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Digital Economy in Indonesia: Trends and Future Research

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Abstract

Digital economy serves as one of the agenda of Association of Southeast Asian Nations (ASEAN) in undertaking the Fourth Industrial Revolution. Additionally, the Indonesian government is committed to conducting research and innovation related to digital economy. Therefore, this study aims to reveal trends and future research under the topic of digital economy in Indonesia. This study utilizes big data methods, conducted through Scopus database, while the analysis is conducted through bibliometrics and visualization VOSViewer. The results of this study indicate that financial technology becomes the most published topic by authors with affiliation from Indonesia, although the topic has been widely discussed in international journals. Meanwhile, future research topics include research on digital payments, technology acceptance for the Micro, small, and medium enterprises (MSMEs), digital transformation for e-learning, and e-government.

Keywords: digital economy; big data methods; bibliometrics; research trends; future research

1.0 INTRODUCTION

Discourse regarding Digital Economy becomes one of the concerns and mandates of President Joko Widodo for National Research and Innovation Agency to conduct research and innovation. As such, researchers within National Agency for Research and Innovation (Badan Riset dan Inovasi Nasional - BRIN) are required to generate research and innovation products demonstrating the superiority of science and technology research and innovation (Badan Riset dan Inovasi Nasional, 2021). In particular, digital economy as one of the concerns of President Joko Widodo has been emphasized by the data indicating that 21 million new digital consumers developed during the Covid-19 pandemic in Indonesia, even 72% were from new consumers in non-metropolitan areas (Google, Temasek, 2021). Furthermore, approximately 28% of digital vendors in Indonesia reported that they would not survive the pandemic, if it were not for digital platforms, specifically in the form of digital financial services and digital solutions (Fig. 1).

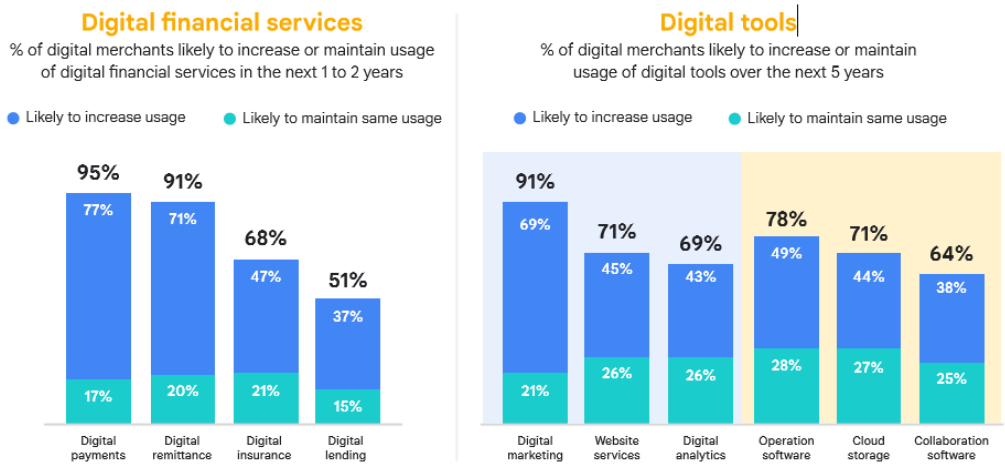

Fig 1. Digital Platform Growth in Indonesia

Source: Google-commissioned Dynata SEA-6 Digital Merchant Survey 2021

Based on these conditions, it is deemed important to navigate how the research trends under the topic of digital economy has been conducted in Indonesia, and how they developed, as well as future agenda supported by the existence of BRIN as the agent or actor of research and innovation (representing government institution) in Indonesia.

The organization of the paper is as follows. Section 2 contains an explanation of the literature review of the digital economy. This section also provides limitations on the aspects of the digital economy used in this study. Furthermore, Section 3 describes the research methods, data collection protocols, and data visualization techniques. Section 4 describes the results and discussion of the data collection and analysis results, starting from an overview of the results, such as distribution per cluster and cluster trends per year. Furthermore, this section describes the network visualization of the digital economy in Indonesia, overlay visualization for research trends of the digital economy in Indonesia, and density visualization for future research agendas of the digital economy in Indonesia. Finally, conclusions and analysis of research gaps that become opportunities for future research are presented in Section 5.

■ 2.0 LITERATURE REVIEW

The presence of the Fourth Industrial Revolution (4IR), with the shifting of the physical and digital worlds, has attracted worldwide attention, including Association of Southeast Asian Nations (ASEAN). ASEAN has set the three strategic focuses and priorities in dealing with 4IR conditions, including digital economy, and two other priorities (Technological governance and cyber security, and digital transformation of society). Thus far, digital economy is defined as:

> "…. activities and transactions initiated by the public and private sectors, as well as citizens, to produce, adopt, and innovate digital technologies and services in relation to socio-economic functions for enhancement of wealth creation, productivity, and quality of life. ." (The ASEAN Secretariat, 2021: pp.17)

On the other hand, digital economy positively contributes to renewable energy transition in high-income countries, generating regional heterogeneity which affects energy transition (Shahbaz et al., 2022). In addition, the importance of digital economy is evident through research as an important driver for regional low-carbon development. Environmental governance, technological innovation, and improving industrial structures serve as the three main channels for digital economy to influence low carbon campaign (Zhang et al., 2022).

No.	Aspects of Digital Economy	
1.	Digital trade	1. digital goods and services
		2. tangible goods and services delivered digitally
		3. digital enablers of trade transactions
		4. emerging transformative digital technologies
2.	Industry 4.0 (advanced manufacturing)	specialised technologies, such as sensors, robotics, high-performance computing, control systems, platform technologies, additive manufacturing, and sustainable and green technologies
3.	Services sectors of the new economy	Health services technology
		financial technology (fintech)
		Logistics technology
		Tourism (digital tourism relates to the use of digital technologies)
		Other professional service (solutions to commercial systems and consumer markets, particularly in business consulting, accounting, tax and legal services, advertising, marketing, customer service, and computer-related services.)
		Stimulating the adoption of smart agriculture
		Digitally enabling MSMEs to be globally competitive

Table 1. Aspects of Digital Economy

Source: The ASEAN Secretariat, 2021

In this article, the digital economy emphasizes the three aspects (Table 1), comprising: 1) Digital trade, includes: digital goods and services, tangible goods and services delivered digitally, digital enablers of trade transactions, and emerging transformative digital technologies; 2) Industry 4.0 (advanced manufacturing),

includes: specialised technologies, such as sensors, robotics, high-performance computing, control systems, platform technologies, additive manufacturing, and sustainable and green technologies; and 3) Service sectors of new economy, includes: Health services technology, financial technology, Logistics technology, digital tourism, solutions to commercial systems and consumer markets, particularly in business consulting, accounting, tax and legal services, advertising, marketing, customer service, and computer-related services, stimulating the adoption of smart agriculture, and Digitally enabling Micro, small, and medium enterprises (MSMEs) to be globally competitive. As such, the aforementioned sectors become ASEAN concern in developing digital economy within South East Asia region.

■ 3.0 RESEARCH METHODOLOGY

This study utilizes big data methods (Oswald & Putka, 2017), for data collection or acknowledged as text data mining (Putera, Suryanto, et al., 2022; Putera, Widianingsih, et al., 2022), conducted through Scopus database on August 08, 2022. The data collection query is illustrated in Table 2. Further, the collected data is conducted through bibliometrics and visualization VOSViewer (Van Eck & Waltman, 2018), aimed to observe future research trend and agenda. Reviews of current and future research have been carried out using bibliometric studies, such as those carried out to find out powertrain technologies (Conway et al., 2021), logistics Internet-of-Things (Abdul et al., 2021), remediation of microplastics using constructed wetlands (Xu et al., 2022), Constructed wetlands in 1991–2011 (Zhi & Ji, 2012), sous vide processing in the meat industry (Thathsarani et al., 2022), and circular economy research on building construction and demolition waste (Oluleye et al., 2022).

Aspects of Digital Economy	Query	Results
digital trade	(TITLE-ABS-KEY ("digital trade") OR TITLE-ABS-KEY ("digital goods") OR TITLE-ABS-KEY ("digital services") OR TITLE-ABS-KEY ("deliver* digita*") OR TITLE-ABS-KEY ("digital product*") OR TITLE-ABS-KEY ("Digital Delivery") OR TITLE-ABS-KEY ("tangible digital*") OR TITLE-ABS-KEY ("digital transactions") OR TITLE-ABS-KEY ("e-payment") OR TITLE-ABS-KEY ("e-signature*") OR TITLE-ABS-KEY ("digitalisation of trade document*") OR TITLE-ABS-KEY ("transformative digital") OR TITLE-ABS-KEY ("digital technologies") AND AFFILCOUNTRY (indonesi*))	597 document results
digital technologies for industry and MSMEs	(TITLE-ABS-KEY (sensors) OR TITLE-ABS-KEY (robotics) OR TITLE-ABS-KEY ("high-performance computing") OR TITLE-ABS-KEY ("control systems") OR TITLE-ABS-KEY ("platform technologies") OR TITLE-ABS-KEY ("additive manufacturing") OR TITLE-ABS-KEY ("green technologies") OR TITLE-ABS-KEY ("sustainable technologies") OR TITLE-ABS-KEY ("digital technologies") AND TITLE-ABS-KEY (industry) OR TITLE-ABS-KEY ("MSMEs") OR TITLE-ABS-KEY ("micro-, small-, and medium-sized enterprises") AND AFFILCOUNTRY (indonesi*))	642 document results
services sectors of the new economy	(TITLE-ABS-KEY ("Health services technology") OR TITLE-ABS-KEY ("e-Health") OR TITLE-ABS-KEY ("digital Health") OR TITLE-ABS-KEY ("financial technology") OR TITLE-ABS-KEY (fintech) OR TITLE-ABS-KEY ("Logistics technology") OR TITLE-ABS-KEY ("e-Logistics") OR TITLE-ABS-KEY ("e-Tourism") OR TITLE-ABS-KEY ("digital tourism") OR TITLE-ABS-KEY ("e-commercial") OR TITLE-ABS-KEY ("e-consumer") OR TITLE-ABS-KEY ("electronic market") OR TITLE-ABS-KEY ("electronic consulting") OR TITLE-ABS-KEY ("electronic accounting") OR TITLE-ABS-KEY ("electronic tax") OR TITLE-ABS-KEY ("electronic legal services") OR TITLE-ABS-KEY ("electronic customer service") OR TITLE-ABS-KEY ("smart agriculture") OR TITLE-ABS-KEY ("electronic MSMEs") AND AFFILCOUNTRY (indonesi*))	594 document results

Table 2. Query text data mining digital economy on Scopus database

In research, data collection and analysis went through three stages, namely 1) structured search queries, 2) screening process and 3) ready for analysis. These three stages are referred to as the protocol of literature retrieval, screening procedure, and data analysis **(Fig 2)**. In the first stage, data was collected by accessing the Scopus database on August 8, 2022. They accessed the Scopus database using query text data mining **(Table 2)**, divided into three search clusters: Aspects 1: digital trading, Aspects 2: digital technologies for industry and MSMEs, and Aspects 3: services sectors of the new economy. In addition, there are four additional criteria for searching data, namely:

1) Search within: Article title, Abstract, Keywords.
2) Document type: Conference Paper, Article, Review, Book Chapter, Book, Letter/Note/Data Paper, Erratum, Undefined.
3) Document Language: English, Indonesian.
4) Published from All years.

In this first stage, it produced 1,843 papers. Then in the second stage, a screening process was carried out by excluding publications published in 2023. In the second stage, 1,833 articles were obtained. The results of the second stage are used as a basis for analysis in the third stage. This third stage is analyzed with the help of VOSViewer to display a network visualization of the digital economy in Indonesia, overlay visualization for research trends of the digital economy in Indonesia, and density visualization for future research agendas of the digital economy in Indonesia.

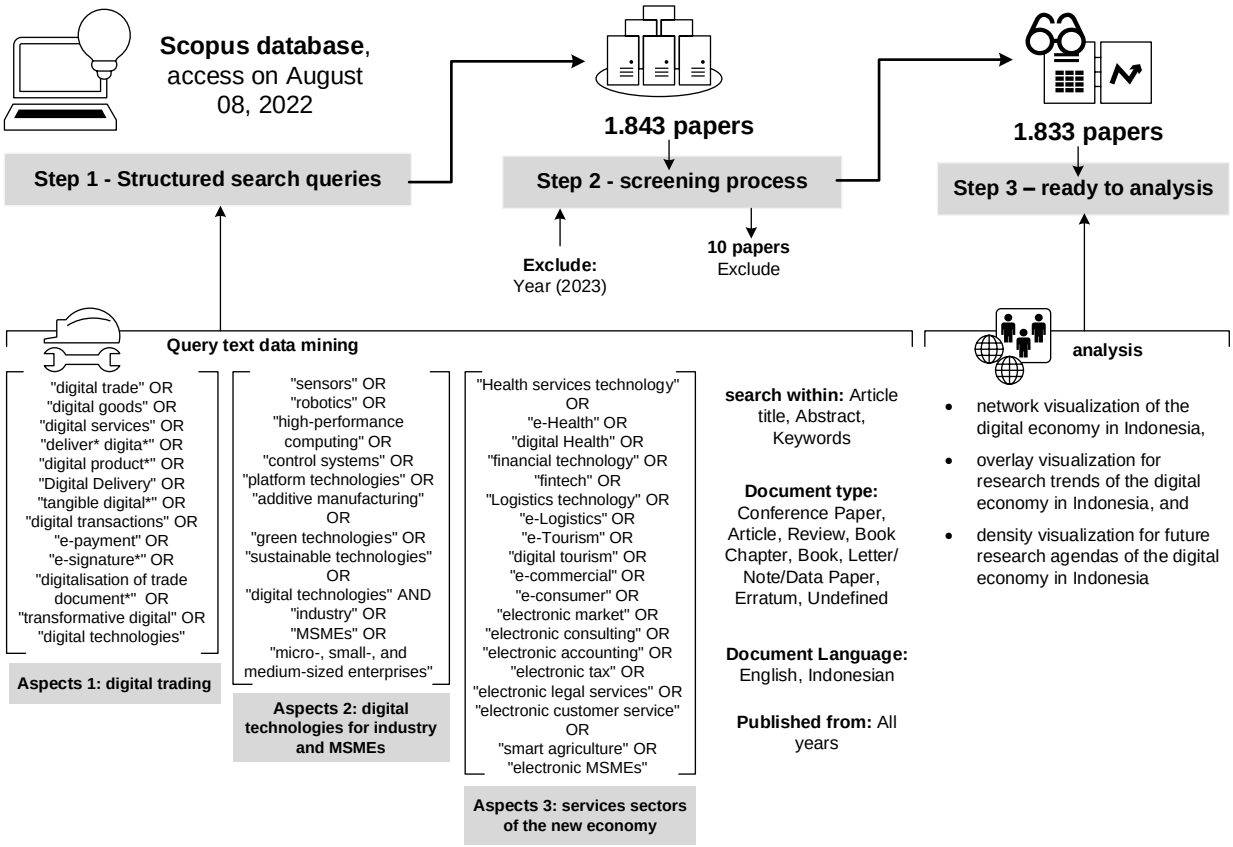

Fig 2. Protocol of literature retrieval, screening procedure and data analysis

4.0 RESULTS AND DISCUSSION

Based on data mining results on the Scopus database, there are 1.833 digital economy publications with author affiliations from Indonesia, with distribution originating from 597 documents resulting from digital trade, 642 resulting documents from a digital technology for industry and MSMEs, and 594 resulting documents from the services sectors of the new economy. Based on these results, there are 53.96% of conference papers and 39.94% of articles, while other depictions are illustrated in Table 3. These results show that more than half of publications by Indonesian authors on the topic of the digital economy are primarily published in document conferences. The conditions presented are possible because the development of digital economy topics in the last decade has attracted brief discussion through international seminars.

Aspects of Digital Economy / document type	digital trade	digital technologies for industry and MSMEs	services sectors of the new economy	Total / percentage
Conference Paper	292	404	293	989 / 53,96%
Article	280	212	261	753 / 41,08%
Review	13	16	20	49 / 2,67%
Book Chapter	10	9	14	33 / 1,80%
Book	-	1	2	3 / 0,16%
Letter/Note/Data Paper	-	-	4	4 / 0,22%
Erratum	1	-	-	1 / 0,05%
Undefined	1	-	-	1 / 0,05%

Table 3. Distribution of Digital Economy publications with Indonesian affiliates

The first digital economy publication was published in 2000 from the digital technologies for industry and MSMEs cluster, with the title "Self-organized network with a supervised training and its comparison with FALVQ in artificial odor recognition system" (Kusumoputro et al., 2000). The digital economy publication trend increased in 2017 and occurred in all digital economy publication clusters (Fig 3). However, in 2020-2022 publications in the digital technologies for industry and MSMEs cluster have decreased. The same happened to the digital trade cluster publications, which fell in 2022 (112 publications) compared to 2021 (167 publications). Only the services sector of the new economy publication cluster has experienced an annual increase since 2014.

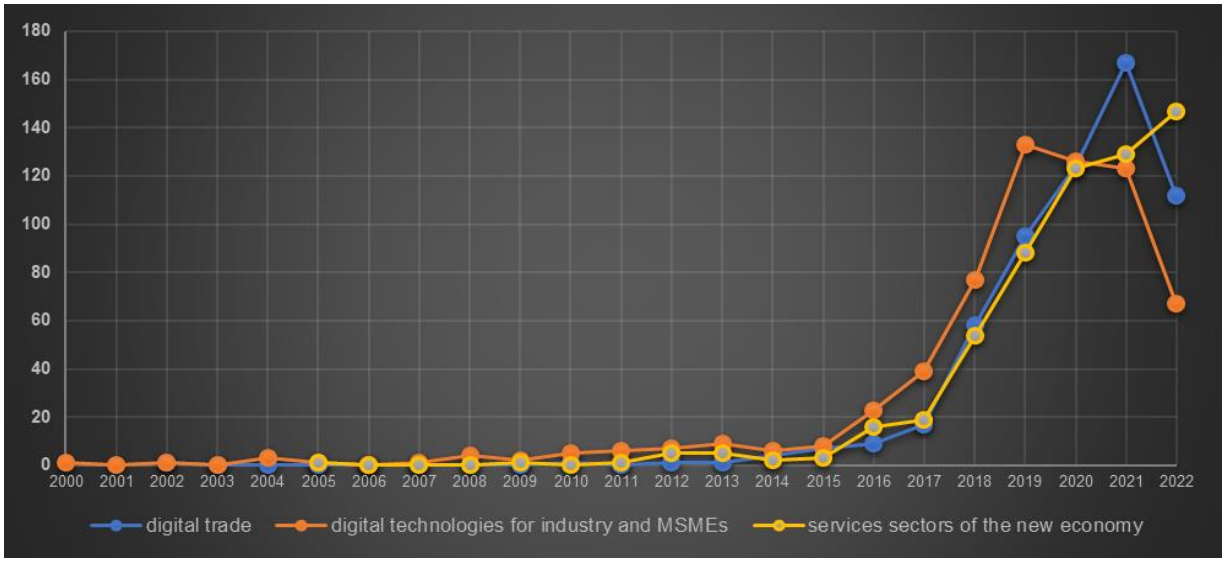

Fig 3. Trends in digital economy publications based on three clusters

The results of analysis and visualization using VOSViewer produce six clusters **(Fig. 4).** In cluster 1, there are two significant nodes (larger nodes), namely e-health and covid-19. In Cluster 1, two articles on e-health topics have received many citations, namely "Universal health coverage in Indonesia: concept, progress, and challenges" (Agustina et al., 2019) with 175 citations and "Design restful web service of national population database for supporting e-health interoperability service" (Miftakul Amin et al., 2018) with 23 citations. In cluster 2, the topic of fintech is the most dominant; in this cluster, there are several influential/most cited articles, namely "Is mobile payment still relevant in the fintech era?" (Iman, 2018) with 78 citations, "Do financial technology firms influence bank performance?" (Phan et al., 2020) with 60 citations, and "Challenges and trends of financial technology (Fintech): A systematic literature review" (Suryono et al., 2020) with 36 citations. In Cluster 3, the internet of things topic is the most dominant. The most cited article is "A critical review on computer vision and artificial intelligence in the food industry," (Kakani et al., 2020) with 81 citations. Then in

Cluster 4, the digital technology topic has the most influence on this cluster. The article "Understanding Modern Learning Environment (MLE) in the big data era" (Huda et al., 2018) became the most cited with 97 citations. For cluster 5 and cluster 6, there are no significant nodes.

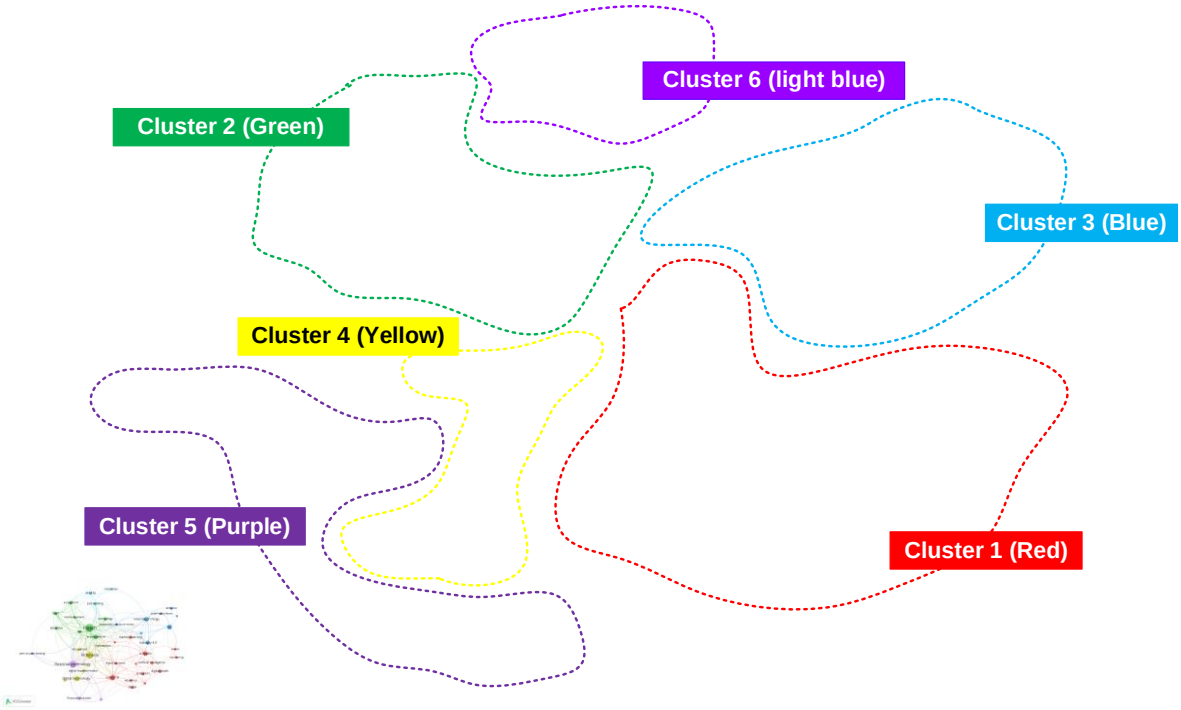

Fig 4. Network visualization of digital economy in Indonesia

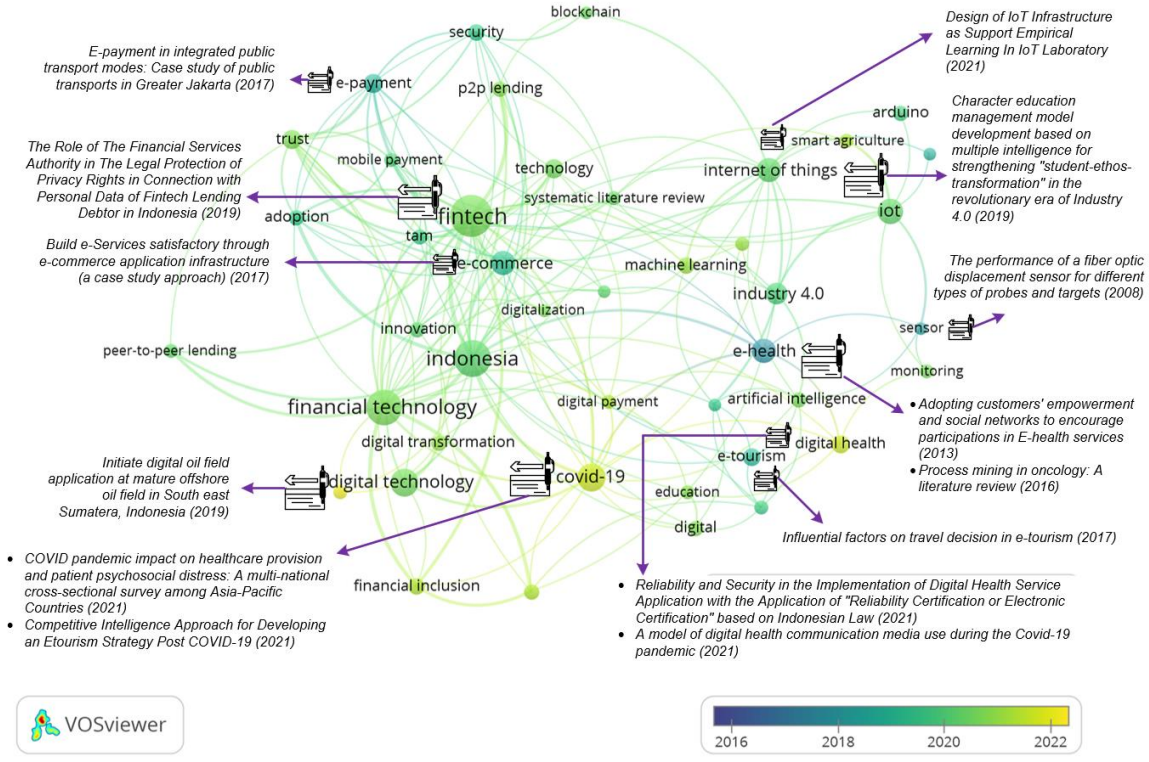

Fig 5. Overlay Visualization for Research Trends of digital economy in Indonesia

The development of the digital economy in Indonesia can be seen from the overlay visualization for research trends of the digital economy in Indonesia **(Fig 5).** Two topics emerged in 2016, namely issues related to sensors (Rizal et al., 2013; Yasin, Harun, Abdul-Rashid, et al., 2008; Yasin, Harun, Karyono, et al., 2008), and e-health (Anshari et al., 2013; Faoziah et al., 2014; Kurniati et al., 2016; Rachmawati et al., 2016). Further developments in 2017-2018 saw topics such as e-tourism (Prasetyo et al., 2017; Titan et al., 2017), e-payment (Abdinagoro & Hamsal, 2017), and e-commerce (Sari & Cassandra, 2017). In 2019-2020, fintech (Priskarini et al., 2019), the internet of things (Masaong & Mas, 2019), and digital technology emerged (Berawi et al., 2019; Waskito et al., 2019). Smart agriculture (Ardiansyah et al., 2019; Omar et al., 2020; Wahyudi, 2021; Wijaya et al., 2021; Wulandari et al., 2020), digital health (Hanif et al., 2021; Sumaedi et al., 2021), and covid-19 (Chung et al., 2021; Tulungen et al., 2021) will be here in 2021-2022.

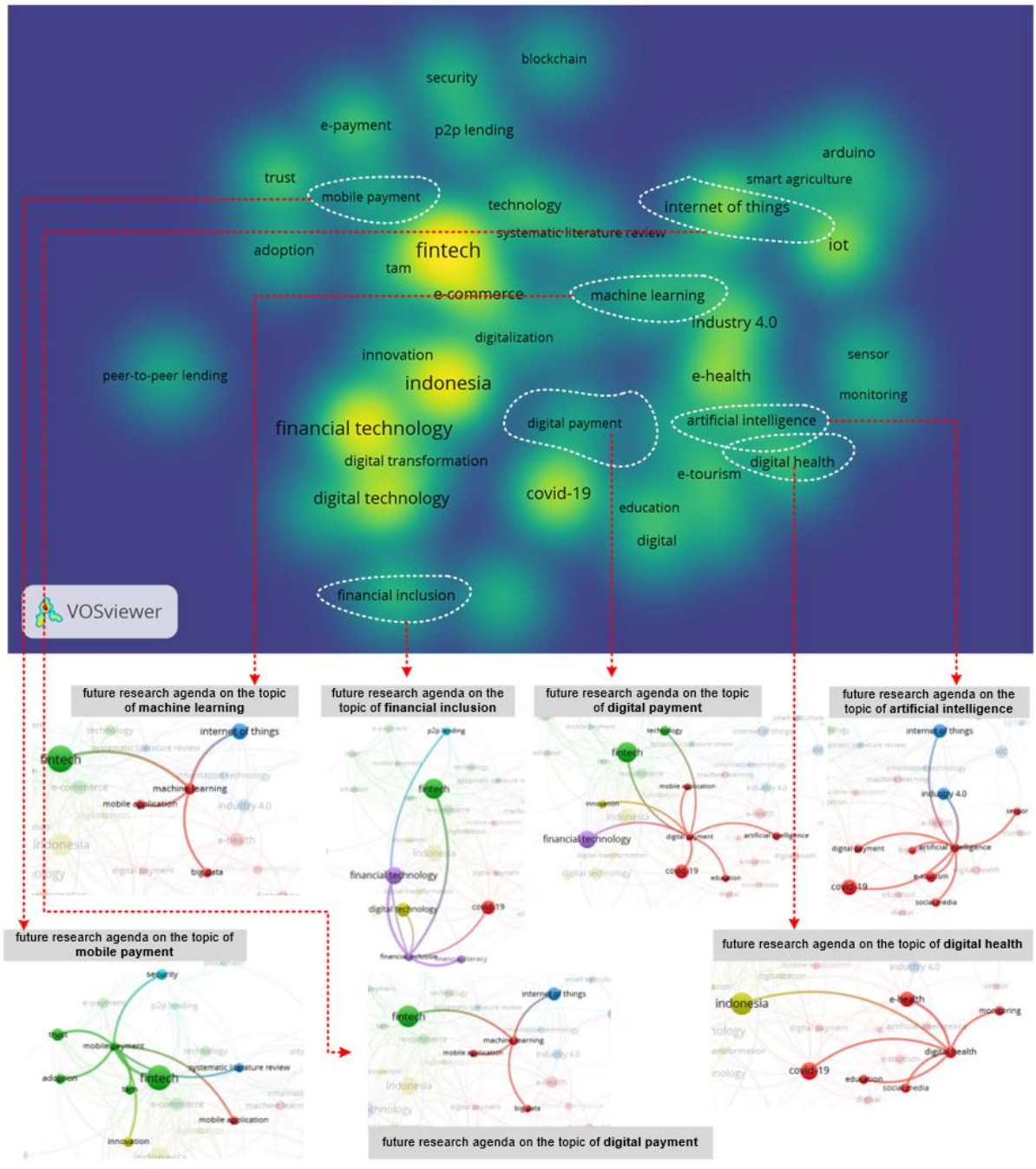

Fig 6. Density visualization for future research agenda of digital economy in Indonesia

The future research agenda can be seen from the results of the VOSViewers density visualization analysis (Fig. 6). seven topics can be used as a future research agenda, namely machine learning connected to fintech, the internet of things, mobile applications, and big data. There are also financial inclusion topics related to fintech,

digital technology, financial literacy, and covid-19. Third, topics related to digital payments are connected with mobile applications, innovation, fintech, technology, education, covid-19, and artificial intelligence. Artificial intelligence is the fourth topic that can become a future research agenda, especially related to industry 4.0, digital payments, e-tourism, social media, sensors, and the internet of things. Digital health is the fifth topic that can be used as a future research agenda, primarily related to e-health, monitoring, education, social media, covid-19, and Indonesia. In addition, two other topics are interrelated and could become future research agendas: digital and mobile payments. These topics are related to security, mobile applications, big data, machine learning, the internet of things, innovation, adoption, trust, and fintech.

■ 5.0 CONCLUSION

Based on results and data analysis on the Scopus database consisting of the three aspects (digital trade, digital technologies for industry and MSMEs, and service sectors of the new economy) with the country affiliation of the author from Indonesia, 1,833 publications were obtained. From these results, it is known that the distribution originates from 597 documents from digital trade, 642 from digital technology for industry and MSMEs, and 594 from the services sector of the new economy. Based on these results, there are 53.96% of conference papers and 39.94% of articles. The themes related to 'digital technologies for industry and MSMEs' are published mainly by authors with affiliations from Indonesia. Several studies on sensors and e-health marked the trend of the digital economy in Indonesia before 2018, then continued with research on e-tourism, e-payment, and e-commerce in 2017-2018. In 2019 - 2022, research emerged, such as fintech, the internet of things, digital technology, smart agriculture, digital health, and covid-19. Meanwhile, the future research agenda for the digital economy in Indonesia can cover topics such as machine learning, financial inclusion, digital payments, artificial intelligence, digital health, and digital and mobile payments.

REFERENCES

Abdinagoro, S. B., & Hamsal, M. (2017). E-payment in integrated public transport modes: Case study of public transports in Greater Jakarta. *2016 International Conference on Information Management and Technology, ICIMTech 2016*, 261–267. https://doi.org/10.1109/ICIMTech.2016.7930341

Abdul, S., Khan, R., & Safaeipour, S. (2021). A review of logistics Internet-of-Things : Current trends and scope for future research. *Journal of Industrial Information Integration Journal*, *22*(January). https://doi.org/10.1016/j.jii.2020.100194

Agustina, R., Dartanto, T., Sitompul, R., Susiloretni, K. A., Suparmi, Achadi, E. L., Taher, A., Wirawan, F., Sungkar, S., Sudarmono, P., Shankar, A. H., Thabrany, H., Susiloretni, K. A., Soewondo, P., Ahmad, S. A., Kurniawan, M., Hidayat, B., Pardede, D., Mundiharno, … Group, I. H. S. (2019). Universal health coverage in Indonesia: concept, progress, and challenges. *The Lancet*, *393*(10166), 75–102. https://doi.org/10.1016/S0140-6736(18)31647-7

Anshari, M., Almunawar, M. N., Low, P. K. C., Wint, Z., & Younis, M. Z. (2013). Adopting customers' empowerment and social networks to encourage participations in E-health services. *Journal of Health Care Finance*, *40*(2), 17–41. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84896372185&partnerID=40&md5=089beb2cb0e8e7ac177edf9ad480d159

Ardiansyah, D., Miftahul Huda, A. S., Darusman, Pratama, R. G., & Putra, A. P. (2019). Wireless Sensor Network Server for Smart Agriculture Optimatization. In T. E.T. & W. F.D. (Eds.), *7th International Conference on Global Optimization and Its Application 2018, ICoGOIA 2018* (Vol. 621, Issue 1). Institute of Physics Publishing. https://doi.org/10.1088/1757-899X/621/1/012001

Badan Riset dan Inovasi Nasional. (2021). *BRIN Bangun Digital, Blue, dan Green Economy melalui Riset dan Inovasi*. Siaran Pers Badan Riset Dan Inovasi Nasional. https://www.brin.go.id/press-conference/97128/brin-bangun-digital-blue-dan-green-economy-melalui-riset-dan-inovasi

Berawi, M. A., Sunardi, A., & Ichsan, M. (2019). Chief-screen 1.0 as the internet of things platform in project monitoring & controlling to improve project schedule performance. In Y. A. (Ed.), *5th Information Systems International Conference, ISICO 2019* (Vol. 161, pp. 1249–1257). Elsevier B.V. https://doi.org/10.1016/j.procs.2019.11.239

Chung, E., Jiann, B.-P., Nagao, K., Hakim, L., Huang, W., Lee, J., Lin, H., Tien Mai, D. B., Nguyen, Q., Park, H. J., Sato, Y., Tantiwongse, K., Yuan, Y., & Park, K. (2021). COVID pandemic impact on healthcare provision and patient psychosocial distress: A multi-national cross-sectional survey among Asia-Pacific Countries. *World Journal of Men's Health*, *39*. https://doi.org/10.5534/WJMH.210033

Conway, G., Joshi, A., Leach, F., García, A., & Kelly, P. (2021). A review of current and future powertrain

technologies and trends in 2020. *Transportation Engineering*, *5*(May), 100080. https://doi.org/10.1016/j.treng.2021.100080

Faoziah, R. A., Kurniati, A. P., Laksitowening, K. A., & Adiwijaya. (2014). Audit of health agency for supporting an e-health management system (EHMS) case study: Ciparay Health Center, Bandung. *2nd International Conference on Information and Communication Technology, ICoICT 2014*, 36–41. https://doi.org/10.1109/ICoICT.2014.6914036

Google, Temasek, and B. (2021). *e-Conomy SEA 2021: Indonesia*. https://services.google.com/fh/files/misc/indonesia_e_conomy_sea_2021_report.pdf.

Hanif, C. A., Amirulloh, M., & Muchtar, H. N. (2021). Reliability and Security in the Implementation of Digital Health Service Application with the Application of "Reliability Certification or Electronic Certification" based on Indonesian Law. *Padjadjaran Jurnal Ilmu Hukum*, *8*(3), 417–438. https://doi.org/10.22304/pjih.v8n3.a6

Huda, M., Maseleno, A., Teh, K. S. M., Don, A. G., Basiron, B., Jasmi, K. A., Mustari, M. I., Nasir, B. M., & Ahmad, R. (2018). Understanding Modern Learning Environment (MLE) in big data era. *International Journal of Emerging Technologies in Learning*, *13*(5), 71–85. https://doi.org/10.3991/ijet.v13i05.8042

Iman, N. (2018). Is mobile payment still relevant in the fintech era? *Electronic Commerce Research and Applications*, *30*, 72–82. https://doi.org/10.1016/j.elerap.2018.05.009

Kakani, V., Nguyen, V. H., Kumar, B. P., Kim, H., & Pasupuleti, V. R. (2020). A critical review on computer vision and artificial intelligence in food industry. *Journal of Agriculture and Food Research*, *2*. https://doi.org/10.1016/j.jafr.2020.100033

Kurniati, A. P., Johnson, O., Hogg, D., & Hall, G. (2016). Process mining in oncology: A literature review. *6th International Conference on Information Communication and Management, ICICM 2016*, 291–297. https://doi.org/10.1109/INFOCOMAN.2016.7784260

Kusumoputro, B., Rostiviani, L., & Saptawijaya, A. (2000). Self-organized network with a supervised training and its comparison with FALVQ in artificial odor recognition system. *Chemical and Biological Sensing*, *4036*, 85–90. https://doi.org/10.1117/12.394070

Masaong, A. K., & Mas, S. R. (2019). Character education management model development based on multiple intelligence for strengthening "student-ethos-transformation" in the revolutionary era of Industry 4.0. *International Journal of Innovation, Creativity and Change*, *5*(4), 692–703. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85084467638&partnerID=40&md5=47f0cdb529dc6492c00954b998028fce

Miftakul Amin, M., Sutrisman, A. D. I., Stiawan, D., Ermatita, & Maseleno, A. (2018). Design restful web service of national population database for supporting e-health interoperability service. *Journal of Theoretical and Applied Information Technology*, *96*(15), 4794–4805. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85051984216&partnerID=40&md5=ed87bde1f86cfb716321307eb90e1d0f

Oluleye, B. I., Chan, D. W. M., Saka, A. B., & Olawumi, T. O. (2022). Circular economy research on building construction and demolition waste : A review of current trends and future research directions. *Journal of Cleaner Production*, *357*(December 2021), 131927. https://doi.org/10.1016/j.jclepro.2022.131927

Omar, N. B., Zen, H. B., Aldrin, N. N. A., Waluyo, & Hadiatna, F. (2020). Accuracy and Reliability of Data in IoT System for Smart Agriculture. *International Journal of Integrated Engineering*, *12*(6), 105–116. https://doi.org/10.30880/IJIE.2020.12.06.013

Oswald, F. L., & Putka, D. J. (2017). Big data methods in the social sciences. *Current Opinion in Behavioral Sciences*, *18*, 103–106. https://doi.org/https://doi.org/10.1016/j.cobeha.2017.10.006

Phan, D. H. B., Narayan, P. K., Rahman, R. E., & Hutabarat, A. R. (2020). Do financial technology firms influence bank performance? *Pacific Basin Finance Journal*, *62*. https://doi.org/10.1016/j.pacfin.2019.101210

Prasetyo, A. C., Purwandari, B., Satria, R., Solichah, I., Yazid, S., & Syalim, A. (2017). Factors influencing e-tourism stickiness: A perspective of TripTrus.Com. *4th International Conference on Information Technology Systems and Innovation, ICITSI 2017, 2018-January*, 325–331. https://doi.org/10.1109/ICITSI.2017.8267965

Priskarini, I. A., Pranoto, & Tejomurti, K. (2019). The Role of The Financial Services Authority in The Legal Protection of Privacy Rights in Connection with Personal Data of Fintech Lending Debtor in Indonesia . *Padjadjaran Jurnal Ilmu Hukum*, *6*(3), 556–575. https://doi.org/10.22304/pjih.v6n3.a7

Putera, P. B., Suryanto, Ningrum, S., Widianingsih, I., & Rianto, Y. (2022). Using Convergent Parallel Mixed Methods and Datasets for Science, Technology, and Innovation Policy Dynamics Research in Indonesia. *ASEAN Journal on Science and Technology for Development*, *39*(2), 61–68. https://doi.org/10.29037/ajstd.845

Putera, P. B., Widianingsih, I., Ningrum, S., Suryanto, S., & Rianto, Y. (2022). The policy dynamics of Indonesia's science, technology, and innovation system (STI system): Current state of research and literature construction. *Journal of Science, Technology and Innovation Policy*, *8*(1), 31–43. https://doi.org/10.11113/jostip.v8n1.107

Rachmawati, U. A., Haryanti, S. C., Aini, N., Pradipta, A., & Suhartanto, H. (2016). E-health grid network topology based on province in Indonesia. *International Journal of Bio-Science and Bio-Technology*, *8*(2), 307–316. https://doi.org/10.14257/ijbsbt.2016.8.2.29

Rizal, M., Ghani, J. A., Nuawi, M. Z., & Haron, C. H. C. (2013). Online tool wear prediction system in the turning process using an adaptive neuro-fuzzy inference system. *Applied Soft Computing Journal*, *13*(4), 1960–1968. https://doi.org/10.1016/j.asoc.2012.11.043

Sari, R., & Cassandra, C. (2017). Build e-Services satisfactory through e-commerce application infrastructure (a case study approach). *2016 International Conference on Information Management and Technology, ICIMTech 2016*, 141–145. https://doi.org/10.1109/ICIMTech.2016.7930318

Shahbaz, M., Wang, J., Dong, K., & Zhao, J. (2022). The impact of digital economy on energy transition across the globe: The mediating role of government governance. *Renewable and Sustainable Energy Reviews*, *166*(May), 112620. https://doi.org/10.1016/j.rser.2022.112620

Sumaedi, S., Sumardjo, Saleh, A., & Syukri, A. F. (2021). A model of digital health communication media use during the Covid-19 pandemic. *Health Education*, *121*(5), 465–485. https://doi.org/10.1108/HE-03-2021-0040

Suryono, R. R., Budi, I., & Purwandari, B. (2020). Challenges and trends of financial technology (Fintech): A systematic literature review. *Information (Switzerland)*, *11*(12), 1–20. https://doi.org/10.3390/info11120590

Thathsarani, A. P. K., Alahakoon, A. U., & Liyanage, R. (2022). Current status and future trends of sous vide processing in meat industry: A review. *Trends in Food Science & Technology*, *129*(October), 353–363. https://doi.org/10.1016/j.tifs.2022.10.009

The ASEAN Secretariat. (2021). *Consolidated Strategy on the Fourth Industrial Revolution for ASEAN*. The ASEAN Secretariat. https://asean.org/wp-content/uploads/2021/10/6.-Consolidated-Strategy-on-the-4IR-for-ASEAN.pdf

Titan, Sanjaya, L. S., & Ferdianto. (2017). Influential factors on travel decision in e-tourism. *2016 International Conference on Information Management and Technology, ICIMTech 2016*, 272–276. https://doi.org/10.1109/ICIMTech.2016.7930343

Tulungen, F., Batmetan, J. R., Komansilan, T., & Kumajas, S. (2021). Competitive Intelligence Approach for Developing an Etourism Strategy Post COVID-19. *Journal of Intelligence Studies in Business*, *11*(1), 48–56. https://doi.org/10.37380/jisib.v1i1.694

Van Eck, N. J., & Waltman, L. (2018). VOSviewer Manual: Manual for VOSviewer version 1.6.7. In *Univeristeit Leiden* (Issue February). Center for Science and Technology Studies - Leiden University. https://www.vosviewer.com/documentation/Manual_VOSviewer_1.6.8.pdf

Wahyudi. (2021). Review of the future smart farmers among industry, social conflict and lost of agricultural land in Indonesia. *International Journal of Agricultural Resources, Governance and Ecology*, *17*(2–4), 346–360. https://doi.org/10.1504/IJARGE.2021.121685

Waskito, L. B., Vidrianto, M., & Cahyoniarso, B. (2019). Initiate digital oil field application at mature offshore oil field in South east Sumatera, Indonesia. *SPE/IATMI Asia Pacific Oil and Gas Conference and Exhibition 2019, APOG 2019*. https://doi.org/10.2118/196398-ms

Wijaya, I. D., Suprianto, D., & Firdaus, V. A. H. (2021). Design of IoT Infrastructure as Support Empirical Learning In IoT Laboratory. *2021 Universitas Riau International Conference on Education Technology, URICET 2021*, 6–9. https://doi.org/10.1109/URICET53378.2021.9865890

Wulandari, D., Utomo, S. H., Narmaditya, B. S., Priambodo, M. P., & Prayitno, P. H. (2020). Digital farming and local economy: A study on nudira, greenhouse bandung. *International Journal of Scientific and Technology Research*, *9*(2), 5689–5694. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85079832921&partnerID=40&md5=5601daeec09b63f255f72456acbe0c34

Xu, D., Yin, X., Zhou, S., Jiang, Y., Xi, X., Sun, H., & Wang, J. (2022). A review on the remediation of microplastics using constructed wetlands: Bibliometric, co-occurrence, current trends, and future directions. *Chemosphere*, *303*(P1), 134990. https://doi.org/10.1016/j.chemosphere.2022.134990

Yasin, M., Harun, S. W., Abdul-Rashid, H. A., Kusminarto, Karyono, & Ahmad, H. (2008). The performance of a fiber optic displacement sensor for different types of probes and targets. *Laser Physics Letters*, *5*(1), 55–58. https://doi.org/10.1002/lapl.200710080

Yasin, M., Harun, S. W., Karyono, K., & Ahmad, H. (2008). Fiber-optic displacement sensor using a multimode

bundle fiber. *Microwave and Optical Technology Letters*, *50*(3), 661–663. https://doi.org/10.1002/mop.23147

Zhang, J., Lyu, Y., Li, Y., & Geng, Y. (2022). Digital economy: An innovation driving factor for low-carbon development. *Environmental Impact Assessment Review*, *96*(May), 106821. https://doi.org/10.1016/j.eiar.2022.106821

Zhi, W., & Ji, G. (2012). Constructed wetlands, 1991 – 2011: A review of research development, current trends, and future directions. *Science of the Total Environment, The*, *441*, 19–27. https://doi.org/10.1016/j.scitotenv.2012.09.064