Radoslaw Miskiewicz,
Silesian University of Technology, Poland
ORCID ID, 0000-0003-2370-4783,
email: radoslaw.miskiewicz@polsl.pl

Correspondence author: radoslaw.miskiewicz@polsl.pl

INTERNET OF THINGS IN MARKETING: BIBLIOMETRIC ANALYSIS

Abstract. *Systematization of scientific treatizes and approaches for investigating the issue of penetration of the Internet of Things into life indicates that the researchers have contributed significantly to enrich this theme of investigation. This paper summarizes the arguments and counterarguments within the scientific discussion on the issue of transforming the marketing processes under the rapid growth of the Internet of Things. The primary purpose of this study is to investigate the structure and dynamic of scientific publications devoted to the issues of IoT development from the marketing point of view. The research hypothesis is analysis background on investigating the problems in the relationship between the IoT and marketing is presented in the high-reliable database Scopus till 2020. The research object is the pool of scientific publications indexed in the Scopus database by the keywords «Internet of Things» and «Marketing». The search of publications was conducted in the article titles, abstracts and keywords. This study involved data from 2008 to 2020, published in different subject areas. The selected publications were visualized using the tools of software VOSviewer and Scopus. Thus, the bibliometric analysis of publications allowed demonstrating the publication activity dynamic, highlight the most impact articles and reliable journals, as well as to visualize the keyword co-occurrences in the papers and co-authorship between countries. The obtained results indicated the relevance of future investigations on financial and personal data cybersecurity, data governance, smart manufacturing, sustainable growth, augmented reality, artificial neural network, etc. The analysis of scientific collaboration allowed noticing the strong relationship between researchers from the USA, Hong Kong and EU countries; China, Japan, Malaysia Vietnam, Taiwan, Indonesia, etc.; South America and European countries and Israel; among the Post-Soviet countries, Australia and Thailand. Therefore, this study is expected to enhance the scientific contributions to investigating the marketing capacities from IoT development.*

Keywords: artificial intelligence, big data, digital economy, cyber-physical systems, Industry 4.0, Internet of things, knowledge economy.

Introduction. Nowadays, the global economy undergoes the new profound transformation. The world faced with the Industry 4.0 development, which provides technological consolidation and destroying the borders between the digital and industrial spheres. In this case, most of the countries work to change the economic paradigm to transform it towards the Industry 4.0 model. That means providing the current development of automatization and data exchange, which includes the cyber-physical systems, Internet of things, artificial intelligence, big data, digital and knowledge economy, cloud-based computing, etc. Besides, it is a new level of the industry organization and value chain management during the whole lifetime of the product.

It should note that one of the most relevant scientific and technological tendencies in Industry 4.0 is the development of the Internet of Things (IoT). IoT development is considered to be a powerful technological revolution in all spheres of life. It allows expanding the opportunities for data collection, processing and distribution, which could be transferred into information or knowledge. Therefore, the IoT development is supported as on the company level, so state one. Given that, the governments of the most developed countries actively invest in the research and development in the IoT field. The systematization of literary sources indicated that the level of IoT development differs in the world. It worth noting that European countries tend to create a unique digital market. However, it requires more

effective regulation of the technological infrastructure. In turn, the USA invest a significant amount of money into Internet companies. However, the IoT has been supported as on the national level, so by the companies. Such technological giants like IBM, Cisco, Intel, etc. established the group to develop the new engineer standards for IoT. Despite the fact that the general level of Internet connection is one of the highest, the USA needs to overcome the regulatory barriers and assure the low cost of Internet broadband. Herewith, it should note that the most developed market of IoT is in Asia-Pacific countries.

At these days, the information and data volumes have rapid growth. There is the overall informatization development covering the all public spheres and economic industries. Thus, the volume of information and data expand rapidly. The virtual and digital worlds gradually merge onto the real one and become the virtual reality of the physical world. That means IoT development influences all economic spheres. Most of the enterprises from different industries would transform their business models and strategies or develop new ones. Moreover, in the frame IoT boosting, the marketing methods of product promotion, marketing research and customer communications would undergo a transformation.

In turn, this study is aimed to investigate the research directions in the field of IoT development and its impact on the marketing process. In the frame of this paper, the research question is: Which background on the investigating the issues of the relationship between the IoT and marketing is presented in the high-reliable database Scopus till 2020? Hence, the bibliometric analysis is able to provide the qualitative info metrical research. Therefore, this study endeavours a perfect possibility to define future directions contributing to the field of IoT and marketing development.

Literature Review. The analysis of publication activity dynamic indicates on the growing tendency in publication activity on investigating the IoT concept. Moreover, the theme of IoT is investigated from different subject areas such as computer science, engineering, mathematics, social science, business, econometrics, finance, etc. Thus, there is a considerable research background devoted to investigating the IoT issues. In turn, the scientific papers (Drozdz, 2019; Drozdz et al., 2019; 2020; Dzwigol et al., 2020a; 2020b; Gubbi, et al., 2013; Kazmierczyk, 2012; Kazmierczyk et al., 2020; Kuzior et al., 2019; Kuzior and Kuzior, 2020; Kwilinski, 2018; 2019; Kwilinski and Kuzior, 2020; Kwilinski et al., 2020; Lakhno et al., 2018; Lyulyov and Pimonenko, 2017; Melnychenko, 2019; 2020; Miorandi et al., 2012; Miskiewicz, 2017a; 2017b; 2018; 2019a; 2019b; Miskiewicz and Wolniak, 2020; Pimonenko et al., 2017; Sharma et al., 2020; Stankovich, 2014; Tkachenko et al., 2019a; 2019b; Trushkina, 2019; Turkes et al., 2020; Vyshnevskyi, 2019; Zaloznova and Trushkina, 2019) aimed at investigating the worldwide implementation of IoT. These studies ware devoted to exploring the key research topics to boost the discussion on the IoT issues.

The scientific articles (Spring and Araujo, 2017; Hens et al., 2019; Dalevska et al., 2019; Lyeonov et al., 2019; Pajak et al., 2017; Pimonenko et al., 2018a; Pimonenko et al., 2018b) considered the circular economy development in the context of IoT. Herewith, the authors indicated that the circular economy growth emphasized the need considering the product to be a constitutive of a distributed network. Furthermore, the authors of researches (Boiko et al., 2019; Czyzewski et al., 2019; Dementyev and Kwilinski, 2020; Chandeth et al., 2020; Dzwigol 2019; Furmaniak et al., 2018; 2019a; 2019b; Hroznyi et al., 2019; Kodama and Shibata, 2015; Kuznyetsov et al., 2019; Saluga et al., 2020; Savchenko 2019; Turkay et al., 2018) considered the concept demand articulation in the process of corporate policy formulation. In turn, it was emphasized that big data allows conducting the simulation of alternative business models. Herewith it is a necessary condition to bring IoT into reality.

Moreover, it was found that the current research direction in the field of IoT development is focused on the providing the financial cybersecurity in the Internet (Vovchak et al. 2019; Kuznyetsova and Klishchuk, 2017; Baranovskyi 2020; Baranovskyi, 2018; Dubina et al., 2020; Pajak et al., 2016). Furthermore, the study (Niyato et al., 2016) presented the big data market model to develop the optimal

pricing scheme. The systematization of scientific sources (Ranasinghe, 2019; Ntalianis et al., 2015; Mura and Kajzar, 2019; Mira et al., 2018; Korodi & David, 2019; Kamata, 2016) indicated the significant interest to forecast the tourism development concerning the growth of IoT. In turn, the Austrian researchers Neidhardt and Werthner (2018) investigated the issues of e-tourism from the scientific point of view. They emphasized that the future development of e-tourism requires a strong scientific background based on the computer science background. The researches in the papers (Jara et al., 2014; Ibragimov et al., 2019; Dobrovic et al., 2019; Bardy et al., 2017) explored the capabilities of IoT to extend the social media marketing through the identification and interaction.

Methodology and research methods. In the frame of this study, the most relevant publications were considered to achieve the study goal. In turn, the investigation was conducted in the sequence as follows. At the first stage, the survey sample was formulated. The search request for publication was made in the Scopus database (Scopus, 2020) under the keywords «Internet of Things» and «marketing». It worth noting, in the Scopus database, the advanced search of publications on IoT and marketing was conducted using logical operator «AND». Given that, the obtained results demonstrated the publications where both keywords were presented in the article title, abstract or keywords. Therefore, this study involved data from 410 documents published in different languages in all subject area from 2008 to 2020. The Scopus database tools allowed providing the publication activity dynamic in the field of IoT and marketing. Moreover, the most cited documents were highlighted. In turn, the study presented the review of sources which were most popular for publishing the articles.

At the second stage, the visualization of the thematic proximity of investigated articles was conducted using the VOSviewer software tools. It worth noting that VOSviwer allowed creating the co-occurrences network map considering the several limitations as follows: 1) type of analysis – co-occurrence; 2) counting method – full counting; 3) unit of analysis – author keywords; 4) the minimal number of keyword occurrences in the names, keywords, and abstracts of the chosen documents – 3. Herewith, to assure the high qualitative analysis, the irrelevant keywords were deleted. Thus, out of 4898 keywords, 351 met the thresholds.

At the third stage, it was built the network map following the next limitations: 1) type of analysis – co-authorship; 2) counting method – full counting; 3) unit of analysis – countries; 4) the minimal number of documents of an author – 3. Thus, out of 395 keywords, 56 met the thresholds.

It should note that the networks maps consist of the circles differently coloured and links with different strengths. In turn, the several circles with one colour of the formulate the cluster (Panchenko et al., 2020). The size of the circle indicates the number of publications according to the type of analysis (co-occurrences, co-authorship, citation, bibliographic coupling or co-citation). The bigger the circle size is, the more documents were published. Besides, the distance between circles indicates the frequency of items appearing. Given that, the longer distance between the two circles is, the weaker relations between them is. Moreover, the number of links indicates how many interactions are between particular items.

Results. For investigating the relationship between IoT and marketing, the bibliometric analysis has been conducted using the VOSviwer software tool. The sample for analysis was 410 documents presented in the Scopus database. For creating the network map, there are a set of limitations as follows: 1) type of analysis – co-occurrence; 2) counting method – full counting; 3) unit of analysis – author keywords; 4) the minimal number of keyword occurrences in the names, keywords, and abstracts of the chosen documents – 3. Besides, the irrelevant keywords were deleted. Thus, out of 4898 keywords, 351 met the thresholds.
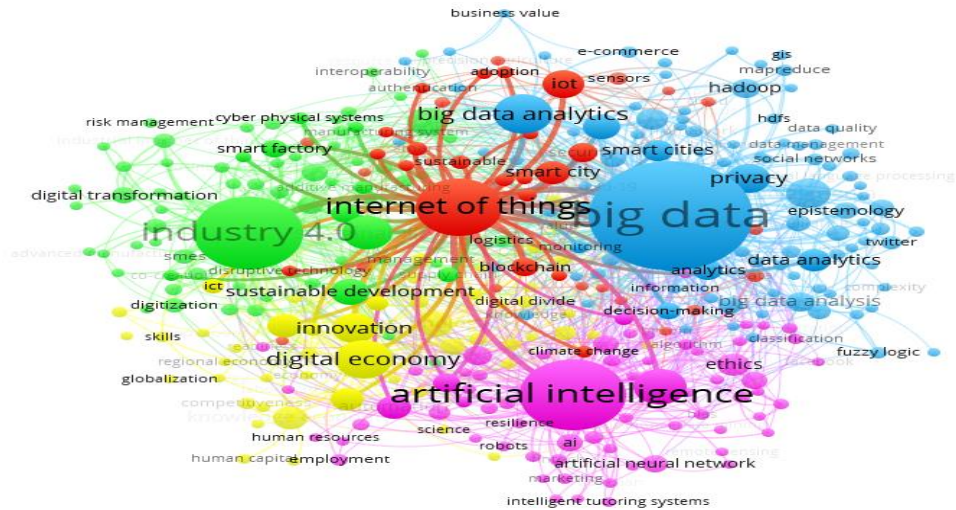
Figure 1. Network map on co-occurrences of terms «Internet of Things» and «Marketing» in titles, keywords and abstracts of publications

Source: developed by the authors on the basis of (Scopus, 2020).

It should note that the researchers' interest to this theme appeared in 2008. Thus, the period for investigation is from 2008 to 2020. The keywords for formulating the set of documents were «Internet of Things» and «Marketing» occurred in the article titles, keywords and abstracts.

Following the mentioned above limitations the results of the bibliometric analysis presented 5 clusters (Figure 1). It allowed defining the thematic proximity in the investigated theme and assume future research directions. In turn, the biggest cluster (97 items) presents the scope of documents aimed at investigating the features of big data. The authors intended to explore the role of big data analytics in marketing and design science researches as well as the decision-making process. Thus, in the first cluster include the keywords as follows: big data, big data analysis, control, big data storage, marketing analytics, etc. It worth noting that the analysis of this cluster allowed noticing the researchers' interest in investigating the issue of COVID-19.

The second cluster (69 items) demonstrates the documents devoted to the issues on Industry 4.0. Thus, this cluster mostly highlights the theme of the link between digital marketing and a new stage of industrial development. The documents cover the issues on the cyber-physical production, changes in education, reforming the business model under digital transformation, etc. Moreover, in the frame of studies on Industry 4.0, there is a comprehensive investigation of sustainable development features, circular economy and energy energy-efficiency.

The third cluster (68 items) covers the articles aimed at investigating artificial intelligence prospects. Thus, the research direction appeared under exploring the influence of the artificial neural networks on marketing, climate changes, higher education, finance, human resources, etc. Herewith, more attention devotes to trials aimed at the protection of personal data. The fourth cluster opens the research directions in the knowledge economy and management. The studies highlight the features of transforming towards digitalization development. Therefore, the relevant themes cover the issues on digital skills, digital economy, digital strategies, digital development, innovations, technological

development, etc. The fifth cluster (38 items) concentrates on investigating the influence of IoT development on the smart city development, climate change, national security, etc.

It should note, there is possible to notice the vector of scientists' publication development. Indeed, the themes of big data exploring have a growing tendency. That means, it is relevant to investigate the issues of financial and personal data cybersecurity, data governance, smart manufacturing, sustainable growth, augmented reality, artificial neural network, etc.
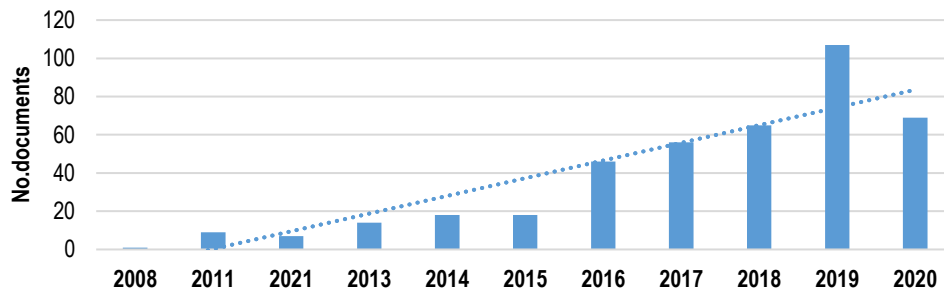

Figure 2. The dynamic of published documents on «Internet of Things» and «Marketing» for 2000-2019

Sources: developed by the authors based on (Scopus, 2020).

Figure 2 demonstrated the growing tendency in the publication activity on the linkage between IoT and marketing. It worth noting, firstly, the term IoT was introduced in 1999 by K.Eshton, who was a brand-manager in Procter & Gamble company (Dyubravok and Ratty, 2015). Despite that, the Scopus database indexed the first document on IoT in 2003. In turn, the first article devoted to the investigation of the relationship between IoT and marketing appeared in 2008. However, in 2019 its number was 107. Besides, the number of publications increased by approximately 65% in 2019 compared to 2018.

Table 1 demonstrates ten most cited articles in the field of IoT and marketing. The obtained results showed that the study «Towards Industry 4.0: Mapping digital technologies for supply chain management-marketing integration» had the highest Field-Weighted Citation Impact – 24.35 (Ardito et al., 2019). This article aimed at investigating innovative efforts to develop digital technologies in marketing processes. In turn, the most cited article was «Opportunistic IoT: Exploring the harmonious interaction between human and the internet of things» (Guo et al., 2013). The authors of this study focused on developing the opportunistic IoT systems, where opportunistic marketing was presented as a potential sphere to use it.

**Table 1. Field-weighted citation impact of top-10 cited articles**

Rank	Article title	Field-Weighted Citation Impact	Journal	SJR 2019
1	Opportunistic IoT: Exploring the harmonious interaction between human and the Internet of things	8.79	Journal of Network and Computer Applications	1.39/Q1
2	The Internet-of-Things: Review and research directions	11.47	International Journal of Research in Marketing	2.91/Q1
3	Internet of Things: Convenience vs. privacy and secrecy	7.11	Business Horizons	1.4/Q1

Continued Table 1

4	Product biographies in servitization and the circular economy	4.54	Industrial Marketing Management	2.08/Q1
5	Towards Industry 4.0: Mapping digital technologies for supply chain management-marketing integration	24.35	Business Process Management Journal	0.73/Q1
6	Research on Big Data – A systematic mapping study	8.74	Computer Standards and Interfaces	0.66/Q1
7	Consumer Connectivity in a Complex, Technology-enabled, and Mobile-oriented World with Smart Products	4.16	Journal of Interactive Marketing	3.29/Q1
8	Demand articulation in the open-innovation paradigm	6.76	Journal of Open Innovation: Technology, Market, and Complexity	0.78/Q1
9	Surveillance in ubiquitous network societies: Normative conflicts related to the consumer in-store supermarket experience in the context of the Internet of Things	1.91	Ethics and Information Technology	0.78/Q1
10	Modelling the Internet of things adoption barriers in food retail supply chains	6.85	Journal of Retailing and Consumer Services	1.34/Q1

Sources: developed by the authors based on (Scopus, 2020).

It should note that all these articles (Table 1) were published in the high-ranked journals. In turn, the according, the USA journal «Journal of Interactive Marketing» was the most cited on its subject field (SJR is 3.29). However, the analysis of sources allowed highlight 10 most productive journal in the investigated them viz: «Advances In Intelligent Systems And Computing» (11 documents); «IEEE Access» (9 documents); IFIP Advances In Information And Communication Technology (6 documents); Sensors Switzerland (6 documents), etc. Therefore, the journal mentioned above could be reliable sources for exploring the issues on the IoT and marketing issues.
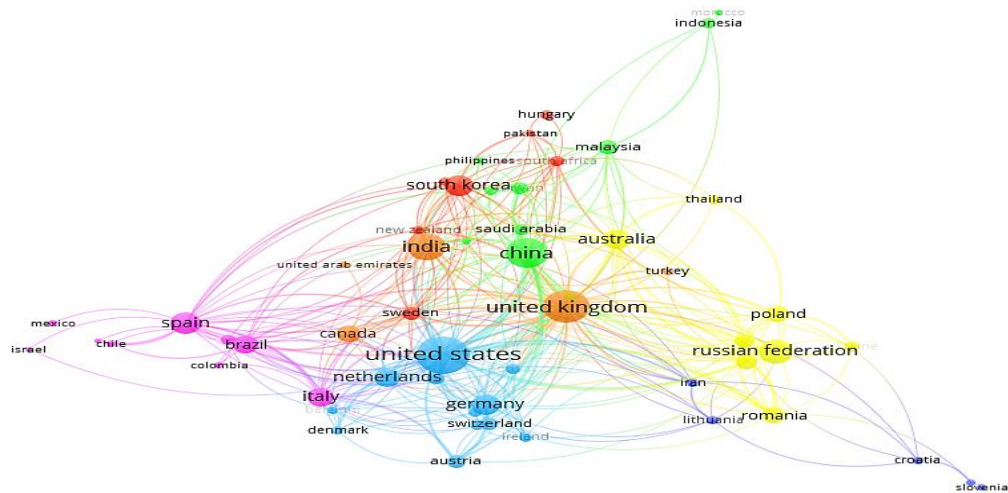
Figure 3. Network map of the analyzed documents by the countries (2008-2020)
Sources: developed by the authors based on (VOSviewer, 2020).

Figure 3 allowed noticing the scientific cooperation between the researchers from different countries. There are 7 clusters which show the collaboration between countries. Thus, the obtained results showed that the USA researchers published 227 documents on the investigated field. In turn, it has strong scientific cooperation with researchers from Hong Kong and EU countries (Belgium, Denmark, Finland, France, Germany, Netherlands, Norway, Switzerland, etc.). The second cluster showed the powerful collaborations between researchers from Asian Pacific, such as China, Japan, Malaysia, Vietnam, Taiwan, Indonesia, etc. The third cluster demonstrates the common work among the researchers from the countries of South America, European ones (Italy, Spain, Portugal) and Israel. The fourth cluster indicates the collaboration among the Post-Soviet countries (Ukraine, Slovakia, Check Republic, etc.), Australia and Thailand. It worth noting that Ukraine mostly collaborated with researchers from European countries.

Conclusions. The results of the bibliometric analysis indicated the relationship between the issues of Internet of Thing and marketing. Thus, there is a growing tendency in publication activity on the investigating field. Despite the fact that the first definition of the Internet of Thing appeared in 1999, in the Scopus database, the researchers' interest has boosted since the beginning of the XXI century. Moreover, the first study devoted to investigating the link between the Internet of Things and marketing was published in 2008. The sample for providing the bibliometric analysis consisted of 410 documents presented in the Scopus database. For formulating the study sample, the search was conducted with the keywords «Internet of Things» and «Marketing» in the article title, keywords and abstracts. The period of documents' publication was 2008-2020. For gaining the study goal, The VOSviewer and Scopus software tools were used. Therefore, the obtained results allowed visualizing 5 clusters of thematic proximity of the investigated studies. Therefore, there is a vector of scientists' publication development. That means, it would be the relevant investigation on the issues of financial and personal data cybersecurity, data governance, smart manufacturing, sustainable growth, augmented reality, artificial neural network, etc. The analysis of authors' collaboration allowed noticing the strong relationship between researchers from the USA, Hong Kong and EU countries; China, Japan, Malaysia Vietnam, Taiwan, Indonesia, etc.; South America and European countries and Israel; among the Post-Soviet

countries, Australia and Thailand. Herewith, Ukraine mostly collaborated with researchers from European countries.

It should note that his study covered just the publications presented in the Scopus database. Therefore, it is expected to in-depth the investigated theme by analysis the papers from the other high-reliable databases, especially, Web of Science.

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References

Ardito, L., Petruzzelli, A. M., Panniello, U., & Garavelli, A. C. (2019). Towards Industry 4.0. *Business Process Management Journal 25(2)*. [Google Scholar] [CrossRef]

Baranovskyi, O. I. (2020). Regulation of functional and structural transformational processes in the financial sector. *Financial and credit activity: problems of theory and practice*, *1*(32), 292-306. [Google Scholar] [CrossRef]

Baranovskyi, O. I. (2018). Quality of the transformational processes in the financial sector of the national economy: vectors of the measurement. *Financial and credit activity: problems of theory and practice*, *3*(26), 350-367. [Google Scholar] [CrossRef]

Bardy, R., Rubens, A., & Eberle, P. (2017). Soft Skills and Job Opportunities of Migrants: Systemic Relationships in the Labour Market. Business Ethics and Leadership. 1(4), 5-21. [Google Scholar]

Boiko, V., Kwilinski, A., Misiuk, M., & Boiko, L. (2019). Competitive advantages of wholesale markets of agricultural products as a type of entrepreneurial activity: the experience of Ukraine and Poland. *Economic Annals-XXI*, *175*(1-2), 68-72. [Google Scholar] [CrossRef]

Chandeth, L., Shostakovska, A., Tsymbal, P., & Vlasova, G. (2020). Quality Control Development at the Strategic Level. *Virtual Economics*, *3*(1), 58-73. [Google Scholar] [CrossRef]

Czyzewski, B., Matuszczak, A., & Miskiewicz, R. (2019). Public goods versus the farm price-cost squeeze: shaping the sustainability of the EU's common agricultural policy. *Technological and Economic Development of Economy*, *25*(1), 82-102. [Google Scholar] [CrossRef]

Dalevska, N., Khobta, V., Kwilinski, A., & Kravchenko, S. (2019). A model for estimating social and economic indicators of sustainable development. *Entrepreneurship and Sustainability Issues*, *6*(4), 1839-1860. [Google Scholar] [CrossRef]

Dementyev, V. V., & Kwilinski, A. (2020). Institutional component of production costs. *Journal of Institutional Studies*, *12*(1), 100-116. [Google Scholar] [CrossRef]

Dobrovic, J., Kmeco, Ľ., Gallo, P., & Gallo jr, P. (2019). Implications of the Model EFQM as a strategic management tool in practice: a case of Slovak tourism sector. *Journal of Tourism and Services*, *10*(18), 47-62. [Google Scholar] [CrossRef]

Drozdz, W. (2019). The development of electromobility in Poland. *Virtual Economics*, *2*(2), 61-69. [Google Scholar] [CrossRef]

Drozdz, W., Miskiewicz, R., Pokrzywniak, J., & Elzanowski, F. (2019). *Urban Electromobility in the Context of Industry 4.0.* Torun: Wydawnictwo Adam Marszalek.

Drozdz, W., Marszalek-Kawa, J., Miskiewicz, R., & Szczepanska-Waszczyna, K. (2020). *Digital Economy in the Comporary World.* Torun: Wydawnictwo Adam Marszalek.

Dyubrovok, Sh., Ratty, C. (2015). Internet of Thigs: evolution or revolution. Consumer Electronic Association.

Dzwigol, H. (2019). The concept of the system approach of the enterprise restructuring process. *Virtual Economics*, *2*(4), 46-70. [Google Scholar] [CrossRef]

Dzwigol, H., Dzwigol-Barosz, M., Miskiewicz, R., & Kwilinski, A. (2020a). Manager Competency Assessment Model in the Conditions of Industry 4.0. *Entrepreneurship and Sustainability Issues,* *7*(4), 2630-2644. [Google Scholar] [CrossRef]

Dzwigol, H., Dzwigol–Barosz, M., & Kwilinski, A. (2020b). Formation of Global Competitive Enterprise Environment Based on Industry 4.0 Concept. *International Journal of Entrepreneurship,* *24*(1), 1-5. [Google Scholar]

Dubina, O., Us, Y., Pimonenko, T., & Lyulyov, O. (2020). Customer Loyalty to Bank Services: The Bibliometric Analysis. *Virtual Economics,* *3*(3), 53-66. [Google Scholar] [CrossRef]

Furmaniak, S., Gauden, P. A., Patrykiejew, A., Miskiewicz, R., & Kowalczyk, P. (2018). Carbon nanohorns as reaction nanochambers–a systematic Monte Carlo study. *Scientific Reports, 8(1),* 1-9. [Google Scholar] [CrossRef]

Furmaniak, S., Gauden, P. A., Patrykiejew, A., Miskiewicz, R., & Kowalczyk, P. (2019a). The Effects of Confinement in Pores Built of Folded Graphene Sheets on the Equilibrium of Nitrogen Monoxide Dimerisation Reaction. *Journal of Physics Condensed Matter, 31*(13), 135001. [Google Scholar] [CrossRef]

Furmaniak, S., Gauden, P. A., Patrykiejew, A., Szymański, G., Miskiewicz, R., & Kowalczyk, P. (2019b). In Silico Study on the Effects of Carbonyl Groups on Chemical Equilibrium of Reactions with a Polar Product Occurring under Confinement in Pores of Activated Carbons. *Chemical Engineering Communications*, 1-12. [Google Scholar] [CrossRef]

Gubbi, J., Buyya, R., Marusic, S., & Palaniswami, M. (2013). Internet of Things (IoT): A vision, architectural elements, and future directions. *Future generation computer systems*, *29*(7), 1645-1660. [Google Scholar] [CrossRef]

Guo, B., Zhang, D., Wang, Z., Yu, Z., & Zhou, X. (2013). Opportunistic IoT: Exploring the harmonious interaction between human and the internet of things. *Journal of Network and Computer Applications*, *36*(6), 1531-1539. [Google Scholar] [CrossRef]

Hens, L., Melnyk, L. H., Matsenko, O. M., Chyhryn, O. Y., & Gonzales, C. C. (2019). Transport Economics and Sustainable Development in Ukraine. Marketing and Management of Innovations, 3, 272-284 [Google Scholar] [CrossRef]

Hroznyi, I., Tymoshyk, M., & Malevski, E. (2019). Risk Optimization of Industrial Enterprise. *Virtual Economics, 2*(3), 55-72. [Google Scholar] [CrossRef]

Ibragimov, Z., Vasylieva, T., & Lyulyov, O. (2019). The national economy competitiveness: effect of macroeconomic stability, renewable energy on economic growth. *Economic and Social Development: Book of Proceedings*, 877-886. [Google Scholar]

Jara, A. J., Parra, M. C., & Skarmeta, A. F. (2014). Participative marketing: extending social media marketing through the identification and interaction capabilities from the Internet of things. *Personal and Ubiquitous Computing*, *18*(4), 997-1011. [google Scholar] [CrossRef]

Kamata, H. (2016). A Segmentation Analysis of Japanese Spa Tourists. *Journal of Tourism & Services*, *7*(12). [Google Scholar]

Kazmierczyk, J. (2012). Information Technology Systems and Their Impact on the Employment Level in the Polish Banking Sector. *Journal of Security and Sustainability Issues, 1*(3), 187-195. [Google Scholar]

Kazmierczyk, J., Romashkina, G. F., & Macholak, P. (2020). Lifelong Learning as an Employee Retention Tool. Comparative Banking Analysis. *Entrepreneurship and Sustainability Issues, 8*(1), 1064-1080. [Google Scholar] [CrossRef]

Kodama, F., & Shibata, T. (2015). Demand articulation in the open-innovation paradigm. *Journal of open innovation: Technology, Market, and Complexity*, *1*(1), 2. [Google Scholar] [CrossRef]

Kóródi, M., & Dávid, L. D. (2019). The Uniqueness Of The Hungarian Rural Tourism Supply. *Journal of Tourism and Services*, *10*(19), 24-39. [Google Scholar] [CrossRef]

Kuzior, A., Kwilinski, A., & Tkachenko, V. (2019). Sustainable Development of Organizations Based on the Combinatorial Model of Artificial Intelligence. *Entrepreneurship and Sustainability, 7*(2), 1353-1376. [Google Scholar] [CrossRef]

Kuzior, A., & Kuzior, P. (2020). The Quadruple Helix Model as a Smart City Design Principle. *Virtual Economics, 3*(1), 39-57. [Google Scholar] [CrossRef]

Kuznyetsova, A. Y., Zherebylo, I. V., Klipkova, O. I., & Kozmuk, N. I. (2019). Creation of the value of national enterprises with the help of the innovation centers in the cluster formations. *Financial and credit activity: problems of theory and practice*, *2*(29), 391-402. [Google Scholar] [CrossRef]

Kuznyetsova, A. Y., & Klishchuk, O. V. (2017). Theoretical conception of price stability targeting arrangement: investigation of basic principles of implementation monetary regime. *Financial and credit activity: problems of theory and practice*, *2*(23), 388-396. [Google Scholar] [CrossRef]

Kwilinski, A. (2018). Mechanism of Formation of Industrial Enterprise Development Strategy in the Information Economy. *Virtual Economics, 1*(1), 7-25. [Google Scholar] [CrossRef]

Kwilinski, A. (2019). Implementation of Blockchain Technology in Accounting Sphere. *Academy of Accounting and Financial Studies Journal, 23*, 1-6. [Google Scholar]

Kwilinski, A., & Kuzior, A. (2020). Cognitive Technologies in the Management and Formation of Directions of the Priority Development of Industrial Enterprises. *Management Systems in Production Engineering, 28*(2), 133-138. [Google Scholar] [CrossRef]

Kwilinski, A., Vyshnevskyi, O., & Dzwigol, H. (2020). Digitalization of the EU Economies and People at Risk of Poverty or Social Exclusion. *Journal of Risk and Financial Management, 13*(7), 142. [Google Scholar] [CrossRef]

Lakhno, V., Malyukov, V., Bochulia, T., Hipters, Z., Kwilinski, A., & Tomashevska, O. (2018). Model of Managing of the Procedure of Mutual Financial Investing in Information Technologies and Smart City Systems. *International Journal of Civil Engineering and Technology, 9*(8), 1802-1812. [Google Scholar]

Lyeonov, S., Pimonenko, T., Bilan, Y., Štreimikienė, D., & Mentel, G. (2019). Assessment of green investments' impact on sustainable development: Linking gross domestic product per capita, greenhouse gas emissions and renewable energy. *Energies, 12*(20), 3891. [Google Scholar] [CrossRef]

Lyulyov, O. V., & Pimonenko, T. V. (2017). Lotka-Volterra model as an instrument of the investment and innovative processes stability analysis. *Marketing and Management of Innovations*, (1), 159-169.

Melnychenko, O. (2019). Application of Artificial Intelligence in Control Systems of Economic Activity. *Virtual Economics, 2*(3), 30-40. [Google Scholar] [CrossRef]

Melnychenko, O. (2020). Is Artificial Intelligence Ready to Assess an Enterprise's Financial Security? *Journal of Risk and Financial Management, 13*(9), 191. [Google Scholar] [CrossRef]

Miskiewicz, R. (2017a). Knowledge in the Process of Enterprise Acquisition. *Progress in Economic Sciences*, 4, 415-432. [Google Scholar] [CrossRef]

Miskiewicz, R. (2017b). *Knowledge Transfer in Merger and Acquisition Processes in the Metallurgical Industry.* Warsaw: PWN. [Google Scholar]

Miskiewicz, R. (2018). *The Importance of Knowledge Transfer on the Energy Market. Polityka Energetyczna, 21*(2), 49-62.

[Google Scholar] [CrossRef]

Miskiewicz, R. (2019a). Challenges Facing Management Practice in the Light of Industry 4.0: The Example of Poland. *Virtual Economics, 2*(2), 37-47. [Google Scholar] [CrossRef]

Miskiewicz, J. (2019b). The Merger of Natural Intelligence with Artificial Intelligence, with a Focus on Neuralink Company. *Virtual Economics, 2*(3), 22-29. [Google Scholar] [CrossRef]

Miskiewicz, R, & Wolniak, R. (2020). Practical Application of the Industry 4.0 Concept in a Steel Company. *Sustainability, 12*(14), 5776. [Google Scholar] [CrossRef]

Miorandi, D., Sicari, S., De Pellegrini, F., & Chlamtac, I. (2012). Internet of things: Vision, applications and research challenges. *Ad Hoc Networks, 10*(7), 1497-1516. [Google Scholar] [CrossRef]

Mira, M. D. R. C., Moura, A. F. A., & Mónico, L. D. S. M. (2018). A new measure of the quality of tourism product. *Journal of Tourism and Services, 9(17)*. [CrossRef]

Mura, L., & Kajzar, P. (2019). Small Businesses in Cultural Tourism in a Central European Country. *Journal of Tourism and Services, 10(19), 40-54*. [Google Scholar] [CrossRef]

Neidhardt, J., & Werthner, H. (2018). IT and tourism: still a hot topic, but do not forget IT. *Information Technology & Tourism, 20*(1-4), 1-7. [Google Scholar] [CrossRef]

Niyato, D., Alsheikh, M. A., Wang, P., Kim, D. I., & Han, Z. (2016, May). Market model and optimal pricing scheme of big data and Internet of Things (IoT). In *2016 IEEE International Conference on Communications (ICC)* (pp. 1-6). IEEE. [Google Scholar] [CrossRef]

Ntalianis, K., Kavoura, A., Tomaras, P., & Drigas, A. (2015). Non-Gatekeeping on Social Media: A Reputation Monitoring Approach and its Application in Tourism Services. *Journal of Tourism & Services*, *6*(10). [Google Scholar]

Pajak, K., Kamińska, B., & Kvilinskyi, O. (2016). Modern Trends of Financial Sector Development under the Virtual Regionalization Conditions. *Financial and Credit Activity: Problems of Theory and Practice, 2*(21), 204-217. [Google Scholar] [CrossRef]

Pajak, K., Kvilinskyi, O., Fasiecka, O., & Miskiewicz, R. (2017). Energy Security in Regional Policy in Wielkopolska Region of Poland. *Economics and Environment, 2*(61), 122-138. [Google Scholar]

Panchenko, V., Harust, Yu., Us, Ya., Korobets, O., & Pavlyk, V. (2020). Energy-Efficient Innovations: Marketing, Management and Law Supporting. Marketing and Management of Innovations, 1, 256-264. [google Scholar] [CrossRef]

Pimonenko T., Us J., Leus D., Fedyna S. (2017). The modern ecological and economic instruments for sustainable development. *Bulletin of Sumy State University. Economy Ser., 2,* 57–67.

Pimonenko, T., Lyulyov, O., & Us, Y. (2018a). Green development of small and medium enterprises of Ukraine: the eu experience. In *Competitivitatea si Inovarea în Economia Cunoasterii* (Vol. 2, pp. 69-78). [Google Scholar]

Pimonenko, T., Lyulyov, O., Chygryn, O., & Palienko, M. (2018b). Environmental Performance Index: relation between social and economic welfare of the countries. *Environmental Economics, 9(3)*, 1. [Google Scholar]

Ranasinghe, R. (2019). Antecedents of Job Performance of Tourism Graduates: Evidence from State University-Graduated Employees in Sri Lanka. *Journal of Tourism and Services, 10(18)*, 16-34. [Google Scholar] [CrossRef]

Saluga, P.W., Szczepańska-Woszczyna, K., Miskiewicz, R., & Chlad, M. (2020). Cost of Equity of Coal-Fired Power Generation Projects in Poland: Its Importance for the Management of Decision-Making Process. *Energies, 13*(18), 4833. [Google Scholar] [CrossRef]

Savchenko, T., Basiurkina, N., Rodina, O., & Kwilinski, A. (2019). Improvement of the Assessment Methods of Product Competitiveness of the Specialized Poultry Enterprises. *Management Theory and Studies for Rural Business and Infrastructure Development, 41*(1), 43-61. [Google Scholar] [CrossRef]

Sharma, A., Tomar, R., Chilamkurti, N., & Kim, B. G. (2020). Blockchain Based Smart Contracts for Internet of Medical Things in e-Healthcare. *Electronics*, *9*(10), 1609. [Google Scholar] [CrossRef]

Spring, M., & Araujo, L. (2017). Product biographies in servitization and the circular economy. *Industrial Marketing Management*, *60*, 126-137. [Google Scholar] [CrossRef]

Stankovic, J. A. (2014). Research directions for the internet of things. *IEEE Internet of Things Journal*, *1*(1), 3-9. [Google Scholar] [CrossRef]

Tkachenko, V., Kwilinski, A., Klymchuk, M., & Tkachenko, I. (2019). The economic-mathematical development of buildings construction model optimization on the basis of digital economy. *Management Systems in Production Engineering*, *27*(2), 119-123. [Google Scholar] [CrossRef]

Tkachenko, V., Kwilinski, A., Kaminska, B., Tkachenko, I., & Puzyrova, P. (2019b). Development and Effectiveness of Financial Potential Management of Enterprises in Modern Conditions. *Financial and Credit Activity: Problems of Theory and Practice, 3*(30), 85-94. [Google Scholar] [CrossRef]

Trushkina, N. (2019). Development of the information economy under the conditions of global economic transformations: features, factors and prospects. *Virtual Economics*, *2*(4), 7-25. [Google Scholar] [CrossRef]

Trushkina, N., Abazov, R., Rynkevych, N., & Bakhautdinova, G. (2020). Digital Transformation of Organizational Culture under Conditions of the Information Economy. *Virtual Economics*, *3*(1), 7-38. [Google Scholar] [CrossRef]

Turkay, O., Korkutata, A., & Yılmaz, O. (2018). Does Animation Services Really Matter? Place of Animation Services in the Perceived Quality–Overall Satisfaction Model. *Journal of Tourism and Services*, *9*(16), 14-30. [Google Scholar] [CrossRef]

Turkes, M. C., Căpusneanu, S., Topor, D. I., Staras, A. I., Hint, M. S., & Stoenica, L. F. (2020). Motivations for the Use of IoT Solutions by Company Managers in the Digital Age: A Romanian Case. *Applied Sciences*, *10*(19), 6905. [Google Scholar] [CrossRef]

Vyshnevskyi, O. (2019). Unity of digital and virtual economies within concept of Dataism. *Virtual Economics*, 2(3), 7-21. [Google Scholar] [CrossRef]

Vovchak, O. D., Senyshch, P. M., & Melnyk, T. V. (2019). «Purging» of the banking system: impacton the key performance indicators of banks. *Financial and credit activity: problems of theory and practice, 1(28)*, 16-25. [Google Scholar] [CrossRef]

Zaloznova, Y., & Trushkina, N. (2019). Management of logistic activities as a mechanism for providing sustainable development of enterprises in the digital economy. *Virtual Economics*, *2*(1), 64-81. [Google Scholar] [CrossRef]

Радослав Мішкєвіч, д.е.н., Сілезька політехніка, Польща

Інтернет речей та маркетинг: бібліографічний аналіз

Систематизація наукових джерел та підходів щодо дослідження особливостей стрімкого проникнення Інтернету речей в життя свідчить про значний внесок науковців у вирішення даного питання. У статті узагальнено аргументи та контраргументи в рамках наукової дискусії щодо особливостей трансформації маркетингових процесів в умовах швидкого розвитку Інтернету речей. Головною метою дослідження є аналіз структури та динаміки наукових публікацій, присвячених тематиці розвитку Інтернету речей з маркетингової точки зору. Гіпотеза дослідження полягає в аналізі наукового доробку, представленого у базі даних Scopus, щодо взаємозв'язку між розвитком Інтернету речей та маркетингом. Об'єктом дослідження є низка наукових публікацій в різних предметних областях, які індексуються у базі даних Scopus за ключовими словами «Internet of Things» та «Marketing». Пошук ключових слів здійснено у заголовках статей, їх анотаціях та ключових словах. Періодом дослідження обрано 2008-2020 роки. Практична реалізація усіх етапів даного дослідження здійснена за допомогою інструментарію програмного забезпечення VOSviewer та Scopus. У ході емпіричного аналізу визначено динаміку публікаційної активності, висвітлено найбільш впливові статті та журнали з означеної тематики. Відповідно до мети дослідження проведено бібліометричний аналіз обраних публікацій за критеріями спільної появи ключових слів та співавторства за країнами. Отримані результати дозволили зробити висновок про актуальність подальших досліджень питань щодо кібербезпеки фінансових та персональних даних, управління даними, смарт-виробництва, сталого розвитку, доповненої реальності, штучної нейронної мережі тощо. Результатами бібліометричного аналізу свідчать про тісну співпрацю між науковцями з 1) США, Гонконгу та ЄС; 2) Китаю, Японії, Малайзії, В'єтнаму, Тайвані, Індонезії тощо; 3) Південної Америки, Ізраїлю та країн Європи; 4) Австралії та Таїланду та пострадянських країн. Автори зазначили, що результати проведеного дослідження мають науковий внесок у подальший розвиток маркетингових процесів під впливом Інтернету речей.

Ключові слова: штучний інтелект, великі дані, цифрова економіка, кіберфізичні системи, Індустрія 4.0, Інтернет речей, економіка знань.