

A BIBLIOMETRIC ANALYSIS FOR GLOBAL RESEARCH TRENDS ON DIGITAL ECONOMY

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Abstract

Introduced two decades ago, the digital economy concept became a subject of interest for governments and businessmen, politicians and researchers. This paper aims at highlighting the current state of research and trends on digital economy. There is no previous evidence of a global bibliometric analysis on digital economy. Therefore, we conducted a bibliometric analysis on digital economy literature, to identify area of interest and potential for future research. Through this research we aimed to answer the following questions: How many scientific papers on digital economy have been published in journals? What are the most productive journals, countries and authors on the subject of digital economy? What are the most cited papers on digital economy? What are the most frequent keywords in published documents on digital economy? The data used for the research were extracted from the Web of Science database, collections Science Citation Index Expanded, Social Sciences Citation Index, and Emerging Sources Citation Index, and the processing of collected information was done using package biblioshiny for bibliometrix from statistical R software. The results, obtained with the mentioned computer tools, answer the research questions. Research production and publication of documents on digital economy are increasing. As no bibliometric analysis on digital economy has been identified in the Web of Science database, this paper is intended to cover this gap

Keywords: digital economy, bibliometric analysis, R software, bibliometrix, biblioshiny

JEL classification: A10, L86, O10

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1. Introduction

The concept of digital economy was first introduced in 1994, by the global information technology expert Don Tapscott, publishing his book entitled *The Digital Economy: Promise and Peril in the Age of Networked Intelligence*. It was described as "a socio-political and economic system that is characterized by an access to information utilizing a variety of tools, the ability to process information, and a high communication capacity" (Aryanto and Christmastuti, 2011).

Digital economy is a new form of social development (Li and Liu, 2021), "an economic sector that includes goods and services, whose development, manufacturing, merchandising or supply depend on critical digital technologies" (del Águila et al., 2003), "a mixed economy with the coexistence of multiple business models and diversified value creation models based on the information and communication technologies" (ICTs) (Yin and Liu, 2020). It is not a homogeneous sector and cannot be identified with ICT (Benito et al., 2015). Frolov and Lavrentyeva (2019) are of the following opinion: "It is unacceptable to talk about digital economy as an unchanged homogeneous phenomenon. This is absolutely not correct. Digital economy is a highly heterogeneous conglomerate of technologies, types of economic activity, professions, institutions, organizations, infrastructure facilities, business models, markets, goods, services, etc." For Domazet, Zubović and Lazić (2018), the digital economy is "an economy based on digital technologies and the primary use of information technology hardware, software, applications and telecommunications in all areas of economy, including internal activities of organizations (companies, government, associations, non-profit organizations, etc.), then external activities (various transactions) between the organizations, between organizations and individuals, as well as individuals among each other (individuals as consumers and citizens)". Digital economy is not only based on digital technology (Frolov and Lavrentyeva, 2019); it is based on complexes of interconnected physical technologies and institutions as social technologies (Frolov, 2011). In different research papers, the digital economy is defined as a complex adaptive ecosystem (Frolov and Lavrentyeva, 2019), a multiple-criteria phenomenon (Balcerzak and Pietrzak, 2017), or a concept that is not an independent and self-sufficient economic and socio-political phenomenon (Kravchenko et al., 2021). In another study, it is presented as a solution to issues of inequality (Darcy, Yerbury and Maxwell, 2019).

The digital economy is "the economic activity that results from billions of everyday online connections among people, businesses, devices, data, and processes. The backbone of the digital economy is hyperconnectivity which means growing interconnectedness of people, organisations, and machines that results from the Internet, mobile technology and the internet of things" (Deloitte). In terms of content, "the modern digital economy is a rather complex and multi-level phenomenon, which has both global, regional and national trajectories for the development of software, information services, digital services, etc., and forms fundamentally new national and extraterritorial markets" (Kravchenko et al., 2021). The digital economy can be conceptualized into four different subsectors: infrastructure, applications, electronic commerce, and new intermediaries (del Águila et al., 2003). Companies participating in the digital economy are diverse and heterogeneous. Taking into account the position of firms in the value chain, Benito et al. (2015) identified the following four subsectors of homogeneous firms: telecommunications, mobile/internet content and services, software and information technology services, and application software.

This paper aims at highlighting the current state of research and trends on digital economy. For this, we conducted a bibliometric analysis on the scientific literature published on digital economy, to identify area of interest and potential for future research. The data used for the research were extracted from the Web of Science (WoS) database, and the processing of collected information was done using R software version 4.0.3 (R Core Team, 2020) and RStudio version 1.4.1103 (RStudio Team, 2021), together with the package Bibliometrix developed by Aria and Cuccurullo (2017).

2. Literature Review

The emergence and intensive use of ICTs, which gave rise to the digital economy, have strongly affected the opportunities and efficiency of the way companies produce and deliver goods and services (Cardona, Kretschmer and Strobel, 2013). The digital economy has an impact on all industries, with a special emphasis on those intensive in information or where information is the product. As the media industries have been affected by these changes, Álvarez Monzoncillo, de Haro and López-Villanueva (2016) reviewed, in a monography, among others, aspects such as talent and labor, the new audiences, adaptation to the digital environment for different industries, to see a perspective on a possible future evolution through a review of some

important aspects of the past. Contesting the digital economy and culture, Lee (2009) examined the changes brought by digital technologies in the cultural economy of music in Korea. Espinel (2016) considers that digital economy permeates all aspects of society, including the way people interact, the economic landscape, the skills needed to get a good job, and even political decision-making.

In terms of the regulatory policy for digital economy, Frolov and Lavrentyeva (2019) analyse the nature and specificity of digital economy as an object of regulation from the standpoint of institutional methodology. They conclude about the importance of creating an institutional environment using hybrid institutions based on a combination of algorithmic and traditional law in a multilevel format and in the mode of experiments like regulatory sandboxes, public discussions, legal foresight. The scientific work of Kravchenko et al. (2021) examines the principles and tasks on forming a system of legal policy priorities and principles in the digital economy of a modern state. The already developed approaches to the formulation of the legal regulation principles for the digital economy in various research projects, existing regulatory legal acts, doctrinal and other legal documents are analysed.

Athique (2020) says that at the heart of the digital economy is the willful imposition of a powerful combination of hardware and software, time and data, surveillance, prediction and behavioural control. His article argues that a central ambition of digital society has been the pursuit of an integrated commodity form. The digital economy has been intentionally geared towards extracting commissions and data from user interactions and is increasingly looking to generate new forms of value from users who simply exist in the digital society. The digital economy "hybridizes public and private life through perpetual surveillance and its corresponding social practices". The article written by Weinberg (2017) has demonstrated the limitations of privacy rights discourse for scholars seeking to formulate a critique of the digital economy. Companies as Amazon, Apple, Facebook, and Google lead the digital economy. And people personal data are at the central point of the digital economy, raw material for big data and internet of things. For Becerril (2018), the question of who should benefit from products and services based on digital data generated by users are the main uncertainties that shape the digital market opportunities. She asks the following questions: How can we measure trust in companies if we are not aware of the value our personal

information has in the digital economy? What is the value that, as headlines, we give to our personal data? Trust is an important piece in the foundation of the digital economy. Given the uncertainty of online transactions, the digital economy encourages the creation of institutional structures that assure online interorganizational exchange relationships. The research of Pavlou (2002) examines how institution-based trust develops in online B2B marketplaces to facilitate interorganizational trust.

"The originality of digital economy is in its optimising effect on production and consumption possible because of operativeness and consolidation of information and computing systems" (Peshkova and Samarina, 2018). Starting from the fact that Russia is a consumer of the products of the United States digital economy of semiconductors, Betelin (2018) discusses on the challenges and risks in forming a digital economy in Russia. With the objective of determining the situation of the digital economy in Spain and its impact on the firm, del Águila et al. (2003) proposed a method of analysis which use two aspects: infrastructure and economic and business activity. The study of Aryanto and Chrismastuti (2011) presents the early development of digital economy in Indonesia. Their research focused on the investigation of the business model of digital economy and its role in the economy of Indonesia. The internet-based digital economy is changing both the production and consumption patterns at the global scale. Researching the environmental impacts of the emerging digital economy, Sui and Rejeski (2002) consider that the emerging digital economy has, in principle, great potentials for positive environmental impacts, which have been generally summarized as the three D's for the new economy: dematerialization, decarbonization, and demobilization. Because supply chain management is likely to play an important role in the digital economy, Swaminathan and Tayur (2003) present an overview of relevant analytical research models that have been developed for supply chains. Kannan and Kopalle (2001) explain the relevance of dynamic pricing in the digital economy by comparing the physical value chain with the virtual-information-based value chain. In addition, the digital economy is characterized by the use of intellectual property (e.g. software, patents, trademarks). As the pricing of such intangibles assets is widely used to shift profits to low-tax countries, Juranek, Schindler and Schjelderup (2018) analyse the implications of different OECD methods to regulate transfer pricing and the role of a source tax on royalty payments for abusive transfer pricing.

The essay of Sambamurthy and Zmud (2000) seeks to direct research attention toward the following question: How should firms organize their IT activities in order to manage the imperatives of the business and technological environments in the digital economy? After a study about the skill needs in the ICT sector for the purpose of powering the emerging digital economy, Mutula and Van Brakel (2007) found that there is an acute global shortage of highly qualified and practical staff needed to lead emerging digital economy in both developed and developing countries. In the digital economy, standards will continue to play a vital role and the standards process develops new technologies with strong implications for downstream innovation (Teece, 2018). In their article, Kraus, Kraus and Osetskyi (2020) study the priorities and possibilities of functioning of blockchain technology as an effective digital economy management tool for solving business and government tasks.

How do firms may achieve sustained competitive advantage in a digital economy? Koch and Windsperger (2017) consider that based on the network-centric view, the firms may achieve competitive advantage by actively shaping the digital environment and by value co-creating of the interconnected firms in the digital environment; the framework may help firms to design and create strategies in order to attain and sustain competitive advantage in a digital economy. International competitiveness cannot be improved without developing an efficient digital economy infrastructure. With an empirical research, Balcerzak and Pietrzak (2017) have analysed and compared the development level of digital economy of Visegrad countries at regional level, by using the TOPSIS method with application of generalized distance measure; the data for diagnostic variables concerning digital infrastructure in the years 2012 and 2015 was provided by Eurostat. The results confirmed a relatively quick progress in building digital economy at regional level in Poland, the Czech Republic, Slovakia and Hungary, but also significant disparities between the analysed regions can be seen, especially in case of Polish regions. In their paper, Domazet, Zubović and Lazić (2018) highlight the importance of ICTs as a factor for competitiveness and development of the digital economy, analyse the application of ICT in Serbian economy, to highlight the benefits of development and acceptance of new solutions in the field of ICT, to create recommendations that would contribute to improving the business environment in the field of ICT, and consequently of the digital economy as a whole. The internationalization of the digital economy is an important part of the development stage of the digital economy.

Aiming at the current deficiencies in the development of the digital economy, Wang (2021) combines edge computing and fuzzy clustering technology to carry out research on digital economy and human resources.

The digital economy is "becoming a development trend in most modern countries, the basis for sustainable economic growth and living standards of the population". Silenko, Bezrodna and Nikogosyan (2020) study the impact of the digital economy on the quality and living conditions of citizens in a welfare state. The results show that the digital economy has both positive and negative consequences for people. The digital economy improves the ability to solve many social problems, but at the same time creates and exposes new problems. After a research on the spatial distribution pattern and influencing factors of digital economy development in China, Li and Liu (2021) have found that the development level of China's digital economy is characterized by regional heterogeneity and spatial aggregation among the eight comprehensive economic zones. Digital economy is characterized by a virtual dimension and participants must have in this new form of economy access to the skills, equipment and telecommunications infrastructure which connects particular nodes to these networks of opportunity. In this context, Grimes (2003) researched the issues facing small and medium-sized enterprises in Europe's more peripheral rural areas seeking to benefit from the digital economy. Li et al. (2016) studied how smart cities can potentially transform operational models and set out a research agenda for operations management in smart cities in the digital economy. Yin and Liu (2020) have conducted a research on the resource scheduling and strategic management of smart city under the background of digital economy. They consider that the smart city is the main carrier of the development of the digital economy and digital economy is also the main feature of the development of the industrial economy of the smart city.

3. Research Methodology

Bibliometrics became an essential tool for evaluating and analysing scientific research work of scholars (Moral-Muñoz et al., 2020). There is a series of applications allowing the bibliometrics research, as CiteSpace (Chen, 2006), VOSviewer (Van Eck and Waltman, 2010), SciMAT (Cobo et al., 2012), CitNetExplorer (Van Eck and Waltman, 2014), bibliometrix (Aria and Cuccurullo, 2017). Moral-Muñoz et al. (2020) conducted an updated review of the various tools available for bibliometric and scientometric analyses.

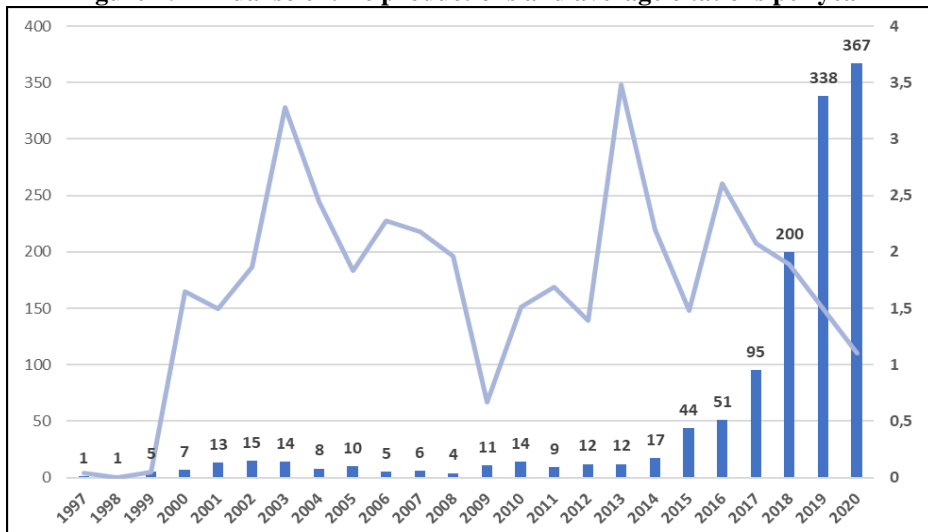
Through this research we aimed to answer the following questions: *How many scientific papers on digital economy have been published in journals? What are the most productive journals, countries and authors on the subject of digital economy? What are the most cited papers on digital economy? What are the most frequent keywords in published documents on digital economy?*

To identify the publications on digital economy, we used the following query: TS=("digital economy"). TS stand for topic that is, the search of the mentioned words in the title, abstract, author keywords, and Keywords Plus. By searching on WoS database, in collections Science Citation Index Expanded (1975-present), Social Sciences Citation Index (1975-present) and Emerging Sources Citation Index (2015-present), of documents on digital economy, on 25 May 2021, we found 1563 titles, from which we eliminated the book reviews, the editorials, and the meeting abstracts. No other restrictions were imposed. We performed a bibliometric analysis of 1387 documents (1349 articles and 38 reviews) with Biblioshiny for Bibliometrix package in R software, to reveal: sources (most relevant sources, source dynamics, most local cited sources), authors (most relevant authors), documents (most global cited documents, most local cited documents, most frequent words), clustering, conceptual structure (co-occurrence network, thematic map, factorial analysis), and social structure (collaboration network, country collaboration). No bibliometric analysis on digital economy has been identified in the WoS database.

4. Results and Discussion

During the years 1997-2021, 3150 researchers (authors appearances: 3456, authors of single-authored documents: 433, authors of multi-authored documents: 2717) studied digital economy and published 1387 articles in 723 journals, with the following description and results: average years from publication: 3.5, average citations per documents: 6.32, average citations per year per document: 1.092, and references: 52119. After analysing the dynamics of the articles' number (figure 1), we observe an upward trend. The year 2018 ($n = 200$) marks a double documents number compared to 2017 ($n = 95$). In 2019, 338 articles were published, and in 2020 the number of studies was 367. The average citations number per years varies. In 2013 is the highest (3.47), followed by 2003 (3.27), and 2016 (2.60). In 2021, there are 128 articles on digital economy published in the WoS database.

Figure 1: Annual scientific productions and average citations per year

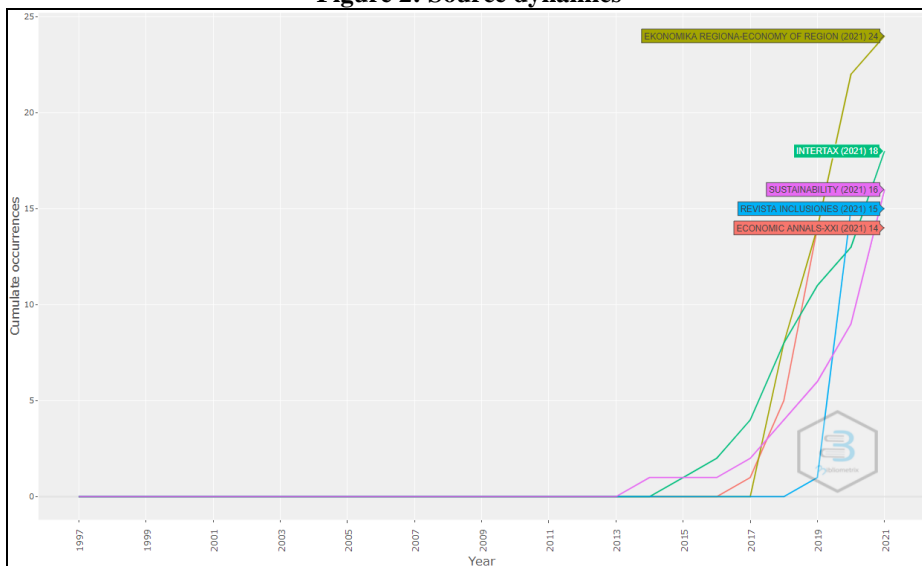


Source: Authors' projection, based on the information extracted from the WoS database

The journal with the most numerous papers on digital economy is *Ekonomika Regiona-Economy of Region* (Publisher: Institute of Economics of the Ural Branch of the Russian Academy of Sciences, Russia), with 24 articles, followed by *Intertax* (Publisher: Kluwer Law Int, Netherlands), with 18 documents. On the third position is *Sustainability* (Publisher: MDPI, Switzerland), with 16 articles. Other journals with an important number of documents are *Revista Inclusiones*, with 15 papers, *Economic Annals-XXI*, with 14 articles, *Marine Intellectual Technologies* and *Technology in Society*, each with 13 articles, followed by *Computer Law & Security Review*, *Entrepreneurship and Sustainability Issues*, *Quality - Access to Success*, and *Technological Forecasting and Social Change*, each with 12 articles on digital economy. In figure 2 is presented a graph with the source growth for the top five journals.

Most local cited sources (from reference lists) belong to the following journals: *Management Science* ($n = 323$), *MIS Quarterly* ($n = 280$), *American Economic Review* ($n = 262$), *Strategic Management Journal* ($n = 246$), *Harvard Business Review* ($n = 227$), and *Research Policy* ($n = 212$).

Figure 2: Source dynamics



Source: Graph generated with biblioshiny for bibliometrix in R software, based on data extracted from the WoS database

The list of top productive authors on digital economy is opened by Watanabe, C., with 10 articles, followed by Neittaanmaki, P., with 9 studies, Alizadeh, T., Leon, L.F.A., and Sukhodolov, A.P., with 6 publications each, Khisamova, Z.I., Li, F., Nuriev, A.G., Valeev, D.K., and Yafasov, A.Y., with 5 documents each. Regarding the most relevant affiliations of the authors' articles, the first five positions are occupied by the Financial University under the Government of the Russian Federation, with 44 authors, Kazan Federal University, with 13 authors, Plekhanov Russian University of Economics, with 28 authors, Kaliningrad State Technical University, with 19 authors, and Saint Petersburg State University, with 18 authors.

Top 5 most cited papers on digital economy is presented in table 1. On first rank is Brynjolfsson, E., Hu, Y, and Smith, M.D. (2003), with the paper Consumer Surplus in the Digital Economy: Estimating the Value of Increased Product Variety at Online Booksellers ($n = 423$), followed by Swaminathan, J.M. and Tayur, S.R. (2003), Models for Supply Chains in E-Business ($n = 240$), and Pavlou, P.A. (2002), Institution-based trust in interorganizational

exchange relationships: the role of online B2B marketplaces on trust formation ($n = 218$).

Table 1: Top 5 most global cited papers

Document	Total citations	Total citations per year
Brynjolfsson, E., Hu, Y., Smith, M.D.: Consumer Surplus in the Digital Economy: Estimating the Value of Increased Product Variety at Online Booksellers. <i>Management Science</i> (2003)	423	22,26
Swaminathan, J.M., Tayur, S.R.: Models for Supply Chains in E-Business. <i>Management Science</i> (2003)	240	12,63
Pavlou, P.A., Institution-based trust in interorganizational exchange relationships: the role of online B2B marketplaces on trust formation. <i>The Journal of Strategic Information Systems</i> (2002)	218	10,90
Cardona, M., Kretschmer, T., Strobel, T.: ICT and productivity: conclusions from the empirical literature. <i>Information Economics and Policy</i> (2013)	186	20,66
Sambamurthy, V., Zmud, R.W. Research Commentary: The Organizing Logic for an Enterprise's IT Activities in the Digital Era—A Prognosis of Practice and a Call for Research. <i>Information Systems Research</i> (2000)	158	7,18

Source: Authors' projection, based on data extracted from the WoS database

In table 2 is included top 5 most local cited papers. Local citations of papers measure how many times a document included in a collection have been cited by the documents included in the same collection. The most cited paper belongs to Watanabe, C. et al. (2018), Measuring GDP in the digital economy: Increasing dependence on uncaptured GDP. Technological Forecasting and Social Change.

Table 2: Top 5 most local cited papers

Document	Local citations	Global citations	LC/GC Ratio (%)
Watanabe, C., Naveed, K., Tou, Y., Neittaanmaki, P.: Measuring GDP in the digital economy: Increasing dependence on uncaptured GDP. Technological Forecasting and Social Change (2018)	8	17	47,06
Zhao, F., Wallis, J., Singh, M.: E-government development and the digital economy: a reciprocal relationship, Internet Research (2015)	6	27	22,22
Corrocher, N., Ordanini, A.: Measuring the Digital Divide: A Framework for the Analysis of Cross-Country Differences, Journal of Information Technology (2002)	5	104	4,81
Teece, D.J.: Profiting from innovation in the digital economy: Enabling technologies, standards, and licensing models in the wireless world. Research Policy (2018)	5	123	4,07
Johnson, M.R.: Inclusion and exclusion in the digital economy: disability and mental health as a live streamer on Twitch.tv. Information, Communication & Society (2019)	5	26	19,23

Source: Authors' projection, based on data extracted from the WoS database processed by biblioshiny for bibliometrix in R software

A list of the top 10 most frequent keywords within digital economy papers, from a total author's keywords of 4527 and a total keyword plus of 1255, is presented in table 3.

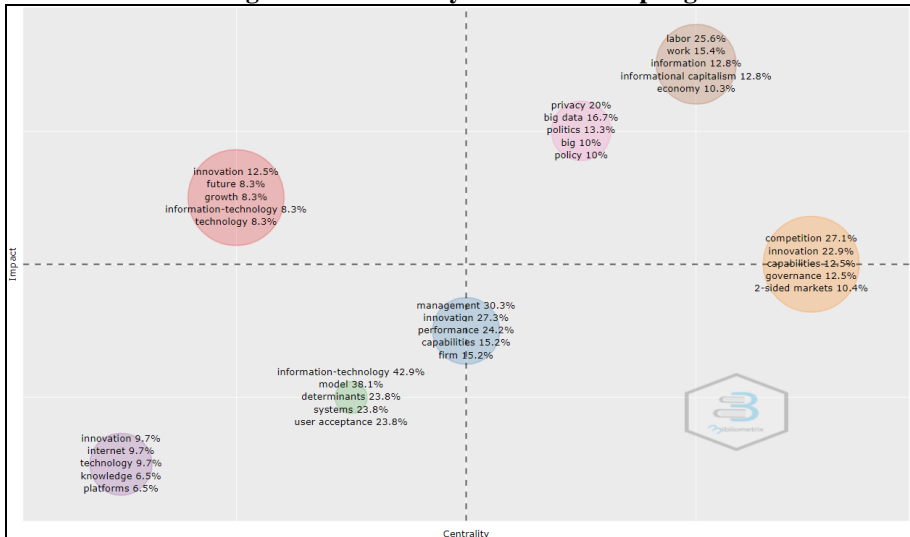
The document coupling map (figure 3) was generated with the tool biblioshiny for bibliometrix in R software, by using the following parameters: unit of analysis - documents, coupling measured by references, impact measure - local citation score, cluster labelling by keyword plus, number of units - 250, minimum cluster frequency - 5, labels per cluster 5.

Table 3: Top 10 most frequent words

Author's keywords	Occurrences	Keywords plus	Occurrences
digital economy	538	innovation	62
digitalization	89	information	47
digital transformation	44	management	46
innovation	42	internet	39
internet	39	model	39
big data	37	technology	37
digital technologies	37	performance	36
artificial intelligence	34	impact	34
blockchain	29	knowledge	28
e-commerce	28	competition	22

Source: Authors' projection, based on data extracted from the WoS database processed by biblioshiny for bibliometrix in R software

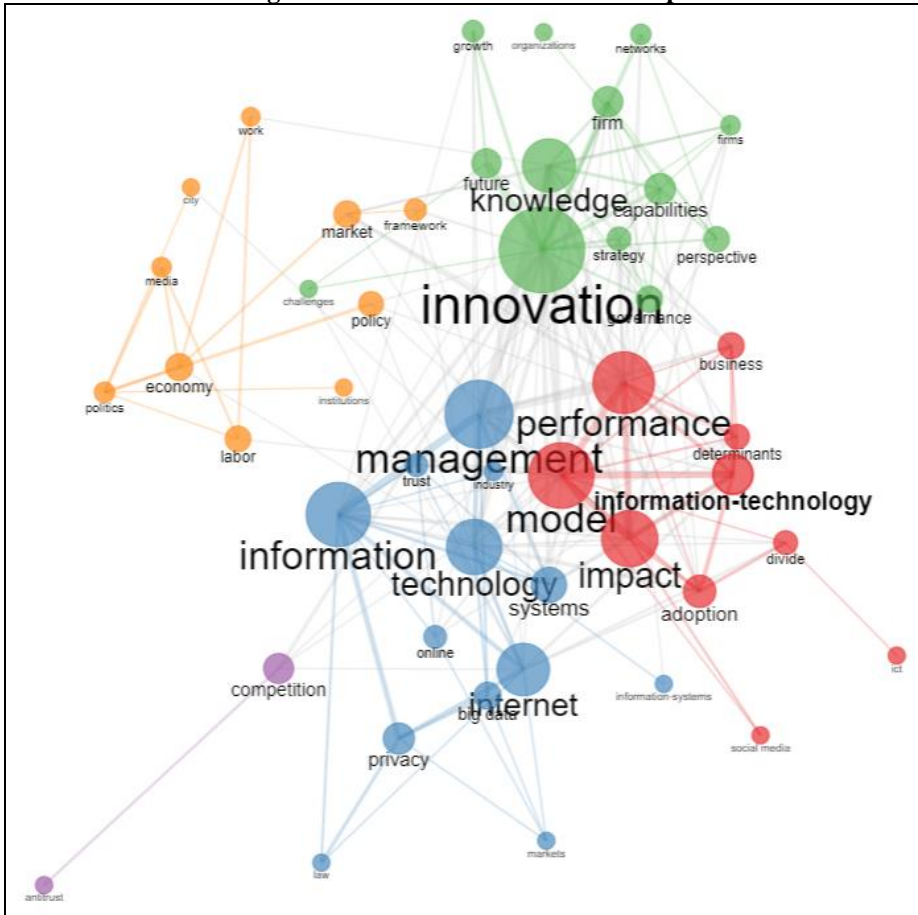
Figure 3: Clusters by documents coupling



Source: Graph generated with biblioshiny for bibliometrix in R software, based on data extracted from the WoS database

The conceptual structure is examined through the co-occurrence network map (figure 4), using the keywords plus field and 50 labels. In the first cluster (red) there are grouped the following keywords: "model", "performance", "impact", "information-technology", "adoption", "divide", "business", "determinants", "ICT", and "social media".

Figure 4: Co-occurrence network map

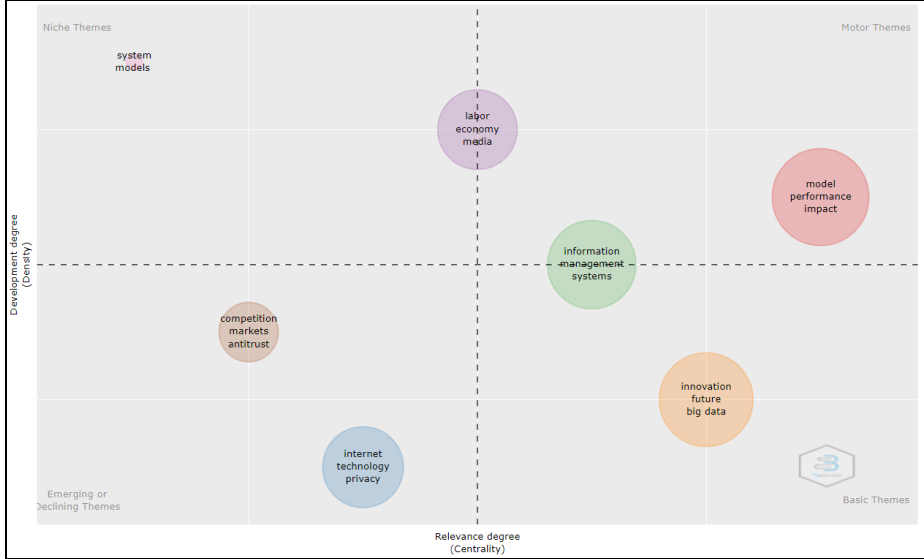


Source: Graph generated with biblioshiny for bibliometrix in R software, based on data extracted from the WoS database

The thematic map (figure 5) reveals the first three keywords plus for each of the seven clusters within the basic themes, motor themes, niche themes, and emerging or declining themes.

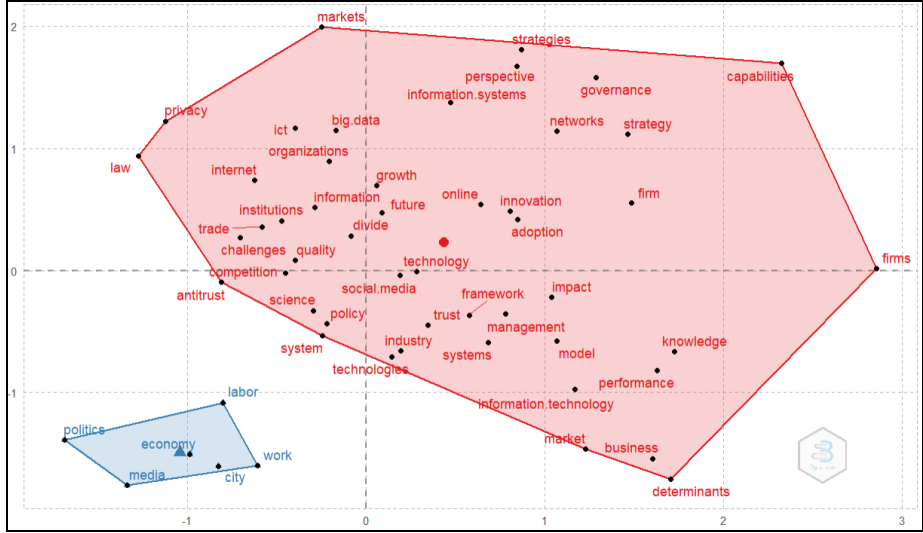
The method correspondence analysis applied on author’s keywords from the data collection used in research reveals two clusters, as can be seen in figure 6.

Figure 5: Thematic map



Source: Graph generated with biblioshiny for bibliometrix in R software, based on data extracted from the WoS database

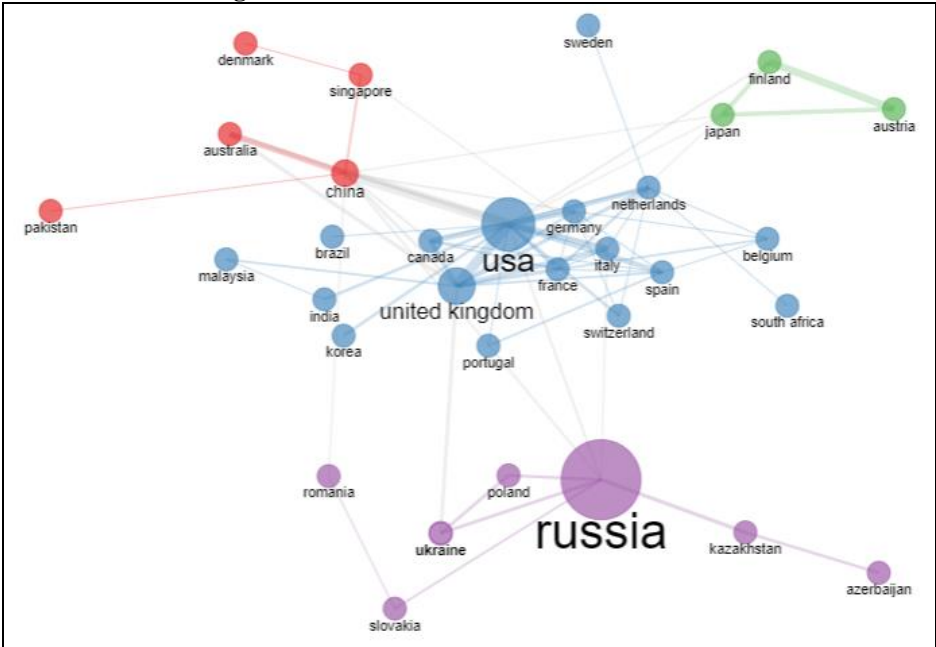
Figure 6: Conceptual structure map (factorial analysis)



Source: Graph generated with biblioshiny for bibliometrix in R software, based on data extracted from the WoS database

Authors collaboration in figures means: 458 single-authored documents, 0.44 documents per author, 2.27 authors per document, 2.49 co-authors per documents, and a collaboration index of 2.92. Regarding social structure, the analyse of collaboration network for countries is presented graphic in figure 7 and in table 4.

Figure 7: Collaboration network of countries



Source: Graph generated with biblioshiny for bibliometrix in R software, based on data extracted from the WoS database

Table 4: Country collaboration

From	To	Frequency
USA	CHINA	14
USA	UNITED KINGDOM	14
FINLAND	AUSTRIA	10
CHINA	AUSTRALIA	8
USA	CANADA	8
USA	ITALY	8
UNITED KINGDOM	ITALY	7
USA	GERMANY	7
USA	NETHERLANDS	7
USA	SPAIN	7

Source: Authors' projection, based on data extracted from the WoS database processed by biblioshiny for bibliometrix in R software

5. Conclusions

Introduced two decades ago, the digital economy concept became a subject of interest for governments and businessmen, politicians and researchers. The digital economy is born and rise from the traditional economy through the process of digital transformation. Today, more than never, ICTs is impacting the economies of the world's states. Year after year, the economy will become more and more digital. Digital economy is "an accelerator of the socioeconomic life of society in modern world and is capable of rapidly increasing the GDP of the country" (Kraus, Kraus and Osetskyi, 2020). Geoffrion and Krishnan (2003) conclude that the digital economy is giving birth to new research questions in three main ways (not all independent): by enabling and popularizing several types of technology-mediated interactions, by spawning large-scale digital data sources, and by creating recurring operational decisions that need to be automated. Currently, "two antinomical trends are unfolding: on the one hand, digitalization is leading to a new branch of the digital globalization of the economic system, and on the other, the dependence of the software and information service developer on national sales markets, territorial binding of servers, software products, etc. neutralizes global competition in the digital segment" (Kravchenko et al., 2021).

In this paper we conducted a bibliometric analysis on digital economy, using the R software and the biblioshiny for bibliometrix package, to highlight the current state of research and trends in digital economy. As no bibliometric analysis on digital economy has been identified in the WoS database, this paper is intended to cover this gap. The results presented above, regarding sources (most relevant sources, most local cited sources), authors (most relevant authors), documents (most global cited documents, most local cited documents, most frequent words), clustering, and conceptual structure (co-occurrence network, thematic map, factorial analysis), can help scholars to establish the future research agenda on digital economy.

Our study has several limitations. We included articles only from WoS database, and therefore the research cannot cover the entire literature on digital economy. Even if we would have used Scopus or another database, it should be underlined that no scientific database is comprehensive (Aria et al., 2021), and each of them has its own strengths and weaknesses (Falagas et al., 2008). In addition, many other articles on digital economy might have been published in journals not yet indexed in any database, and therefore they cannot be found. However, despite the research limitations, the data presented provide a significant insight into the trends on digital economy studies. The results contribute to the enrichment of the scientific literature, providing an overview of the research on the digital economy.

6. References

- Álvarez Monzoncillo, J.; de Haro, G.; López-Villanueva, J. (2016) Spanish media in a new digital world: The great bonfire of the vanities, *Revista ICONO14 Revista Científica De Comunicación Y Tecnologías Emergentes*, 14 (2), p. 9-45. <https://doi.org/10.7195/ri14.v14i2.998>
- Aria, M.; Alterisio, A.; Scandurra, A.; Pinelli, C.; D'Aniello, B. (2021) The scholar's best friend: research trends in dog cognitive and behavioral studies, *Animal Cognition*, 24, p. 541-553. <https://doi.org/10.1007/s10071-020-01448-2>
- Aria, M.; Cuccurullo, C. (2017) Bibliometrix: an R-tool for comprehensive science mapping analysis, *Journal of Informetrics*, 11 (4), p. 959-975. <https://doi.org/10.1016/j.joi.2017.08.007>
- Aryanto, V.D.W.; Chrismastuti, A.A. (2011) Model for Digital Economy in Indonesia, *International Journal of Innovation in the*

Digital Economy, 2 (2), p. 39-55. <https://doi.org/10.4018/jide.2011040104>

- Athique, A. (2020) Integrated commodities in the digital economy, *Media, Culture & Society*, 42 (4), p. 554-570. <https://doi.org/10.1177/0163443719861815>
- Balcerzak, A.P.; Pietrzak, B.M. (2017) Digital Economy in Visegrad Countries. Multiple-criteria Decision Analysis at Regional Level in The Years 2012 and 2015, *Journal of Competitiveness*, 9 (2), p. 5-18. <https://doi.org/10.7441/joc.2017.02.01>
- Becerril, A.A. (2018) The value of our personal data in the Big Data and the Internet of all Things Era, *ADCAIJ: Advances in Distributed Computing and Artificial Intelligence Journal*, 7 (2), p. 71-80. <https://doi.org/10.14201/ADCAIJ2018727180>
- Benito, S.; Juan, R.; Gómez, R.; Mochón, F. (2015) Differences in Measuring Market Risk in Four Subsectors of the Digital Economy, *International Journal of Interactive Multimedia and Artificial Intelligence*, 3 (2), p. 9-16. <https://doi.org/10.9781/ijimai.2015.321>
- Betelin, V.B. (2018) Challenges and Opportunities in Forming a Digital Economy in Russia, *Herald of the Russian Academy of Sciences*, 88 (1), p. 1-6. <https://doi.org/10.1134/S101933161801001X>
- Brynjolfsson, E.; Hu, Y.; Smith, M.D. (2003) Consumer Surplus in the Digital Economy: Estimating the Value of Increased Product Variety at Online Booksellers, *Management Science*, 49 (11), p. 1445-1615. <https://doi.org/10.1287/mnsc.49.11.1580.20580>
- Cardona, M.; Kretschmer, T.; Strobel, T. (2013) ICT and productivity: conclusions from the empirical literature, *Information Economics and Policy*, 25 (3), p. 109-125. <https://doi.org/10.1016/j.infoecopol.2012.12.002>
- Chen, C. (2006) CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature, *Journal of the American Society for Information Science and Technology*, 57 (3), p. 359-377. <https://doi.org/10.1002/asi.20317>
- Cobo, M.J.; López-Herrera, A.G.; Herrera-Viedma, E.; Herrera, F. (2012) SciMAT: A new science mapping analysis software tool, *Journal of the American Society for Information Science and*

Technology 2012, 63 (8), p. 1609-1630. <https://doi.org/10.1002/asi.22688>

- Corrocher, N.; Ordanini, A. (2002) Measuring the Digital Divide: A Framework for the Analysis of Cross-Country Differences, *Journal of Information Technology*, 17 (1), p. 9-19. <https://doi.org/10.1080/02683960210132061>
- Darcy, S.; Yerbury, H.; Maxwell, H. Disability citizenship and digital capital: the case of engagement with a social enterprise telco, *Information, Communication & Society*, 22 (4), p. 538-553. <https://doi.org/10.1080/1369118X.2018.1548632>
- del Águila, A.R.; Padilla, A.; Serarols, C.; Veciana, J.M. (2003) Digital economy and management in Spain, *Internet Research*, 13 (1), p. 6-16. <https://doi.org/10.1108/10662240310458332>
- Deloitte *What is digital economy? Unicorns, transformation and the internet of things*. Available at: <https://www2.deloitte.com/mt/en/pages/technology/articles/mt-what-is-digital-economy.html>, last accessed 2021/05/25
- Domazet, I.; Zubović, J.; Lazić, M. (2018) Driving factors of Serbian competitiveness: Digital economy and ICT, *Strategic Management*, 23 (2), p. 20-28. <https://doi.org/10.5937/StraMan1801020D>
- Espinel, V.A. (2016) *The digital economy: what is it and how will it transform our lives?* Available at <https://www.weforum.org/agenda/2016/11/the-digitaleconomy-what-is-it-and-how-will-it-transform-our-lives/>, last accessed 2021/06/23
- Falagas, M.E.; Pitsouni, E.I.; Malietzis, G.A.; Pappas, G. (2008) Comparison of PubMed, Scopus, Web of Science, and Google scholar: strengths and weaknesses. *FASEB Journal* 22, p. 338-342. <https://doi.org/10.1096/fj.07-9492LSF>
- Frolov, D. (2011) Theory of Crises after Crisis: Technologies versus Institutions, *Voprosy Ekonomiki*, 7, p. 17-33. <https://doi.org/10.32609/0042-8736-2011-7-17-33>
- Frolov, D.; Lavrentyeva, A. (2019) Regulatory Policy for Digital Economy: Holistic Institutional Framework, *Montenegrin Journal of Economics*, 15 (4), p. 33-44. <https://doi.org/10.14254/1800-5845/2019.15-4.3>

- Geoffrion, A.M.; Krishnan, R. (2003) E-Business and Management Science: Mutual Impacts (Part 1 of 2), *Management Science*, 49 (10), p. 1275-1286. <https://doi.org/10.1287/mnsc.49.10.1275.17311>
- Grimes, S. (2003) The digital economy challenge facing peripheral rural areas, *Progress in Human Geography*, 27 (2), p. 174-193. <https://doi.org/10.1191/0309132503ph421oa>
- Johnson, M.R. (2019) Inclusion and exclusion in the digital economy: disability and mental health as a live streamer on Twitch.tv, *Information, Communication & Society*, 22 (4), p. 506-520. <https://doi.org/10.1080/1369118X.2018.1476575>
- Juranek, S.; Schindler, D.; Schjelderup, G. (2018) Transfer pricing regulation and taxation of royalty payments, *Journal of Public Economic Theory*, 20 (1), p. 67-84. <https://doi.org/10.1111/jpet.12260>
- Kannan, P.K.; Kopalle, P.K. (2001) Dynamic Pricing on the Internet: Importance and Implications for Consumer Behavior, *International Journal of Electronic Commerce*, 5 (3), p. 63-83. <http://dx.doi.org/10.1080/10864415.2001.11044211>
- Koch, T.; Windsperger, J. (2017) Seeing through the network: Competitive advantage in the digital economy, *Journal of Organization Design*, 6 (1), 6. <https://doi.org/10.1186/s41469-017-0016-z>
- Kraus, N.; Kraus, K.; Osetskiy, V. (2020) New Quality of Financial Institutions and Business Management, *Baltic Journal of Economic Studies*, 6 (1), p. 59-66. <https://doi.org/10.30525/2256-0742/2020-6-1-59-66>
- Kravchenko, A.G.; Kim, A.A.; Mamychev, A.Y.; Ovchinnikov, A.I. (2021) Principles of modern state legal policy in stimulating and developing the digital economy, *Laplace em Revista (International)*, 7 (2), p.173-181. <https://doi.org/10.24115/S2446-6220202172699p.173-181>
- Lee, J. (2009) Contesting the digital economy and culture: digital technologies and the transformation of popular music in Korea, *Inter-Asia Cultural Studies*, 10 (4), p. 489-506. <https://doi.org/10.1080/14649370903166143>
- Li, F.; Nucciarelli, A.; Roden, S.; Graham, G. (2016) How smart cities transform operations models: a new research agenda for operations

- management in the digital economy, *Production Planning & Control*, 27 (6), p. 514-528. <https://doi.org/10.1080/09537287.2016.1147096>
- Li, Z.; Liu, Y. (2021) Research on the Spatial Distribution Pattern and Influencing Factors of Digital Economy Development in China, *IEEE Access*, 9, p. 63094-63106. <https://doi.org/10.1109/ACCESS.2021.3075249>
 - Moral-Muñoz, J.A.; Herrera-Viedma, E.; Santisteban-Espejo, A.; Cobo, M.J. (2020) Software tools for conducting bibliometric analysis in science: an up-to-date review, *El profesional de la información*, 29 (1), e290103. <https://doi.org/10.3145/epi.2020.ene.03>
 - Mutula, S.M.; Van Brakel, P. (2007) ICT skills readiness for the emerging global digital economy among small businesses in developing countries: Case study of Botswana, *Library Hi Tech*, 25 (2), p. 231-245. <https://doi.org/10.1108/07378830710754992>
 - Pavlou, P.A. (2002) Institution-based trust in interorganizational exchange relationships: the role of online B2B marketplaces on trust formation, *The Journal of Strategic Information Systems*, 11 (3-4), p. 215-243. [https://doi.org/10.1016/S0963-8687\(02\)00017-3](https://doi.org/10.1016/S0963-8687(02)00017-3)
 - Peshkova, G.Y.; Samarina, A.Y. (2018) Digital Economy and Recruitment Potential: Strategical Interconnection and Prospects, *The Education and Science Journal*, 20 (10), p. 50-75. <https://doi.org/10.17853/1994-5639-2018-10-50-75>
 - R Core Team (2020) *R: A language and environment for statistical computing*, R Foundation for Statistical Computing, Vienna. Available at: <https://www.R-project.org/>
 - RStudio Team (2021) *RStudio: Integrated Development Environment for R*, RStudio, PBC, Boston, MA. Available at: <http://www.rstudio.com/>
 - Sambamurthy, V.; Zmud, R.W. (2000) Research Commentary: The Organizing Logic for an Enterprise's IT Activities in the Digital Era—A Prognosis of Practice and a Call for Research, *Information Systems Research*, 11 (2), p. 105-114. <https://doi.org/10.1287/isre.11.2.105.11780>
 - Silenko, A.; Bezrodna, V.; Nikogosyan, O. (2020) Digital Economy as a Factor in the Development of a Social State, *Baltic Journal of*

- Economic Studies*, 6 (5), p. 155-162. <https://doi.org/10.30525/2256-0742/2020-6-5-155-162>
- Sui, D.Z.; Rejeski, D.W. (2002) Environmental Impacts of the Emerging Digital Economy: The E-for-Environment E-Commerce? *Environmental Management*, 29 (2), p. 155-163. <https://doi.org/10.1007/s00267-001-0027-X>
 - Swaminathan, J.M.; Tayur, S.R. (2003) Models for Supply Chains in E-Business, *Management Science*, 49 (10), p. 1275-1444. <https://doi.org/10.1287/mnsc.49.10.1387.17309>
 - Tapscott, D. *The Digital Economy: Promise and Peril In The Age of Networked Intelligence*. Available at: <https://dontapscott.com/books/the-digital-economy/>
 - Teece, D.J. (2018) Profiting from innovation in the digital economy: Enabling technologies, standards, and licensing models in the wireless world, *Research Policy*, 47 (8), p. 1367-1387. <https://doi.org/10.1016/j.respol.2017.01.015>
 - Van Eck, N.J.; Waltman, L. (2010) Software survey: VOSviewer, a computer program for bibliometric mapping, *Scientometrics*, 84, p. 523-538. <https://doi.org/10.1007/s11192-009-0146-3>
 - Van Eck, N.J.; Waltman, L. (2014) CitNetExplorer: A new software tool for analyzing and visualizing citation networks, *Journal of Informetrics*, 8 (4), p. 802-823. <https://doi.org/10.1016/j.joi.2014.07.006>
 - Wang, Z. (2021) Research on Digital Economy and Human Resources Based on Fuzzy Clustering and Edge Computing, *Security and Communication Networks*, 5583967. <https://doi.org/10.1155/2021/5583967>
 - Watanabe, C.; Naveed, K.; Tou, Y.; Neittaanmaki, P. (2018) Measuring GDP in the digital economy: Increasing dependence on uncaptured GDP, *Technological Forecasting and Social Change*, 137, p. 226-240. <https://doi.org/10.1016/j.techfore.2018.07.053>
 - Weinberg, L. (2017) Rethinking Privacy: A Feminist Approach to Privacy Rights after Snowden, *Westminster Papers in Culture and Communication*, 12 (3), p. 5-20. <https://doi.org/10.16997/wpcc.258>

- Yin, Q.; Liu, G. (2020) Resource Scheduling and Strategic Management of Smart Cities under the Background of Digital Economy, *Complexity*, 6624307. <https://doi.org/10.1155/2020/6624307>
- Zhao, F.; Wallis, J.; Singh, M. (2015) E-government development and the digital economy: a reciprocal relationship, *Internet Research*, 25 (5), p. 734-766. <https://doi.org/10.1108/IntR-02-2014-0055>