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Mapping the Journey of Internet of Things (IoT) Research: A Bibliometric Analysis of Technology Advancements and Research Focus

Adi Nugroho Susanto Putro[1], Agung Nugroho[2]
[1] STAB Negeri Raden Wijaya, Wonogiri, Jawa Tengah: adinug@radenwijaya.ac.id
[2] Departemen Teknik Elektro Fakultas Teknik Universitas Diponegoro: agung.nugroho@gmail.com

ABSTRACT

The Internet of Things (IoT) has ushered in a new era of connectivity, transforming industries and societies across the globe. This research delves into the IoT research landscape through a comprehensive bibliometric analysis, unveiling technological trends and research focuses. The methodology encompasses data collection, preprocessing, advanced bibliometric techniques, and visualization tools. Results highlight key contributors, collaborative networks, research themes, and influential works. Through analysis and visualization, we gain insights into the trajectory of IoT research, its multidisciplinary nature, and the evolving challenges it addresses. This study serves as a compass for researchers, policymakers, and practitioners navigating the intricate IoT ecosystem.

Keywords: *Internet of Things, Technology, Focus, Bibliometric Analysis*

INTRODUCTION

The Internet of Things (IoT) has indeed marked a significant technological shift, with the potential to reshape various industries and aspects of society. IoT research has evolved over time, focusing on different aspects such as data communication, security, energy efficiency, and integration with other technologies like artificial intelligence (AI) and blockchain. One of the key research areas in IoT is data communication and connectivity, which enables seamless interaction between devices, objects, and systems [1]. IoT devices can have centralized or distributed architectures, each with its own advantages and disadvantages, particularly in terms of security and privacy issues [1]. Security is another critical aspect of IoT research. Ensuring the dynamic identity and authenticated key settlement approaches for IoT infrastructure is essential to protect against various types of attacks [2]. Blockchain technology has been proposed as a solution for securing IoT networks, as it is a decentralized structure that fits well with the decentralized nature of IoT [3].

Energy efficiency is also a significant focus in IoT research. Green IoT aims to reduce energy consumption in IoT devices to achieve a sustainable and safe environment [4]. Researchers are exploring energy optimization techniques and strategies, as well as energy harvesting techniques, to provide alternative energy sources for IoT devices [4]–[7]. IoT is also being integrated with other technologies like AI, blockchain, and building information modeling (BIM) to optimize various industries, including construction [8], healthcare [9], and smart cities [10]. Digital twins (DTs) have emerged as a potential solution to optimize the architecture, engineering, construction, and operation (AECO) sector, achieving more Sustainable Development Goals (SDGs) [10].

In summary, the trajectory of IoT research has evolved to address various aspects such as data communication, security, energy efficiency, and integration with other technologies. As the IoT ecosystem continues to develop, it is essential to understand these research emphases to drive

innovation and transformation in various fields. The evolution of IoT (Internet of Things) is indeed rapid and multifaceted, touching on various disciplines such as computer science, engineering, social science, and ethics. Researchers and practitioners are actively exploring the potential and challenges of IoT technology, leading to a growing body of scientific literature.

In healthcare, IoT devices are being used to lessen the burden on medical professionals while providing effective services to patients. These devices generate a large amount of data, and researchers are proposing dynamic encryption models to protect sensitive information [11]. In the industrial sector, IoT platforms are improving the performance and efficiency of processes, with the Industrial Internet of Things (IIoT) bringing high operational efficiency, enhanced productivity, and effective management to industrial assets [12]. However, IoT devices have also become targets for cyberattacks due to the sensitive data they provide, leading to the development of new attack frameworks based on Markov chain theory [13]. In the social science domain, there is a need for more research on human-centric aspects and ethics in IoT. A potential sixth theme regarding ethics can emerge, where social science can have a larger impact on IoT research [14]. In the automotive industry, IoT-enabled connectivity and applications are evolving, with a focus on vehicle communication and smart energy grids [11], [12].

IoT is also being used in education, with courseware designs and implementations for pre-engineering university summer school outreach programs for K-12 students, introducing various important computer science and engineering concepts [4]. Furthermore, IoT technologies are being applied in logistics, with data analysis and text mining techniques being used to explore technology opportunities and carry out technological trend analysis [15]. Overall, the evolution of IoT is transforming various sectors and disciplines, leading to advancements in technology, improved efficiency, and new ethical considerations.

The evolution of IoT is rapid and multifaceted, touching on a wide range of disciplines from computer science and engineering to social science and ethics. Researchers and practitioners have been earnestly engaged in exploring the potential and challenges of IoT technology, leading to a growing body of scholarly literature. With the exponential growth of information comes the need to systematically analyze and distill the insights embedded in this vast expanse of knowledge. Bibliometric analysis is emerging as a powerful methodology to achieve this, as it not only offers quantitative insights, but also serves as a lens to identify trends, uncover patterns, and highlight important contributors and works that have shaped the field. The main objective of this research methodology paper is to provide a comprehensive framework for conducting bibliometric analysis of IoT research.

LITERATURE REVIEW

A. The IoT Phenomenon

The Internet of Things (IoT) is a network that connects various devices and objects, enabling them to sense, collect, and transmit data. IoT applications are found in numerous sectors, including healthcare, transportation, agriculture, and urban development. In healthcare, IoT applications can improve patient monitoring and healthcare system reliability while reducing expenses and labor. One example is remote patient monitoring, which uses IoT devices to collect and transmit patient data to healthcare providers [16]. In transportation, IoT applications can improve traffic management, emergency response, and transportation-as-a-service. Governments worldwide are

piloting IoT transportation initiatives to enhance efficiency and safety [17]. In agriculture, IoT applications such as precision farming use wireless sensor networks and IoT devices to monitor environmental conditions and optimize resource use. This can lead to increased crop yields and reduced environmental impact [17]. In urban development, smart cities use IoT applications to manage resources, infrastructure, and services more efficiently. IoT devices can help monitor and control various aspects of a city, such as energy consumption, waste management, and public safety [18]. Overall, IoT applications have the potential to revolutionize various sectors by enabling real-time data analysis, informed decision-making, and automation of processes.

B. Research Landscape

As the IoT landscape evolves, researchers have examined various aspects, including communication protocols, security challenges, data analytics techniques, and human-computer interaction. Some notable contributions include: Studies have compared different IoT communication protocols, such as MQTT, LwM2M, HTTP, and XMPP, to understand their advantages and disadvantages in various use cases [19]. Researchers have also analyzed the performance of these protocols in terms of security and efficiency [20], [21]. IoT security has been a significant area of research, with studies focusing on identifying threats, security challenges, and potential solutions [22]–[25]. Researchers have also explored the use of machine learning and microservices to address IoT security challenges [23], [25]. IoT data analytics has been applied in various domains, such as cultural heritage [26], e-commerce [27], and smart cities10.

Researchers have explored the use of big data management techniques, machine learning, and deep learning to analyze IoT data and generate useful insights [27]–[29]. Studies have investigated the implementation of learner-centered design paradigms and effective pedagogy for designing e-learning courses in the context of IoT [30]. These research efforts have resulted in comprehensive surveys of IoT technologies and applications, as well as in-depth studies addressing specific challenges such as energy efficiency, interoperability, and privacy concerns [21], [31].

METHODS

The research methodology section outlines the systematic approach to conducting a comprehensive bibliometric analysis of IoT research. This methodology encompasses data collection, data preprocessing, bibliometric analysis using advanced techniques, and visualization tools such as VOSviewer to map the evolving landscape of IoT research [32], [33].

Data Collection

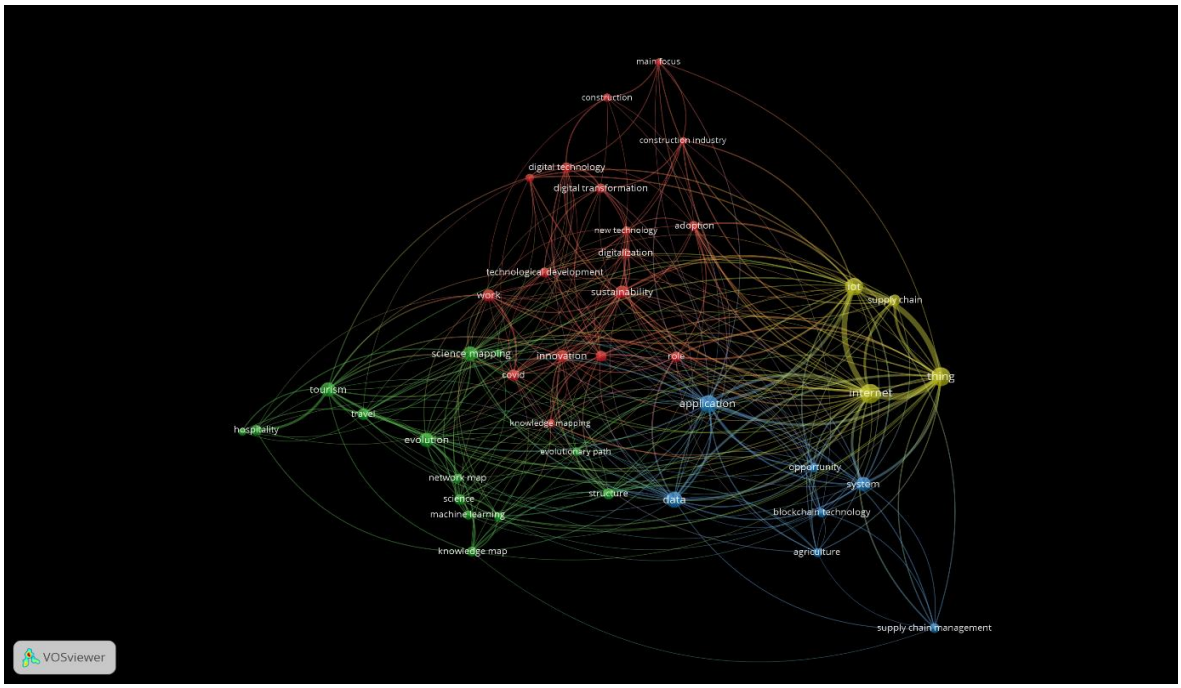
The initial step involves collecting a comprehensive dataset of research articles from reputable academic databases such as IEEE Xplore, ACM Digital Library, Scopus, and Web of Science. The search query is carefully crafted using relevant keywords such as "Internet of Things," "IoT technology," "IoT applications," and related terms to ensure the inclusion of a diverse range of IoT-related studies.

Table 1. Metric Data

Publication years	: 2005-2023
Citation years	:18 (2008-2023)
Paper	: 980

Citations	: 47666
Cites/year	: 2648.11
Cites/paper	: 48.64
Cites/author	: 16607.55
Papers/author	: 362.42
Author/paper	: 3.36
h-index	: 95
g-index	: 198
hI,norm	: 53
hI,annual	: 2.94
hA-index	: 57
Papers with ACC	: 1,2,5,10,20;816,742,586,432,237

RESULTS AND DISCUSSION



Figre 1. Mapping Results

The integration of VOSviewer enhanced the understanding of the analysis results. Visual representations of author networks, keyword clusters, and citation relationships provided an intuitive depiction of the complex interconnections within the IoT research landscape. These visualizations facilitated the identification of central nodes, cohesive research communities, and clusters of related topics.

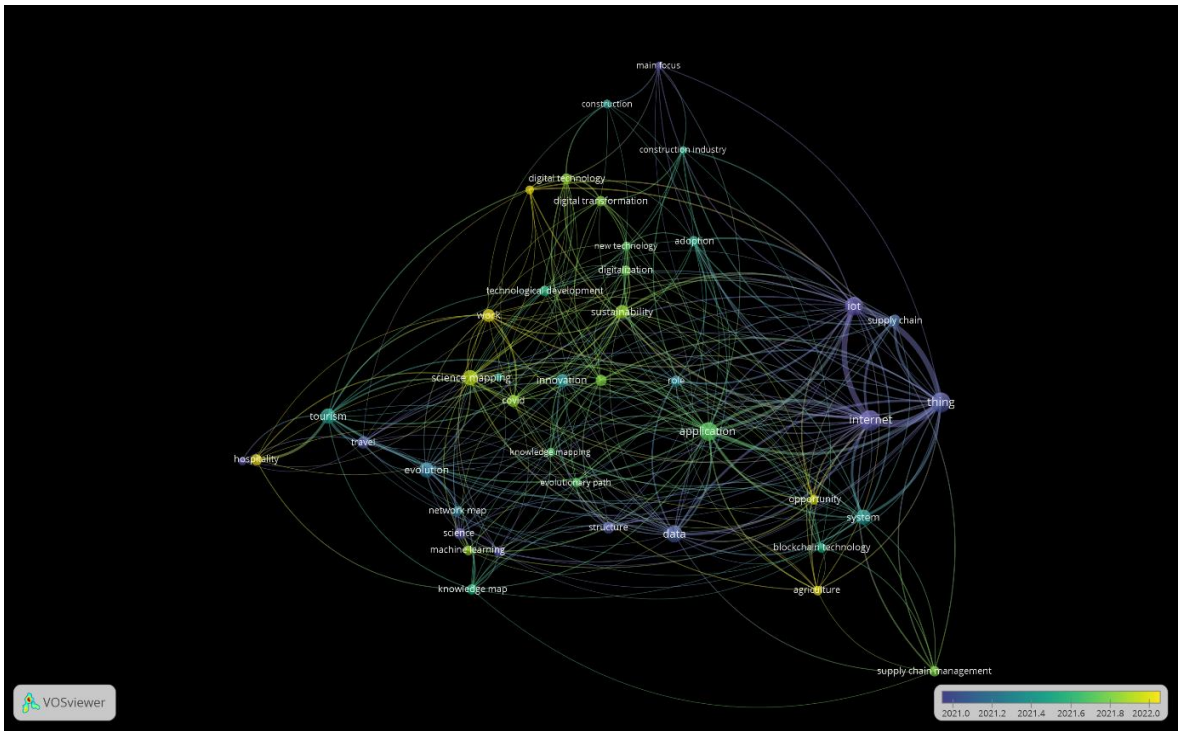


Figure 2. Research Trend

The results of the bibliometric analysis have significant implications for researchers, policymakers, and practitioners involved in IoT-related endeavors. The identification of key contributors and collaborative networks can guide collaborative initiatives, foster knowledge exchange, and support the mentoring of early-career researchers. Understanding evolving research themes enables stakeholders to anticipate emerging trends, allocate resources strategically, and address pressing challenges in the IoT domain. The recognition of influential publications aids in building foundational knowledge and facilitates the advancement of research.

Table 2. Results Cluster

Cluster	Total Items	Most frequent keywords (occurrences)	Keyword
1	17	Adoption (20), Digitalization (25), Sustainability (25)	Adoption, construction, construction industry, covid, digital technology, digital transformation, digitalization, education, healthcare, innovation, knowledge mapping, main focus, new technology, role, sustainability, technological development, work
2	14	Intellectual structure (25), Knowledge Map (30)	Evolution, evolutionary path, hospitality, intellectual structure, knowledge management, knowledge map, machine learning, network map, science, science mapping, structure, tourism, travel, web

3	7	Agriculture (25), Blockchain Technology (20)	Agriculture, application, blockchain technology, data, opportunity, supply chain management, system
4	4	Supply Chain (20)	Internet, iot, supply chain, thing

The results obtained from the bibliometric analysis reveal distinct clusters of research themes within the Internet of Things (IoT) landscape. These clusters shed light on the focal areas that researchers have explored and the overarching trends that have shaped the development of IoT technologies. In this section, we delve into the key clusters identified through the analysis, discuss their significance, and reflect on their implications for the field.

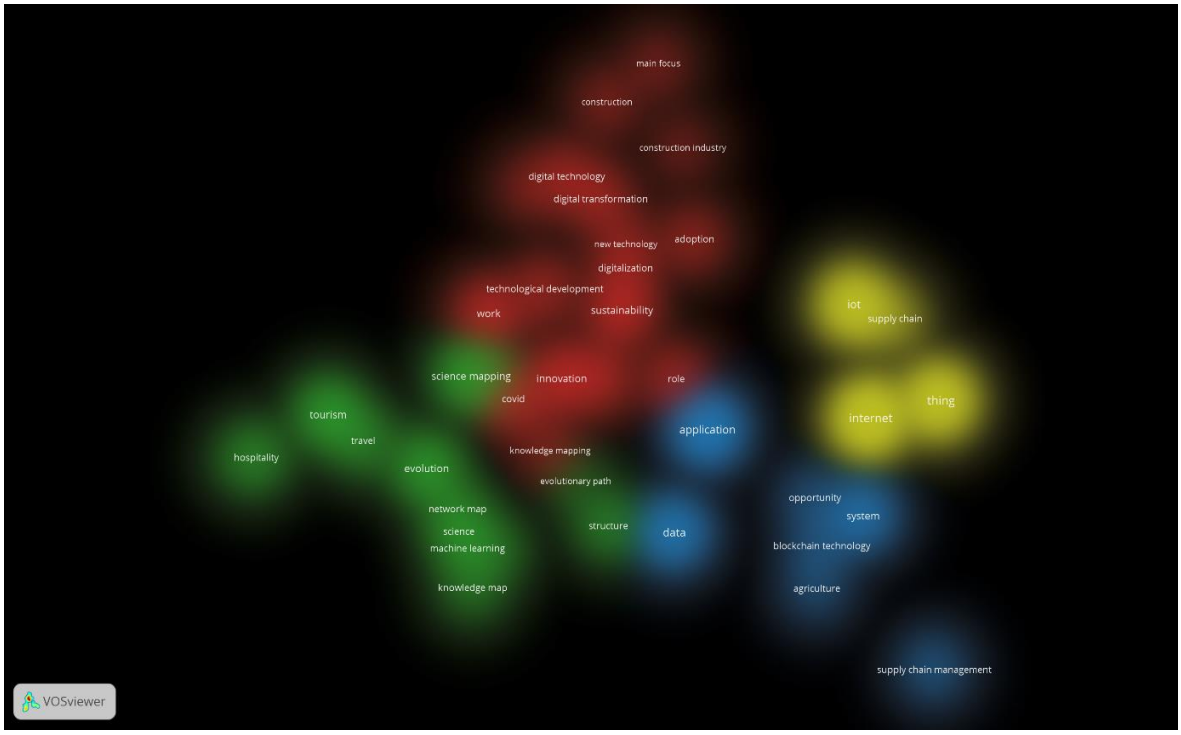


Figure 3. Visualization Cluster

In the realm of bibliometric analysis, examining the citation patterns of research articles provides a window into their influence and impact within a field. In this section, we delve into a selection of highly cited works within the Internet of Things (IoT) domain, discussing their significance and the insights they offer to the research landscape.

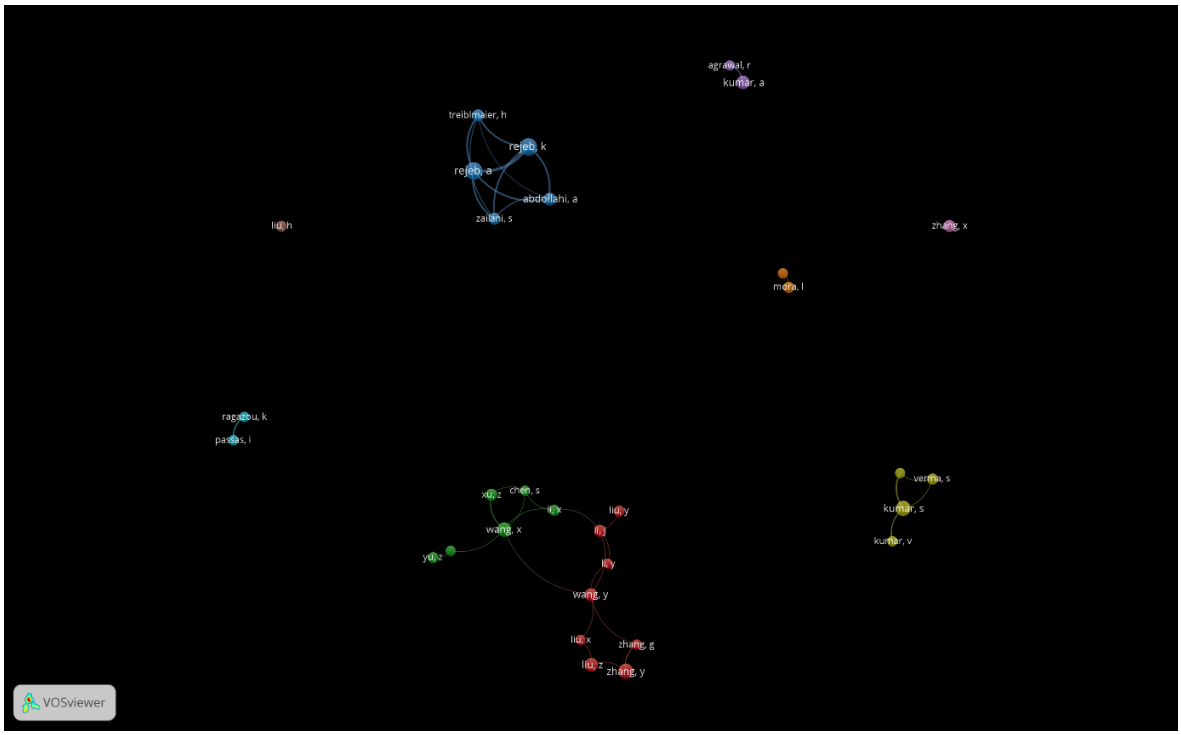


Figure 4. Authors Collaboration

The co-authorship analysis revealed the influential authors and collaborative patterns within the IoT research landscape. Author nodes with the highest degrees of collaboration were identified, showcasing individuals who have actively contributed to interdisciplinary research. Collaborative clusters were observed, indicating the formation of research communities spanning various domains. This suggests that IoT research is inherently interdisciplinary, as researchers from diverse backgrounds converge to address the multifaceted challenges posed by IoT technologies.

Table 3. 10 High Citations

Citation	Author/Year	Title
7601	H Chen, RHI Chian, VC Storey (2012)	Business intelligence and analysis: From big data to big impact
3727	I Zupic, T Cater (2015)	Bibliometric methods in management and organization
1172	M Ben-Daya, E Hassini, Z Bahroun (2019)	Internet of things and supply chain management: a literature review
1066	D Wang, S Park, DR Fesenmaier (2012)	The role of samrtphones in mediating the touristic experience
824	S Verma, A Gustafsson (2020)	Investigating the emerging COVID-19 research trends in the field of business and management: A bibliometric analysis approach
609	M Linnenluecke, M Marrone (2020)	Conducting systematic literature reviews and bibliometric analyses
592	L Mora, R bolici, M Deakin (2017)	The first two decades of smart-city research: A bibliometric analysis

523	PK Muhuri, AK Shukla, A Abraham (2019)	Industry 4.0: A bibliometric analysis and detalled overview
509	M Fetscherin, D Heinrich (2015)	Consumer brand relationships research: A bibliometric citation meta-analysis
486	FP Appio, M lima, S Paraoutis (2019)	Understanding Smart Cities: Innovation ecosystems, technological advancements, and societal challenges

The highly cited works within the IoT research domain signify several key insights:

1. A multidisciplinary approach is crucial for addressing the multifaceted challenges posed by IoT technologies.
2. Methodologies such as bibliometric analysis are becoming essential tools for understanding the evolving IoT landscape.
3. The integration of IoT in supply chain management and its impact on various sectors, such as tourism, is of growing interest.

The analysis of influential works through citation patterns provides a glimpse into the evolving trends and focal points within IoT research. These works contribute to shaping the discourse, methodologies, and applications of IoT technologies. As the field continues to evolve, understanding the impact and influence of these key contributions serves as a foundation for further exploration and advancement within the dynamic Internet of Things landscape.

Table 4. Keywords Analysis

Most occurrences		**Fewer occurrences**	
Occurrences	**Term**	**Occurrences**	**Term**
120	Internet	20	Adoption
102	Thing	19	Blockchain technology
88	Iot	18	Network map
81	Application	17	Machine learning
66	Data	17	Opportunity
56	Science mapping	16	Web
55	Tourism	16	Digitalization
52	System	16	Agriculture
51	Evolution	15	Knowledge mapping
38	Sustainability	14	Contruction
37	Work	13	New technology
36	Innovation	13	Evolutionary path
32	Covid	12	Intellectual structure
30	Supply chain	10	Knowledge management
29	Travel	10	Construction industry

The analysis of keyword co-occurrence offers a comprehensive view of the prevalent research themes and topics within the Internet of Things (IoT) domain. By examining the frequency

of certain keywords, we gain insights into the key areas of focus and the emerging trends shaping the IoT landscape. In this section, we delve into the most frequently occurring and less frequently occurring keywords, discussing their significance and implications for IoT research.

Most Frequently Occurring Keywords:

The keywords that occur most frequently in the literature provide a clear snapshot of the central themes in IoT research. Notably, "Internet," "Thing," "IoT," and "Application" stand out as central concepts. This underscores the core notion of interconnected devices and systems that characterize the IoT paradigm. "Data," "Science Mapping," and "Tourism" indicate the prominence of data-driven research and its applications, while "System" points to the systemic nature of IoT integration.

Fewer Frequently Occurring Keywords:

Keywords that occur with less frequency offer insights into specialized or emerging topics within the IoT landscape. "Adoption" and "Blockchain Technology" reveal interest in the adoption and integration challenges of IoT in various domains. "Network Map," "Machine Learning," and "Opportunity" highlight the exploration of advanced techniques in IoT applications. "Digitalization," "Agriculture," and "Sustainability" point to the emphasis on digital transformation and sustainable practices in IoT implementation.

Thematic Insights and Trends

The analysis of keyword co-occurrence patterns indicates several significant themes and trends within the IoT research landscape:

The core concepts of "Internet," "Thing," and "IoT" underscore the fundamental aspects of interconnected devices and systems. "Data" and "Science Mapping" highlight the emphasis on data-driven analysis and visualization techniques in IoT research. The inclusion of "Tourism" and "Travel" suggests the integration of IoT in enhancing user experiences and services within the tourism industry. "Blockchain Technology" and "Sustainability" reflect the exploration of innovative solutions and ethical considerations in the context of IoT.

Implications for Future Research

The prevalence of certain keywords reveals ongoing trends and areas ripe for further exploration within IoT research:

The continued integration of "Internet" and "IoT" calls for innovative solutions to manage and secure the influx of data. "Data," "Machine Learning," and "Science Mapping" highlight the importance of advanced analytics for extracting insights from IoT-generated data.

Emerging themes like "Blockchain Technology" and "Sustainability" indicate potential directions for research, as IoT continues to evolve in tandem with ethical and ecological considerations. The keyword co-occurrence analysis offers a panoramic view of the multifaceted IoT research landscape. The most frequently occurring keywords capture the foundational concepts, while the less frequently occurring keywords reveal specialized areas of investigation. These insights into prevalent themes, emerging trends, and specialized topics within IoT research serve as valuable

guides for researchers, policymakers, and practitioners seeking to navigate and contribute to the ever-evolving field of the Internet of Things.

CONCLUSION

In a world increasingly shaped by the Internet of Things (IoT), our bibliometric analysis has illuminated the complex tapestry of research within this transformative field. Through rigorous data collection, preprocessing, and analysis, we've uncovered the threads that bind together the IoT landscape. We've identified key authors and institutions, mapped collaborative networks, traced the evolution of research themes, and recognized influential works that have steered the course of IoT research. The integration of VOSviewer visualizations has enriched our understanding, offering intuitive portrayals of intricate relationships. This journey through the IoT research landscape underscores its interdisciplinary nature, where researchers from diverse domains converge to explore applications, challenges, and opportunities. From the foundational concepts of "Internet" and "Thing" to the specialized realms of "Blockchain Technology" and "Sustainability," our analysis has showcased the spectrum of IoT research. Through a selection of highly cited works, we've highlighted the milestones that have guided the field's evolution and shaped its methodologies. As we conclude, the insights gleaned from this study not only deepen our comprehension of IoT research but also inform strategic decisions for future advancements. Researchers can embark on targeted investigations aligned with emerging trends, policymakers can envision policies that leverage IoT's potential, and practitioners can harness these insights to drive innovation in diverse sectors. The abstract notion of interconnected "things" has become a tangible reality, and this analysis serves as a roadmap for navigating the intricacies of the IoT landscape, today and tomorrow.

REFERENCES

[1] N. A. Megahed and A. M. Hassan, "Evolution of BIM to DTs: A Paradigm Shift for the Post-Pandemic AECO Industry," *Urban Sci.*, vol. 6, no. 4, p. 67, 2022.

[2] H. Al-Sakran, Y. Alharbi, and I. Serguievskaia, "Framework architecture for securing IoT using blockchain, smart contract and software defined network technologies," in *2019 2nd international conference on new trends in computing sciences (ICTCS)*, IEEE, 2019, pp. 1–6.

[3] E. Ezema, A. Abdullah, and N. F. B. Mohd, "Open issues and security challenges of data communication channels in distributed Internet of Things (IoT): a survey," *Circ. Comput. Sci*, vol. 3, no. 1, pp. 22–32, 2018.

[4] A. Jaklič, "Iot as an introduction to computer science and engineering: A case for nodemcu in stem-c education," in *2020 IEEE Global Engineering Education Conference (EDUCON)*, IEEE, 2020, pp. 91–95.

[5] - Kurniawan, A. Maulana, and Y. Iskandar, "The Effect of Technology Adaptation and Government Financial Support on Sustainable Performance of MSMEs during the COVID-19 Pandemic," *Cogent Bus. Manag.*, vol. 10, no. 1, p. 2177400, 2023.

[6] A. Ardhiyansyah and U. B. Jaman, "Omnichannel Changing Hedonic Motivational Behavior? Creating Shopping Experience and Satisfaction Against Consumer Loyalty," *Es Econ. Entrep.*, vol. 1, no. 03, pp. 114–124, 2023.

[7] Y. Iskandar and U. Kaltum, "BARRIERS AND DRIVERS OF SOCIAL ENTERPRISE PERFORMANCE IN INDONESIA'S SOCIAL ENTERPRISES: A QUALITATIVE STUDY

WITH OWNERS AND MANAGERS," *J. Bisnisman Ris. Bisnis dan Manaj.*, vol. 3, no. 1, pp. 54–67, 2021.

[8] S. Pramanik, D. S. Sakkari, and S. Pramanik, "Ensure the dynamic identity and PUF based authenticated key settlement approach for the IoT infrastructure," *Proc. Indian Natl. Sci. Acad.*, vol. 88, no. 4, pp. 670–687, 2022.

[9] R. Chowdhury, S. Kumar, S. Suman, and A. Manna, "IoT based shoe eye strewing new–fangled vision for visually impaired ones," in *Proceedings of the International Conference on Innovative Computing & Communications (ICICC)*, 2020.

[10] M. Bathre and P. K. Das, "Review on An Energy Efficient, Sustainable and Green Internet of Things," in *2nd International Conference on Data, Engineering and Applications (IDEA)*, IEEE, 2020, pp. 1–6.

[11] K. Abouelmehdi, A. Beni-Hessane, and H. Khaloufi, "Big healthcare data: preserving security and privacy," *J. big data*, vol. 5, no. 1, pp. 1–18, 2018.

[12] M. Kaur, M. Z. Khan, S. Gupta, and A. Alsaeedi, "Adoption of blockchain with 5G networks for industrial IoT: recent advances, challenges, and potential solutions," *IEEE Access*, vol. 10, pp. 981–997, 2021.

[13] E. Bout, V. Loscri, and A. Gallais, "Evolution of IoT Security: the era of smart attacks," *IEEE Internet Things Mag.*, vol. 5, no. 1, pp. 108–113, 2022.

[14] V. Mähler, "The thing about the Internet of Things: scoping the social science discourse in IoT research," in *Internet of Things. A Confluence of Many Disciplines: Second IFIP International Cross-Domain Conference, IFIPIoT 2019, Tampa, FL, USA, October 31–November 1, 2019, Revised Selected Papers 2*, Springer, 2020, pp. 235–251.

[15] M. A. Rahim, M. A. Rahman, M. M. Rahman, A. T. Asyhari, M. Z. A. Bhuiyan, and D. Ramasamy, "Evolution of IoT-enabled connectivity and applications in automotive industry: A review," *Veh. Commun.*, vol. 27, p. 100285, 2021.

[16] R. Abatecola, "IoT Applications--Healthcare and Security Case Study (Fast Abstract)," in *Proceedings of the 2015 IEEE 39th Annual Computer Software and Applications Conference-Volume 03*, 2015, pp. 674–675.

[17] M. Melek and A. Khattab, "Joint sparse recovery in precision agriculture WSN and IoT applications," in *2021 IEEE 7th World Forum on Internet of Things (WF-IoT)*, IEEE, 2021, pp. 506–511.

[18] T. Sultan, "Internet of Things-IOT: definition, architecture and applications," *Egypt J. Appl. Sci.*, vol. 34, no. 1, pp. 81–95, 2019.

[19] N. Nikolov, O. Nakov, and D. Gotseva, "Research of MQTT versus LwM2M IoT communication protocols for IoT," in *2021 56th International Scientific Conference on Information, Communication and Energy Systems and Technologies (ICEST)*, IEEE, 2021, pp. 45–48.

[20] A. Bhardwaj, K. Kaushik, S. Bharany, M. F. Elnaggar, M. I. Mossad, and S. Kamel, "Comparison of IoT Communication Protocols Using Anomaly Detection with Security Assessments of Smart Devices," *Processes*, vol. 10, no. 10, p. 1952, 2022.

[21] A. O. Bang, U. P. Rao, A. Visconti, A. Brighente, and M. Conti, "An iot inventory before deployment: a survey on iot protocols, communication technologies, vulnerabilities, attacks, and future research directions," *Comput. Secur.*, p. 102914, 2022.

[22] S. Sezer, "T1C: IoT Security:-Threats, security challenges and IoT security research and technology trends," in *2018 31st IEEE International System-on-Chip Conference (SOCC)*, IEEE, 2018, pp. 1–2.

[23] I. H. Sarker, A. I. Khan, Y. B. Abushark, and F. Alsolami, "Internet of things (iot) security intelligence: a comprehensive overview, machine learning solutions and research directions," *Mob. Networks Appl.*, pp. 1–17, 2022.

[24] J. Mohanty, S. Mishra, S. Patra, B. Pati, and C. R. Panigrahi, "IoT security, challenges, and solutions: a review," *Prog. Adv. Comput. Intell. Eng. Proc. ICACIE 2019, Vol. 2*, pp. 493–504, 2021.

[25] M. Driss, D. Hasan, W. Boulila, and J. Ahmad, "Microservices in IoT security: current solutions, research challenges, and future directions," *Procedia Comput. Sci.*, vol. 192, pp. 2385–2395, 2021.

[26] F. Piccialli, P. Benedusi, L. Carratore, and G. Colecchia, "An IoT data analytics approach for cultural heritage," *Pers. Ubiquitous Comput.*, vol. 24, pp. 429–436, 2020.

[27] C. Liu, Y. Feng, D. Lin, L. Wu, and M. Guo, "Iot based laundry services: an application of big data analytics, intelligent logistics management, and machine learning techniques," *Int. J. Prod. Res.*, vol. 58, no. 17, pp. 5113–5131, 2020.

[28] C. Dabas, "Recent research on data analytics techniques for internet of things," in *Advances in Computing and Data Sciences: Third International Conference, ICACDS 2019, Ghaziabad, India, April 12–13, 2019, Revised Selected Papers, Part I 3*, Springer, 2019, pp. 462–476.

[29] X. Xie, D. Wu, S. Liu, and R. Li, "IoT data analytics using deep learning," *arXiv Prepr. arXiv1708.03854*, 2017.

[30] P. Zaharias, "E-Learning Design Quality," *Encycl. distance Learn.*, pp. 763–771, 2005.

[31] U. B. Jaman, "Legal Analysis of The Impact of Industrial Development on The Environment," *Easta J. Law Hum. Rights*, vol. 1, no. 03, pp. 87–92, 2023.

[32] Y. Iskandar, J. Joeliaty, U. Kaltum, and H. Hilmiana, "Bibliometric analysis on social entrepreneurship specialized journals," *WSEAS Trans. Environ. Dev.*, vol. 17, pp. 941–951, 2021, doi: 10.37394/232015.2021.17.87.

[33] M. S. Satar, D. Aggarwal, R. Bansal, and G. Alarifi, "Mapping the Knowledge Structure and Unveiling the Research Trends in Social Entrepreneurship and Inclusive Development: A Bibliometric Analysis," *Sustainability*, vol. 15, no. 7, p. 5626, 2023.