IoT Knowledge among Indigenous Youngsters: A Recent Ten-Year Research Trend

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Article Info	ABSTRACT
	This paper discusses the significance of Information and Communication Technology (ICT) and its rapid advancement in our daily lives, particularly with the emergence of IoT technology. However, there is an issue of IoT knowledge among remote rural youngsters, and this paper aims to explore how IoT can be used to improve the quality of digital education for remote rural youngsters. The study used the Scopus database to retrieve 40 relevant documents on IoT and knowledge transfer from 2013 to 2023. Each document was deemed appropriate for bibliometric analysis, and the study found that IoT has limitless applications that could provide a better-connected and more collaborative future for education, reducing the inequality between rural and urban schools. The study also found that there is potential for further research in this field. Through this study, we hope to raise awareness and provide a better sense of the importance of IoT technology to ensure that remote rural youngsters are not left behind in the digital age. It is important to note that the Scopus database and the usage of keywords in document titles were the only sources of information for this study.

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INTRODUCTION

Knowledge transfer is a critical issue in organizational theory, as it plays a vital role in the success of organizations in today's knowledge-based economy. It is important for organizations to effectively transfer and utilize knowledge to enhance their performance, productivity, and innovation. Knowledge transfer involves the sharing or dissemination of knowledge, expertise, and skills among individuals or groups in an organization or society. The transfer of knowledge is not just limited to communication but also involves providing inputs to problem-solving and decision-making processes. Therefore, organizations need to ensure that the transfer of knowledge is done effectively to ensure that they can make informed decisions and improve their operations (Ramos et al., 2020).

In addition, effective knowledge transfer requires a systematic and structured approach, as the transfer process can be complex and involve multiple stakeholders. According to Argote and Ingram (2000), organizations need to establish clear goals and objectives for the transfer process, identify the relevant knowledge to be transferred, and determine the best methods for transferring the knowledge. Thus, this requires a thorough analysis of the knowledge to be transferred, the recipients of the knowledge, and the context in which the knowledge will be applied. Consequently, organizations can maximize the effectiveness of the transfer process, increase the speed of the transfer, and ensure that the knowledge is utilized efficiently.

Furthermore, evaluation and feedback are critical components of the knowledge transfer process. Evaluation allows organizations to determine whether the transfer process was successful, identify any gaps in knowledge transfer, and modify the process accordingly. On the other hand, feedback from the recipients of the knowledge can also provide insights into the effectiveness of the transfer process and areas for improvement. Thus, organizations need to establish a mechanism for evaluating the transfer process and obtaining feedback from the recipients of the knowledge to continually improve the transfer process (Conway et al., 2019).

For this enthusiasm, the emergence of new technologies such as the IoT has created a gap in technological advancement between urban and rural communities, which requires a knowledge transfer program to address it. Moreover, the IoT is a network of interconnected physical devices, vehicles, and other objects that can communicate with each other and exchange data. Knowledge transfer programs on IoT can provide remote rural youngsters with the necessary knowledge and skills to understand the importance of IoT for their future. Such programs should be designed to meet the specific needs and interests of the target group, while also considering the cultural and linguistic diversity of the community. Moreover, they need to identify the appropriate learning materials, tools, and resources that can be used to deliver the program effectively. On top of that, providing knowledge transfer programs on IoT to rural communities, organizations, and societies can bridge the gap in technological advancement and help remote communities to participate in the digital economy (Conway et al., 2019).

Therefore, effective implementation of a knowledge transfer program on IoT for remote rural youngsters requires a comprehensive and culturally sensitive approach. The program must take into account the unique challenges and opportunities of the rural community, including cultural and linguistic diversity. As relating reference, a study by Conway et al., (2019) found that effective knowledge transfer programs for rural communities require a holistic approach that considers factors such as language, culture, and local contexts. The learning materials, tools, and resources should be adapted to meet the specific needs and interests of the target group. For instance, interactive and participatory learning methods such as role-playing, simulation exercises, and group discussions may be more effective than traditional classroom-based teaching methods. In addition, the program should be delivered in a manner that is accessible and affordable to the rural community. Accordingly, it is important to collaborate with local organizations and community leaders to ensure that the program is delivered in a way that is culturally appropriate and meets the unique needs of the rural community.

Indeed, knowledge transfer is a crucial process that plays a critical role in improving the performance, productivity, and innovation of organizations and societies. It involves sharing knowledge, expertise, and skills among individuals or groups to enable effective problem-solving and decision-making (Conway et al., 2019). Nevertheless, effective knowledge transfer requires careful planning, implementation, and evaluation to ensure its efficiency and effectiveness. It involves identifying the appropriate knowledge to be transferred, the

individuals or groups involved, and the methods or tools to be used in the transfer process. Furthermore, knowledge transfer programs focusing on emerging technologies such as IoT can help bridge the technological gap between urban and rural communities. These programs should be designed to consider the unique challenges and opportunities of the target group, including cultural and linguistic diversity. Ultimately, knowledge transfer is more than just a communication problem and requires a comprehensive approach to ensure its success.

This study uses bibliometric analysis methods to examine past research on knowledge transfer and IoT, with the aim of gaining a better understanding of the literature in this area. By analyzing distribution patterns of articles in specific issues and periods, the study aims to assess the role of knowledge transfer as a platform for sharing information about IoT with young people in remote rural areas and its potential for global reach and collaboration. The study adopts a rigorous bibliometric approach, which allows for a comprehensive view of the research landscape and the identification of trends and patterns. The study classifies bibliometric indicators into three categories: quantity, quality, and structural, and uses indicators such as publication classification, citation, authorship, publication impact, and country to analyze the research landscape. The findings of this study contribute to a deeper understanding of the role of knowledge transfer in sharing information about IoT and provide insights for future research in this field.

LITERATURE REVIEW

Bibliometric Analysis

Ahmi and Mohamad (2019) defined bibliometric analysis as a quantitative and statistical method used to identify patterns in article distribution over specific periods and issues. Bibliometric studies are conducted to demonstrate trends and patterns in a specific research topic and have become a popular research method to showcase a study's impact and trends. Common indicators used in bibliometric studies include publication classification, citation, authorship, publication impact, and country (Mansour et al., 2022). Valérie and Pierre (2010) categorized bibliometric indicators into three groups: quantity, quality, and structural indicators. The quantity indicator focuses on researcher productivity, while the quality indicator measures a researcher's output performance, including citation count, citations per year, total h-index or g-index, and citation score. Research quality indicators can also be evaluated by the impact of publications (IPP) and impact factors (IF) (Ahmi & Mohamad, 2019). Structural indicators analyze the relationships among publications, authors, and research fields, which can be assessed through co-authorship, co-citation, and bibliographic coupling analyses.

Previous Study

Despite significant progress in the digital world, digital equality remains elusive, particularly for marginalized communities lacking technical knowledge and awareness. Among these groups are remote rural communities, a problem that affects both developing and developed countries, including the United States, Australia, and Malaysia, where the issue has been subject to heated debates for decades (Hunter & Radoll, 2020). According to Park (2015) and Young (2019), the digital divide between urban and rural areas is a persistent problem, and authorities worldwide have launched various initiatives to reduce inequality, such as the Sustainable Development Goals (United Nations, 2021). While digital education is increasingly being introduced in rural schools, it is challenging for the government to provide equal quality education to remote communities due to their inaccessibility and inadequate facilities (Awang et al., 2020).

Furthermore, residents of remote rural areas may live in primitive conditions without proper basic necessities, including roads, electricity, communication networks, access to education, healthcare, and clean water supplies, and are also left behind in ICT knowledge and awareness (Siti Zobidah et al., 2008). Despite the increasing importance of ICT in modern life, including IoT, these communities do not consider it a priority or fail to recognize its importance. Such perceptions may not harm them in the short term, but over time, resistance to technology will widen the gap between rural and urban communities. Given the increasing reliance on technology in our daily lives, including IoT, it is essential to bridge the gap in knowledge and awareness of this technology among remote rural communities. IoT applications have the potential to provide better connectivity and collaboration in education, thus reducing inequality between rural and urban schools.

The paper aims to improve the quality of digital education among remote rural pupils, focusing on IoT awareness, current perceptions, and how to provide a better understanding of the technology's importance to prevent them from being left behind.

Knowledge transfer is an important aspect of organizational theory as it seeks to share and disseminate knowledge, thereby providing inputs to problem-solving. In organizational theory, knowledge transfer refers to the practical problem of transferring knowledge from one part of the organization to another. Similar to knowledge management, knowledge transfer seeks to organize, create, capture, or distribute knowledge to ensure its availability for future users. It is more than just a communication problem, as it involves maximizing the effectiveness and efficiency of the knowledge transfer process by considering two main variables: the amount of knowledge to be transferred and the speed of the process (De Luca & Cano Rubio, 2019).

This paper aims to conduct a knowledge transfer program on the Internet of Things (IoT) for remote rural primary school pupils. The remote rural community is often left behind in technological advancement, and this program would at least instill some knowledge in them about the importance of IoT for their future. The IoT is a new paradigm that is revolutionizing computing. It is intended that all objects around us are connected to the network, providing flexible and non-linear access to information (Gómez et al., 2013). The IoT has great potential for helping people in many aspects of their lives. However, it also has the potential to cause serious security and privacy issues (Technology Usability Lab in Privacy and Security, 2020). This paper aims to critically analyze the knowledge transfer process and its effectiveness in the context of the IoT.

Knowledge Transfer in Organizational Theory

Knowledge transfer is a crucial issue in organizational theory as it involves the practical problem of transferring knowledge from one part of an organization to another. Organizations need to transfer knowledge to remain competitive and efficient, and the transfer process requires careful consideration of several factors such as the amount of knowledge to be transferred and the speed of the process. Although it is often considered a communication problem, the transfer of knowledge is much more complex than that. The successful transfer of knowledge is essential for an organization to maintain a competitive edge, but it requires careful planning and implementation to ensure that it is done effectively. As such, organizations must develop strategies that can help them to transfer knowledge efficiently and effectively, ensuring that the knowledge they have gained is shared across the entire organization (Ramos et al., 2020).

Organizational learning and knowledge transfer are closely intertwined concepts that play a vital role in the success of an organization. According to Argote and Ingram (2000), knowledge transfer is a key element of organizational learning, which helps organizations to adapt to changing environments and improve their performance. The transfer of knowledge is not just a matter of communication but involves various other factors such as the amount of knowledge to be transferred and the speed of the transfer process. Effective knowledge transfer is important for organizations to remain competitive and efficient. Thus, it is imperative that organizations develop strategies to facilitate the transfer of knowledge within their various departments to achieve their objectives.

In organizational theory, knowledge transfer is an essential process that ensures the availability of knowledge for future use. It involves organizing, creating, capturing, or distributing knowledge to enhance the organization's efficiency and competitiveness. According to Ramos et al. (2020), knowledge transfer is not just about sharing existing knowledge; it also involves creating new knowledge and improving the existing one in the organization. This transfer of knowledge includes both tacit and explicit knowledge. Tacit knowledge refers to knowledge that is not easily codified or documented, such as skills, experiences, and insights gained through personal interactions. Explicit knowledge, on the other hand, is easily codified or documented, such as reports, manuals, and procedures. Successful knowledge transfer involves a combination of both tacit and explicit knowledge, and the effectiveness of the transfer process depends on how well these types of knowledge are integrated. Therefore, knowledge transfer is a crucial aspect of organizational learning and is critical for organizations to remain competitive and efficient in today's rapidly changing business environment.

The Effectiveness of Knowledge Transfer in the Context of IoT

The Internet of Things (IoT) is a revolutionary technology that has the potential to transform the way we interact with the world around us. As mentioned by Gómez et al. (2013), the IoT is designed to connect all objects to a network, enabling flexible and non-linear access to information. This technology has the potential to bring significant benefits to various aspects of our lives, such as improving healthcare, reducing traffic congestion, and conserving energy. However, as highlighted by the Technology Usability Lab in Privacy and Security (2020), the IoT also has the potential to cause serious security and privacy issues. As the IoT becomes more widespread and integrated into our daily lives, it is essential to address these concerns to ensure that individuals' privacy and security are protected. Therefore, there is a need to explore and understand the potential risks associated with the IoT and develop strategies to mitigate these risks while capitalizing on the benefits it offers.

The effectiveness of knowledge transfer in the context of IoT is a multifaceted issue. It depends on several factors such as the amount of knowledge that needs to be transferred, the speed at which the transfer occurs, and the level of understanding of the audience. The IoT is a complex technology, and it requires a certain level of knowledge and understanding to fully comprehend its potential and its risks. Knowledge transfer must be carried out in a structured manner, with the use of appropriate communication channels and formats that are accessible to the target audience. It is essential to consider the level of technical knowledge and expertise of the audience to ensure effective knowledge transfer. Additionally, the effectiveness of knowledge transfer can be enhanced through the use of interactive learning methods such as hands-on training, workshops, and seminars. Ultimately, effective knowledge transfer is crucial for enabling the adoption of IoT technology and maximizing its potential benefits.

METHODOLOGY

Based on an extensive review of existing literature on the topic of IoT and knowledge transfer research, the aim of this paper is to establish distribution patterns of articles on knowledge transfer and IoT using bibliometric analysis methodology. To gather bibliographical data, the Scopus database was selected due to its advanced search functions, indexation of over 5000 publishers, and high-quality article standards (Martí-Parreño et al., 2016). Scopus contains a vast database with 23,700 peer-reviewed journals, 24,000 titles, 360 trade publications, 750 book series, 195,000 non-serial volumes, and 60 million entries from various subjects, making it a comprehensive source for knowledge transfer and IoT studies worldwide. The paper examined 40 documents that were selected based on predetermined keywords.

In this paper, the researchers have employed various tools and technologies to carry out their bibliometric analysis. One of the key tools used is the Scopus database, which offers powerful search capabilities and allows for the retrieval of vast amounts of data on knowledge transfer and IoT studies from around the world. In addition, the researchers have utilized Microsoft Excel to perform calculations and create visualizations such as charts and graphs, which aid in the interpretation of their findings. To assess publication impact and performance based on selected metrics, the team has made use of the Publish or Perish software. Finally, to visualize bibliometric networks and patterns, they employed the VOSviewer tool. By leveraging these technologies, the researchers have been able to conduct a comprehensive and rigorous analysis of the literature on knowledge transfer and IoT, enabling them to generate new insights and inform future research in this area.

RESEARCH FINDINGS

In this section, the findings of the study will be presented and analyzed in line with the primary objective outlined in the introduction of the paper. The aim of this paper was to investigate and evaluate the impact of IoT and knowledge transfer in remote rural areas and to explore potential solutions to bridge the knowledge gap between urban and rural communities. Therefore, the following sections will focus on discussing the results of the study in relation to this objective.

To initiate the research process, the keywords "IoT" and "knowledge transfer" were identified in the Scopus database by scrutinizing the titles of the articles. The study encompasses all document types acquired from the

Scopus database from 2013 until March 13, 2023. Therefore, the Scopus database was searched using the query TITLE ("IoT" AND "internet of things" AND "knowledge transfer") to retrieve literature on IoT and knowledge transfer. The search yielded 40 relevant documents. As the search was conducted solely within the article titles, it can be assumed that all obtained documents pertaining to the main topic of this study. Following the screening process, none of the documents were eliminated, and all 40 were deemed appropriate for this bibliometric analysis. Figure 1 depicts the search strategy flow chart in this study.
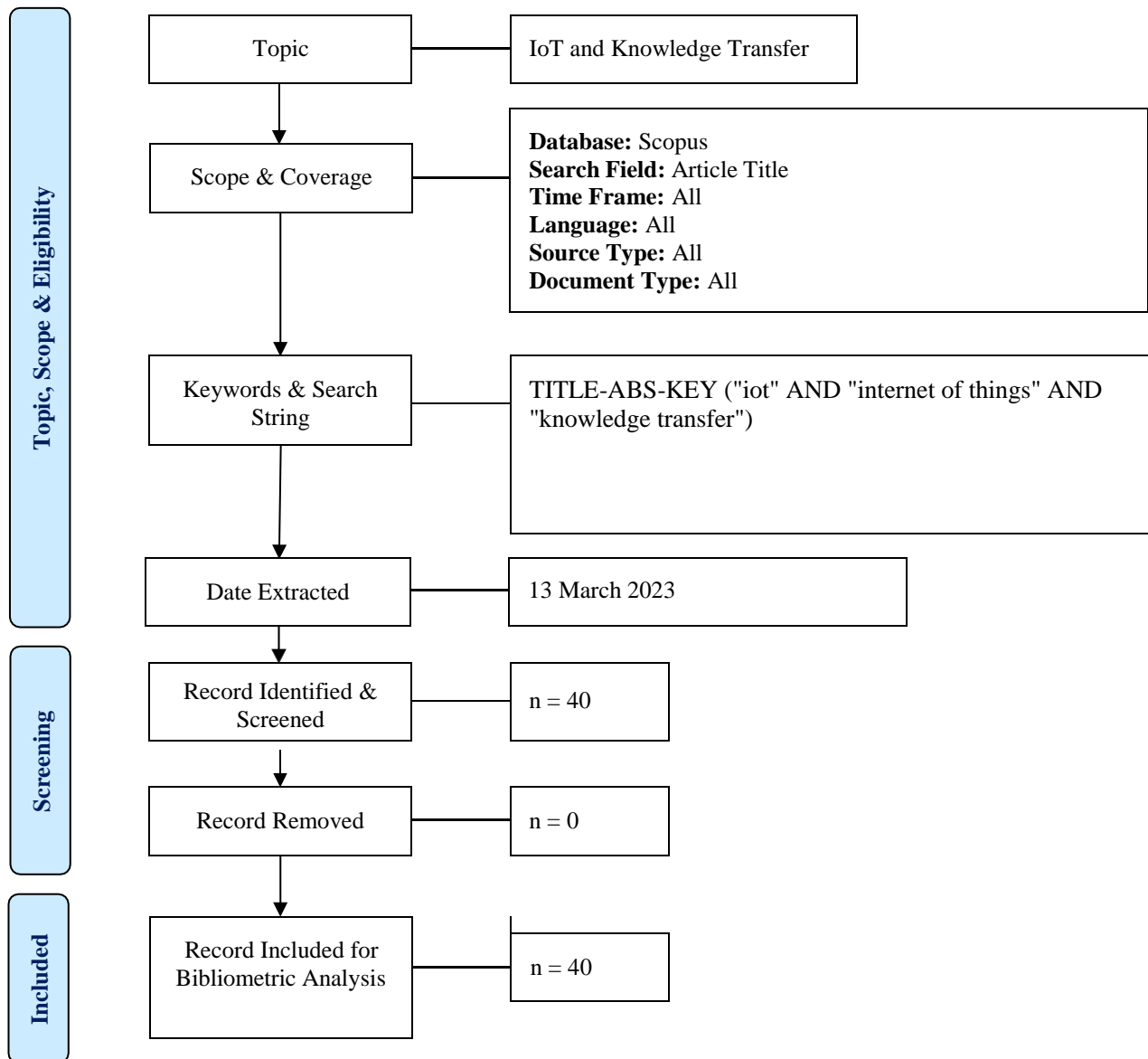
Figure 1: Flow Diagram and Search Strategy

Source: (Zakaria et al., 2021)

Development of Knowledge Transfer Research and Distribution

Type and Source of Document. The primary objective of this study is to determine where research papers concerning IoT, and knowledge transfer are published by analyzing the data based on the type of source document. The findings presented in Table 1 reveal that most of the published literature in the area of IoT and knowledge transfer consists of articles and conference papers, accounting for 45% of the total with 18 documents. This highlights the importance of academic journals and conferences as key platforms for disseminating research in this field. Furthermore, book chapters accounted for only 5% of the literature with

just 2 documents, suggesting that IoT and knowledge transfer may not yet have established a strong presence in the book publishing industry. Lastly, conference reviews represented just 2.5% of the literature, indicating that there is still a need for more comprehensive and in-depth reviews of the existing literature in this area. Overall, these results provide valuable insights into the current state of published literature on IoT and knowledge transfer, which could help guide future research and publication strategies.

Table 1: Document Type of Published Literature in IoT and Knowledge Transfer

Document Type	Total Publications (TP)	Percentage (%)
Article	18	45.00%
Conference Paper	18	45.00%
Book Chapter	2	5.00%
Conference Review	1	2.50%
Total	**40**	**100.00**

The results presented in Table 2 indicate that journals are the most prevalent source, the journal for 47.50% (19) of the total research documents analyzed. Conference proceedings are the second most common source, with 32.50% (13) of the research papers being published in this format. Books series and standalone books are comparatively fewer common sources, with 15% (6) and 5% (2) of the papers being published in these formats, respectively. The dominance of journals as the preferred outlet for publishing research papers on IoT and knowledge transfer is notable, indicating their significance in this field. However, it is crucial to note that journal and conference proceedings also play a significant role in disseminating research findings in this domain.

Table 2: Source of IoT and Knowledge Transfer Research

Source Type	Total Publications (TP)	Percentage (%)
Journal	19	47.50%
Conference Proceeding	13	32.50%
Book Series	6	15.00%
Book	2	5.00%
Total	**40**	**100.00**

If we look more closely at the data in Table 3, it can be identified that the document with the most citations is the research that has become a reference by many researchers at every stage of its evolution. In the early stages of the evolution of IoT and knowledge transfer research, many researchers raised the theme of knowledge transfer in the theological, as well as the basic concept of knowledge transfer, for example, He et al., (2019), Toc and Korodi (2018), Alreshidi and Ahmad (2019), Fu et al., (2020) and Poslad et al., (2013). The results of their research are ultimately a reference for future researchers. The evolution of the theme of knowledge transfer research from a theological perspective to the institutional aspect has produced several kinds of literature that discuss the concept of good governance in knowledge transfer from academicians to youngsters. Therefore, research themes such as the role as academicians (Dec et al., 2022; Li et al., 2022), innovation (Rossi et al., 2022) and learning via mutual (Li et al., 2022) have become references for many studies with this theme.

Table 3: Top 10 Highly Cited Documents

No.	Authors	Title	Cites	Cites per Year
1	X. He, K. Wang, W. Xu (2019)	QoE-Driven Content-Centric Caching with Deep Reinforcement Learning in Edge-Enabled IoT	41	10.25

2	S.-I. Toc, A. Korodi (2018)	Modbus-OPC UA Wrapper Using Node-RED and IoT-2040 with Application in the Water Industry	22	4.40
3	A. Alreshidi, A. Ahmad (2019)	Architecting software for the Internet of Thing based systems	21	5.25
4	S. Fu, Z. Li, K. Liu, S. Din, M. Imran, X. Yang (2020)	Model Compression for IoT Applications in Industry 4.0 via Multiscale Knowledge Transfer	18	6
5	S. Poslad, M. Hamdi, H. Abie (2013)	International workshop on adaptive security & privacy management for the internet of things (ASPI 2013)	16	1.60
6	G. Dec, D. Stadnicka, Å• . PaÅ›ko, M. MÄ…dziel, R. FigliÄ¨, D. Mazzei, M. Tyrovolas, C. Stylios, J. Navarro, X. SolÃ©-Beteta (2020)	Role of Academics in Transferring Knowledge and Skills on Artificial Intelligence, Internet of Things and Edge Computing	10	10.00
7	M. Gorlatova, J. Sarik, P. Kinget, I. Kymissis, G. Zussman (2013)	Project-based learning within a large-scale interdisciplinary research effort	10	1.00
8	C. Li, G. Li, P.K. Varshney (2022)	Decentralized Federated Learning via Mutual Knowledge Transfer	9	9.00
9	T. Xi, Y. Tian, X. Li, H. Gao, W. Wang (2019)	Pixel-wise depth based intelligent station for inferring fine-grained PM2.5	9	2.25
10	F. Rossi, A. Caloffi, A. Colovic, M. Russo (2022)	New business models for public innovation intermediaries supporting emerging innovation systems: The case of the Internet of Things	7	7.00

Keyword Analysis. Figure 2 describes the use of VOSviewer software to analyze author keywords in the literature on IoT and knowledge transfer. The visualization generated by the software provides a clear overview of the relationships between keywords and their degree of association with other terms. The most frequently occurring keywords in the network were "internet of things," "knowledge management," and "knowledge transfer," indicating their centrality in the field.

The network visualization map revealed that the literature on IoT and knowledge transfer is structured around a few core themes and concepts. The formation of 8 items, including 3 clusters, 29 links, and 15 total link strengths, suggests that there is a high degree of interconnectedness between keywords, indicating a shared emphasis on specific topics and research areas.

By identifying the most commonly used keywords and their associations with other terms, this study provides insights into the intellectual structure and research trends of the field. These insights could be useful for researchers who are seeking to build on existing literature or develop their own research agendas. For instance, the identification of key concepts and themes could inform the development of research questions and hypotheses, as well as the selection of appropriate research methods.

Overall, the study highlights the importance of analyzing author keywords to gain a deeper understanding of the literature on a particular topic. By providing a visual representation of the relationships between keywords, VOSviewer software can help researchers to identify the key concepts and themes that are shaping the field and to develop more informed research strategies. However, it is important to note that the analysis is limited to the use of author keywords, and further research may be needed to explore the full range of topics and themes within the literature on IoT and knowledge transfer.
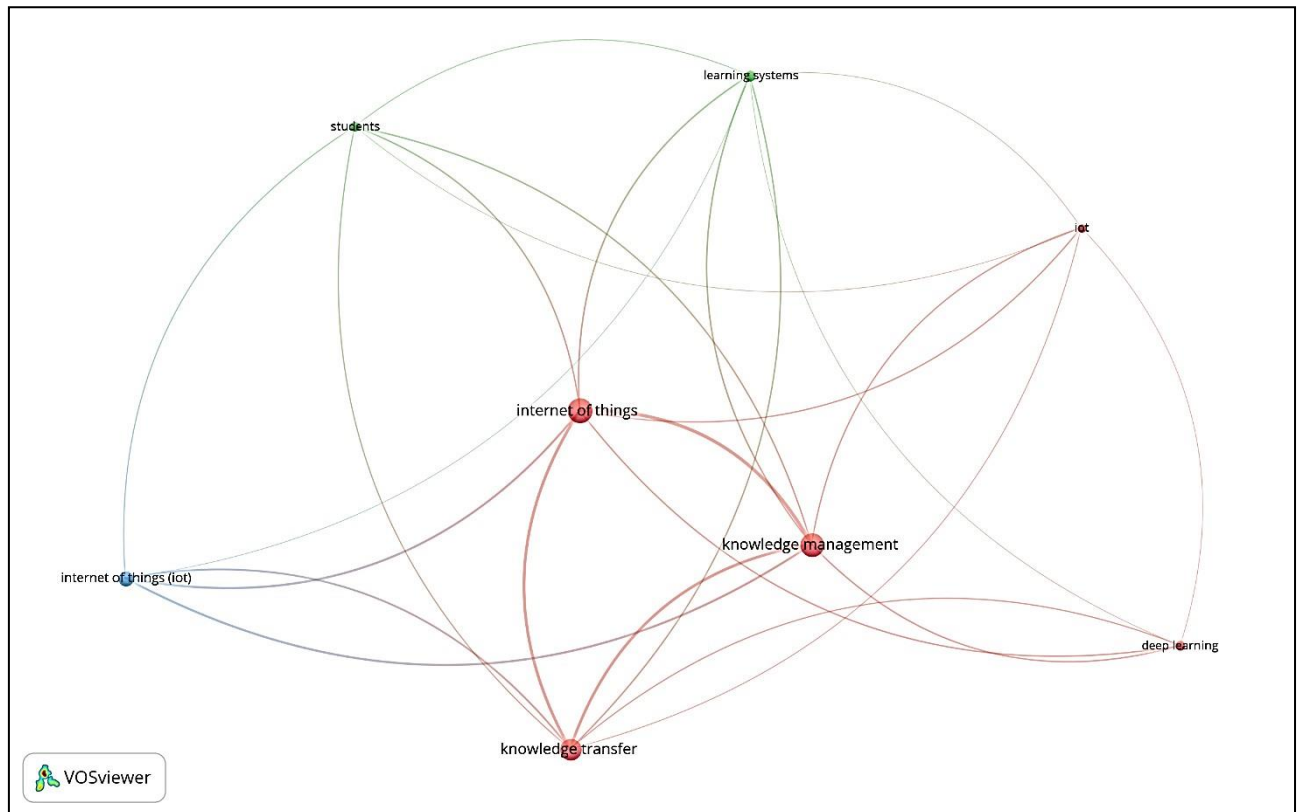
Figure 2: Network Visualization Map of the Author's Keywords

CONCLUSION AND RECOMMENDATION

In conclusion, our bibliometric analysis has provided valuable insights into the state of research on IoT and knowledge transfer, based on 40 related documents found in the Scopus database. While we recognize that our study is limited by the use of Scopus as the only source of information and the reliance on keywords in document titles, we believe that our findings demonstrate progress in this field and highlight areas for further research. Our analysis has also emphasized the increasing importance of ICT, particularly IoT, in our daily lives and the potential it holds for improving digital education in remote rural areas. As such, there is a pressing need to address the issue of IoT knowledge among these communities and provide them with the necessary resources and awareness to fully leverage this technology. Overall, this study aims to explore the current understanding and perceptions of IoT among remote rural communities and propose strategies to improve their knowledge and use of this technology. By doing so, we hope to contribute to a more connected and equitable future for education and society as a whole.

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REFERENCES

Ahmi, A., & Mohamad, R. (2019). Bibliometric analysis of global scientific literature on web accessibility. *International Journal of Recent Technology and Engineering*, *7*(6).

Alreshidi, A., & Ahmad, A. (2019). Architecting software for the Internet of Thing based systems. In *Future Internet* (Vol. 11, Issue 7). https://doi.org/10.3390/fi11070153

Argote, L., & Ingram, P. (2000). Knowledge transfer: A Basis for Competitive Advantage in Firms. *Organizational Behavior and Human Decision Processes*, *82*(1), 150–169.

Awang, H., Zahurin, M. A., Wan Rozaini, S. O., Kamaruddin, E., Al-Mashhadani, A. F. S., & Khamis, S.

(2020). Cabaran Dalam Melaksanakan Teknologi Maklumat Dan Komunikasi: Analisis Kes Persekitaran Pembelajaran Maya-Frog Serta Strategi Untuk Melestarikan Penggunaan Google Classroom Dalam Kalangan Guru. *Journal of Educational Research and Indigenous Studies*, *1*(1).

Conway, A., Dowling, M., Binchy, A., Grosvenor, J., Coohill, M., Naughton, D., James, J., & Devane, D. (2019). Implementing an initiative to promote evidence-informed practice: Part 1- A description of the Evidence Rounds programme. *BMC Medical Education*, *19*(1). https://doi.org/10.1186/s12909-019-1489-y

De Luca, P., & Cano Rubio, M. (2019). The curve of knowledge transfer: a theoretical model. *Business Process Management Journal*, *25*(1). https://doi.org/10.1108/BPMJ-06-2017-0161

Dec, G., Stadnicka, D., Paśko, Ł., Mądziel, M., Figliè, R., Mazzei, D., Tyrovolas, M., Stylios, C., Navarro, J., & Solé-Beteta, X. (2022). Role of Academics in Transferring Knowledge and Skills on Artificial Intelligence, Internet of Things and Edge Computing. *Sensors*, *22*(7). https://doi.org/10.3390/s22072496

Fu, S., Li, Z., Liu, K., Din, S., Imran, M., & Yang, X. (2020). Model Compression for IoT Applications in Industry 4.0 via Multiscale Knowledge Transfer. *IEEE Transactions on Industrial Informatics*, *16*(9). https://doi.org/10.1109/TII.2019.2953106

Gómez, J., Huete, J. F., Hoyos, O., Perez, L., & Grigori, D. (2013). Interaction system based on Internet of things as support for education. *Procedia Computer Science*, *21*. https://doi.org/10.1016/j.procs.2013.09.019

He, X., Wang, K., & Xu, W. (2019). QoE-Driven Content-Centric Caching with Deep Reinforcement Learning in Edge-Enabled IoT. *IEEE Computational Intelligence Magazine*, *14*(4). https://doi.org/10.1109/MCI.2019.2937608

Hunter, B. H., & Radoll, P. J. (2020). Dynamics of Digital Diffusion and Disadoption: A Longitudinal Analysis of Indigenous and Other Australians. *Australasian Journal of Information Systems*, *24*, 1–21. https://doi.org/10.3127/AJIS.V24I0.1805

Li, C., Li, G., & Varshney, P. K. (2022). Decentralized Federated Learning via Mutual Knowledge Transfer. *IEEE Internet of Things Journal*, *9*(2). https://doi.org/10.1109/JIOT.2021.3078543

Mansour, A. Z., Ahmi, A., Popoola, O. M. J., & Znaimat, A. (2022). Discovering the global landscape of fraud detection studies: a bibliometric review. *Journal of Financial Crime*, *29*(2). https://doi.org/10.1108/JFC-03-2021-0052

Martí-Parreño, J., Méndez-Ibáñez, E., & Alonso-Arroyo, A. (2016). The use of gamification in education: a bibliometric and text mining analysis. *Journal of Computer Assisted Learning*, *32*(6). https://doi.org/10.1111/jcal.12161

Park, S. (2015). Digital Inequalities in Rural Australia : A Double Jeopardy of Remoteness and Social Exclusion. *Journal of Rural Studies*, 1–9. https://doi.org/10.1016/j.jrurstud.2015.12.018

Poslad, S., Hamdi, M., & Abie, H. (2013). International workshop on adaptive security & privacy management for the internet of things (ASPI 2013). *UbiComp 2013 Adjunct - Adjunct Publication of the 2013 ACM Conference on Ubiquitous Computing*. https://doi.org/10.1145/2494091.2499770

Ramos, G., Romero, B., & Payares, R. (2020). A theoretical model of knowledge transfer for Sinaloa companies. *INQUIETUD EMPRESARIAL*, *20*(2).

Rossi, F., Caloffi, A., Colovic, A., & Russo, M. (2022). New business models for public innovation intermediaries supporting emerging innovation systems: The case of the Internet of Things. *Technological Forecasting and Social Change*, *175*. https://doi.org/10.1016/j.techfore.2021.121357

Siti Zobidah, O., Musa, A. H., Narimah, I., Jusang, B., Omar, S. Z., Hassan, M. A., Ismail, N., Bolong, J., Siti Zobidah, O., Musa, A. H., Narimah, I., & Jusang, B. (2008). Faktor Kejayaan dan Kegagalan Projek ICT di Luar Bandar. *Pertanika J. Soc Sci & Hum*, *16*(2), 173–186.

Technology Usability Lab in Privacy and Security. (2020). *IoT Awareness*.

Toc, S. I., & Korodi, A. (2018). Modbus-OPC UA Wrapper Using Node-RED and IoT-2040 with Application in the Water Industry. *SISY 2018 - IEEE 16th International Symposium on Intelligent Systems and Informatics, Proceedings*. https://doi.org/10.1109/SISY.2018.8524749

United Nations. (2021). *Sustainable Development: The 17 Goals*.

Valérie, D., & Pierre, A. G. (2010). Bibliometric idicators: Quality masurements of sientific publication. In *Radiology* (Vol. 255, Issue 2). https://doi.org/10.1148/radiol.09090626

Young, J. C. (2019). Rural Digital Geographies and New Landscapes of Social Resilience. *Journal of Rural Studies*, *70*(June), 66–74. https://doi.org/10.1016/j.jrurstud.2019.07.001