizations that shape the laws and regulations governing economic activity” [Milewski 2008]. This perspective fully reflects the systemic approach, in which the system is not only the elements and the links between them, but the totality of the conditions in which the system works.

Researchers in the social sciences, especially in the discipline of economics, pay attention to the phenomenon of the economy evolution [Milewski and Kwiatkowski 2018]. It is important for them not only what the contemporary economy is, but also what factors shape it. The search for the digital economy leads to many sources, although the

concept itself first appeared in Tapscott's 1995 publication and then in 2000 it was defined by Brynjolfsson and Kahin [2000] as follows: "the recent and still largely unrealized transformation of all sectors of the economy through computerized digitization of information" [Śledziwska and Włoch 2020]. This framing preceded researchers' use of terms such as information economy, knowledge economy, and Internet economy, which emerged in response to the development and use of information and communication technologies in economic processes. Each of the mentioned categories was and still is present in scientific publications. Referring to them is important because it allows for a better understanding of the digital economy.

Śledziwska and Włoch [2020], analyzing the content and publications on the digital economy, state that the characteristics described by various authors are not sufficient to define the digital economy in a way that distinguishes it from the traditional economy. In these publications, there have been references identifying the digital economy with the Internet economy. They also emphasized the dependence of economic processes on new technologies, pointing to specific examples of solutions such as cloud computing, big data analysis, artificial intelligence or robotics and process automation. The authors, in turn, propose that the digital economy should be analyzed taking into account the following assumptions: "the digital economy is based on data, on the logic of networks, emerges as a result of digital transformation processes and is a consequence of the fourth industrial revolution" [Śledziwska and Włoch 2020].

Other authors perceive the digital economy as strongly connected with the generation of information technology and an important path for people and organisations that operate on the contemporary market. They also state that it "will become an important driving force and breakthrough point for boosting the new development pattern of dual cycles" [Zhang et al. 2021]. Vyas and Jain, who study the issue, conceptualized digital economy as "participation, behavioral intentions measured through the extended technology acceptance model as adoption, and financial inclusion as acceptance" [Vyas and Jain 2021].

An interesting analysis of the definitions of the digital economy was presented by Bukht and Heeks

[2018], who analyzed 21 definitions of the concept and distinguished three key elements: digital technologies underlying it and two levels of applications of these technologies in the economy. The economy leaves no doubt about the subject, entity and spatial scope included in its definition. At the same time, the conceptualization and operationalization of the digital economy is a process that is currently ongoing. Some authors claim that digital economy is very present from a practical point of view and at the same time it is "shyly, in a categorical, conceptual, and essential sense, mentioned in journals and professional literature" [Lazovic et al. 2021].

The issues of the digital economy mentioned above shows that further development of scientific literature on the subject is an important source of information to determine the current state of knowledge in this area. In this context the issue of scientific articles on the digital economy and research undertaken in this area seems to be cognitively interesting and requiring further analysis.

RESEARCH METHODOLOGY

The aim of the research is to identify bibliometric data and determine research areas undertaken in scientific publications on the digital economy. The research used the method of bibliometric analysis of scientific articles, which helps to summarize large quantities of bibliometric data to present the state of the intellectual structure and emerging trends of a research topic or field [Donthu et al. 2021]. The authors of this paper conducted the analysis with the usage of selected quantitative and qualitative measures. The aim of the research was to identify research areas of the digital economy. Results of the research will be used in the process of choosing the issues of the digital economy for further studies.

While carrying out the bibliometric analysis of scientific articles, a specific procedure was applied. It covers objective and multichannel information that is possible to obtain on the research area, which is the digital economy. The research character of this method is also proved by its systematic nature, precision, repeatability and relevance in the recognition of the problem.

The subject of the analysis was scientific publications containing research results on the digital economy. The analysis was based on a common sense approach to the selection of relevant journal publications. The subject of the search was scientific articles, in particular peer-reviewed articles, containing in the title and/or abstract a phrase including the key words “digital economy”. To maintain objectivity and reliability of the article search, it was conducted in scientific databases considered as leading among available electronic sources. Assuming after Szoltysek, Twaróg and Jeż [2018], that bibliographic databases enabling quick access to articles and publications are an important and indispensable tool in scientific work. Moreover the desirable parameters of such a database are its recognition, the possibility of higher quotability, prestige, reputation and acceptance in the scientific environment, scientific popularity, visibility in the broader community, as well as financial support. Also, the authors indicate that internationally, taking into account the context of all sciences, the most important bibliographic databases are the Web of Science platform and the Scopus database [Jeż et al. 2018]. For the purpose of the analysis, databases of journals available online were reviewed and those related to the problem of digital economy were selected. Articles found in the Web of Science¹ and Scopus² were subjected to bibliometric analysis.

A keyword phrase “digital economy” was used to search for publications related to the research problem. On the basis of the established key words in relation to the title and abstract of the article, an attempt to identify publications related to the research problem was made. With the usage of the method described above, authors found articles related to various scientific disciplines, both social and political sciences, as well as sociology, psychology or economics. In order to identify research areas of the digital economy, the bibliometric analysis of the articles related to the digital economy was conducted.

BIBLIOMETRIC ANALYSIS OF SCIENTIFIC ARTICLES IN THE FIELD OF DIGITAL ECONOMY

The Web of Science and Scopus databases were searched for articles in the field of digital economy published between 2010 and 2021. The article search process was conducted using three different strategies of searching for the phrase “digital economy”: in the title only, in the abstract, and in the title and abstract both. The articles identified using the third approach, i.e. searching for the phrase “digital economy” in the title and abstract, were then analysed to solve the research problem.

In the Web of Science database, a search for the phrase “digital economy” in the abstract of an article revealed 1297 scientific publications (a search by title yielded 435 items, and by title and abstract, 291). More articles were searched using the same strategy in the Scopus database. On the topic of “digital economy”, 1553 articles containing the phrase in the abstract were found, of which only 552 contain the word in the title, and 370 in the title and abstract. Between 2010 and 2021, there was an increase in the number of publications (phrase in the abstract) by more than 12.5 times for the Web of Science, and 12 times for Scopus. A similar upward trend was observed using the other article search strategies. The largest increase in publications on the topic of digital economy compared to the previous year occurred in 2018 (for Web of Science) and in 2017 (for Scopus) – see Table 1.

For further in-depth content analysis of articles on the digital economy, journal publications searched according to the phrase containing key words in the title and abstract were qualified. It was assumed that publications found according to this search strategy described the digital economy in the most comprehensive way. The research areas described in the articles as well as the subject and spatial scopes of the research were identified on the basis of their detailed analysis.

¹ Web of Science is a package of bibliographic and abstract databases covering many fields of science, including economics and related sciences. The database enables users to search for information on a selected topic, search for bibliographic records from the most important journals, conduct citation analysis of specific publications/authors and generate bibliometric indices (Impact Factor, Hirsch Index).

² Scopus is an abstract and citation database indexing over 19,500 academic journal titles from over 5000 international publishers. There are currently 47 million records and 435 million online sources in the database.

Table 1. Articles on digital economy published in 2010–2021 – search phrase “digital economy” in the title, abstract, title and abstract (in numbers)

Specification	Number of articles found in the database:					
	Web of Science containing the keyword in:			Scopus containing keywords in:		
	title	abstract	title and abstract	title	abstract	title and abstract
Total	435	1297	291	552	1553	370
2010	9	23	4	5	30	3
2011	3	13	0	12	25	3
2012	3	16	2	5	23	3
2013	8	31	5	9	35	7
2014	14	25	6	12	30	8
2015	12	39	6	14	37	8
2016	13	42	7	17	46	10
2017	36	78	23	44	95	27
2018	53	164	37	71	179	47
2019	92	272	53	131	342	89
2020	96	304	74	123	351	89
2021	96	290	74	109	360	76

Source: Authors’ own elaboration based on analysed bibliographic databases.

The articles identified in the databases were analyzed for the number of citations between 2010 and 2021. From 2010 to 2015, articles on the topic of digital economy are cited sporadically. A sharp increase in the number of citations is observed in 2017 (Web of Science) and in 2016 (Scopus). Comparing the average level of citations in the analyzed period, a higher increase in the number of citations of articles on the topic of digital economy in the Scopus database by nearly 63% than in the Web of Science database is noted. Moreover, the average level of citations per one publication in the Scopus database is higher by almost 18% than in the Web of Science database. Comparing the Hirsh index for both databases, the index for Scopus comes out better than for Web of Science. The Scopus database not only contains more scientific articles on the digital economy, but also has better bibliometric indices – see Table 2.

Every fifth journal publication found in the Web of Science database describes an area of the digi-

tal economy related to the enterprise (management, business, etc.). Every seventh article described this phenomenon in terms of economics, law or socio-psychology, and every eighth – in terms of information technology. There were also, although less frequently, articles referring to such areas as: metallurgy and engineering, information science, environmental sciences, environment studies, multidisciplinary sciences – see Table 3.

Scientific articles found in the Scopus database are classified in slightly different scientific fields than in the Web of Science. Moreover, the areas in which the articles are published are much smaller in number than in the Web of Science database. Thus, almost 45% of the texts dealt with Social Science. Every third article dealt with Business and Management, every fourth with Economics and Finance, and every fifth with Computer Science. Other fields also significant were: Engineering, Decision Sciences and Environmental Science – see Table 4.

Table 2. Citations of articles on digital economy in 2010–2021 – search for the phrase “digital economy” in the title and abstract of the article (in numbers)

Specification	Number of citations in the database:	
	Web of Science	Scopus
Total	1267	1894
2010	0	0
2011	0	3
2012	0	5
2013	4	5
2014	2	13
2015	8	12
2016	12	19
2017	32	39
2018	118	139
2019	206	328
2020	339	566
2021	546	765
Average number of citations per year	105.6	172.2
Average number of citations per article	4.4	5.1
Index H	18	21

Source: Authors' own elaboration based on data in Web of Science and Scopus database.

Table 3. Scientific fields in which articles on the digital economy are published in 2010–2021 in the Web of Science database – searching for the phrase “digital economy” in the title and abstract ($N = 291$, in %)

Fields in the Web of Science database	%
Management, Business, Business finance, Operations research management science	21.6
Economics	14.1
Law, Criminology penology	13.1
Social Sciences Interdisciplinary, Educational Psychology, Political Science, Sociology, Humanities Multidisciplinary, Social Issues, Social Work, History Philosophy of Science	13.1
Computer Science Information Systems, Computer Science Artificial Intelligence, Computer Science Cybernetics, Computer Science Interdisciplinary Applications	12.0
Metallurgy, Metallurgical Engineering, Engineering Manufacturing, Engineering Multidisciplinary, Engineering Industrial, Engineering Marine, Electrical Electronic, Telecommunications, Optics, Energy Fuels	8.6
Information Science Library Science	7.6

cont. tab. 3

Environmental Sciences, Geography, Geosciences Multidisciplinary	6.2
Environmental Studies	5.2
Multidisciplinary Sciences	5.2
Communication	4.8
International Relations	4.8
Education Educational Research	4.5
Green Sustainable Science Technology	3.8
Urban Studies, Regional Urban Planning	3.1
Biotechnology Applied Microbiology, Agricultural Economics Policy, Analytical Chemistry, Multidisciplinary Physics, Pharmacology Pharmacy	2.1
Mathematics, Mathematics Interdisciplinary Applications	2.1
Public Administration, Public Environmental Occupational Health	0.7
Art, Film Radio Television	0.7
Other: Education Scientific Disciplines, Industrial Relations Labor, Asian Studies, Area Studies, Development Studies, Hospitality Leisure Sport Tourism	4.8

*Percentages do not add up to 100 because an article may have been classified in more than one field.

Source: Authors' own elaboration based on analysed bibliographic databases.

Table 4. Scientific fields in which articles on the digital economy are published in 2010–2021 in the Scopus database – search for the phrase “digital economy” in the title and abstract ($N = 370$, in %)

Fields in the Scopus database	%
Social Sciences	44.3
Business, Management and Accounting	37.3
Economics, Econometrics and Finance	25.4
Computer Science	23.2
Engineering	15.4
Decision Sciences	11.6
Environmental Science	11.6
Arts and Humanities	5.7
Energy	5.4
Mathematics	3.8
Other (less than 10 indications): Earth and Planetary Sciences, Psychology, Materials Science, Physics and Astronomy, Multidisciplinary, Agricultural and Biological Sciences, Biochemistry, Genetics and Molecular Biology, Chemistry, Health Professions, Medicine, Pharmacology, Toxicology and Pharmaceutics, Chemical Engineering	12.2

Source: Authors' own elaboration based on analysed bibliographic databases.

Based on the country of origin of the article, we can infer the nationality of the author of the publication and, in most cases, the spatial scope of the research realized and described by him or her. The scientific articles on the digital economy in both bibliographic databases most often refer to research conducted in the Russian Federation (every third article found). China was ranked second and the United States third. Research relating to the digital economy is also conducted in Romania,

Ukraine and Australia. The situation in Poland was described in 3% of articles related to digital economy and published in both analyzed databases – see Table 5.

The bibliometric analysis of articles on the digital economy also allowed for identification of the most frequent words in abstracts. In both bibliographic databases, among the ten most frequent words were: digital, economy, develop, technology, economic and use – see Table 6.

Table 5. Ranking of 10 countries with articles on the digital economy published in 2010–2021 identified in Web of Science and Scopus databases – search for the phrase “digital economy” in the title and abstract

Web of Science (<i>N</i> = 291)		Scopus (<i>N</i> = 370)	
Countries	%	Countries	%
Russian Federation	37.0	Russian Federation	37.0
China	14.0	China	10.0
United States	8.0	United States	7.0
United Kingdom	5.0	United Kingdom	7.0
Romania	4.0	Romania	4.0
Ukraine	8.0	Ukraine	4.0
Australia	4.0	Australia	4.0
Spain	3.0	Malaysia	4.0
Poland	3.0	Spain	3.0
Italy	3.0	Poland	3.0
		Thailand	3.0

Source: Authors’ own elaboration based on analysed bibliographic databases.

Table 6. Ranking of the 10 most frequently occurring words in the text of abstracts of articles on the digital economy between 2010 and 2021 identified in Web of Science and Scopus databases

Web of Science (<i>N</i> = 291)		Scopus (<i>N</i> = 370)	
Words	%	Words	%
Digital	4.6	Digital	4.6
Economy	3.2	Economy	3.3
Develop	2.0	Develop	2.0
Technology	1.2	Technology	1.3
Use	0.9	Economy	0.9
Economic	0.9	Use	0.9
Inform	0.8	Study	0.8
New	0.8	Research	0.7
Study	0.8	Informed	0.7
Model	0.6	New	0.7

Source: Authors’ own elaboration based on analysed bibliographic databases.

In order to gain information about the most frequently undertaken research areas in searched articles, a qualitative analysis of article titles was performed. The authors assumed that titles contain research problems. The analysis included 93 articles found in the Web of Science database and 111 articles in the Scopus database (duplicate articles in Scopus database were eliminated).

The analysis of the titles of publications found in both databases made it possible to distinguish the following problem areas undertaken by the authors of articles: digital economy in general (its research, measurement, definition, development, evaluation, growth, spheres, structure, trends, model restructuring), digital strategy and market (e.g. innovation

and modernisation strategies; market development in countries such as China, Russia, Indonesia, etc.), business activity of enterprises (including various industries, e.g. transport, finance, geodesy), ICT (e.g. big data, intelligent cities, Internet of Things, digital platforms, artificial intelligence, blockchain, etc.), economic activity of enterprises (including various sectors, e.g. transport, finance, surveying), education (especially as regards higher education), e-tax and finance (taxation, financial reporting, financial risk), competitiveness and innovation (e.g. competitiveness of different countries and industries, innovation potential, revenue from innovation) and the problem was identified in terms of law, human resources and gender – see Table 7.

Table 7. Research areas on which articles are published in 2010–2021 in Web of Science and Scopus databases – analysis of titles of publications on “digital economy” issues (in numbers)

Study area	Example of subject scope	Web of Science	Scopus
		<i>N</i> = 93	<i>N</i> = 111
		in number	
The digital economy in general	indicators, development factors, development, development assessment, risks, post-pandemic situation, general index, measurement, trends, vulnerabilities, spheres of national economy, restructuring, dispersed capitalism, control in the economy, co-production and cooperation, value chain, upgrading strategies, terminology, model, measurement and mapping, research, measurement by DEA and DESI	42	31
Strategy and market	modernisation strategies, innovative clusters strategy, alliance in the economy, digital convergence of markets, structure of digital markets, development of future products, strategic management, development of markets (e.g. in Russia, China, Visegrad countries, Indonesia, Asia, Kazakhstan, Venezuela, India, Poland), investment strategy, operational management, regional management, municipal infrastructure management	24	9
Activities of undertakings and institutions	business capabilities of enterprises, firm performance, transportation industry development, implications for financial institutions, business process efficiency, firm evolution, surveying industry development, oil industry, forest bioeconomy, banks systemic risk, e-business, e-commerce, business models, companies, small businesses, project management, business process transformation, industrial marketing, business transformation, SME digital innovation, brand – image	15	13
ICT	big data, critical success factors for ICT readiness, technology leadership, smart cities, earth remote sensing data, cyber security, biometrics, data science, cryptographic protection, digital technologies, internet of things, information technology, digital platforms, smart contracts, artificial intelligence, neural network integration, digital architecture, blockchain	12	10
Education	innovation and entrepreneurship education, education in hotel and tourism, training, education of professionals, scientific support, adaptability of higher education, legal education, higher education, intellectual reengineering of maritime education, knowledge transfer	12	5

cont. tab. 7

Taxation and finance	accounting and tax differences, taxation, financial control, taxes, financial reporting, typology of digital currencies, basic income, Fintech, financial risk, financial assessment of convergent technology development, regulation of legal relations, tax reforms	7	11
Competitiveness and innovation	competitiveness of countries and industries, state innovation policy, innovation potential of the economy, innovativeness of enterprises, revenue from innovation, user innovation, technological innovation, global governance, competitiveness of enterprises, technological adaptation, international relations, innovation performance, business advantage, diffusion of innovation, innovators	9	9
Law	law governing the economy, antitrust legislation, tax law, copyright, regulatory policy, legal framework for the digital economy, legal policy, regulation, protection of the interests of minors, intellectual property, copyright law	5	8
Human resources	professional competence of employees, human capital, human resources system, self-employment, talents, human resources research, society, human resources training, human capital reproduction, alternative types of employment	6	5
Gender	gender, women, gender in the digital economy, feminist perspective, women overcoming business barriers	2	4
E-government	Development, electronic workflow, security	4	0
Policy	socio-economic policy, world politics	2	–
Other	energy, CO ₂ , working poor, sustainable project management, G-20, BRICS, supply chain, smart city, COVID, library, quality, cybercrime, ecosystem, forensics, sustainability, sailing ecosystem – e-navigation, military sector	12	6

Source: Authors' own compilation based on analysed bibliographic databases.

CONCLUSIONS

The aim of the research was identification of research areas of the digital economy. The main results of the research show that the digital economy is an issue that has been raised by researchers in the last 10 years, with a growing trend indicating interest in this topic. This is confirmed by the scientific articles found in the Web of Science and Scopus databases. The same trend accompanies the citations of the analysed articles, with the highest increase occurring in 2018–2021. The issues of digital economy are most often taken up by researchers from the fields of management science, business, finance, computer science, as well as economics, law, social sciences (e. g. psychology, sociology, political science etc.). Most of the analysed publications come from the Russian Federation and China, and their topics mostly concern the digital economy in general, strategy and market, activities of undertakings and institutions, and ICT. The topics of the articles are very diverse, but there are many issues that researchers can develop as experts presenting different scientific disciplines.

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OBSZARY BADAWCZE GOSPODARKI CYFROWEJ – ANALIZA BIBLIOMETRYCZNA ARTYKUŁÓW INDEKSOWANYCH W WYBRANYCH BAZACH NAUKOWYCH

STRESZCZENIE

Usieciowienie, datafikacja i platformizacja są nieodwracalnymi i wszechobecnymi procesami, które zmieniły warunki funkcjonowania gospodarki, nazywanej współcześnie gospodarką cyfrową (4.0). Gospodarka cyfrowa jako relatywnie nowe zjawisko jest interesującym poznawczo obiektem badań realizowanych w kraju i zagranicą. Celem artykułu jest zaprezentowanie obszarów badań realizowanych w obszarze gospodarki cyfrowej w ciągu ostatnich jedenastu lat. Dodatkowym rezultatem przeprowadzonych badań jest podjęcie próby konceptualizacji i operacjonalizacji pojęcia gospodarki cyfrowej. Badania przeprowadzono w oparciu o analizę bibliometryczną artykułów naukowych indeksowanych w wybranych bazach danych czasopism. Artykuły indeksowane odgrywają znaczącą rolę w poznawaniu wyników badań prowadzonych w różnych krajowych i zagranicznych ośrodkach badawczych, stąd ich analizę uznano za odpowiednią metodę naukową do realizacji wskazanego celu.

Słowa kluczowe: gospodarka cyfrowa, bazy naukowe, analiza bibliometryczna, obszary badawcze