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BIBLIOMETRIC ANALYSIS OF DIGITAL SKILLS AND ICT ADOPTION IN INDONESIA: A DECADE OF RESEARCH TRENDS

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Abstract—This research presents a comprehensive bibliometric analysis of the evolving landscape of digital skills and Information and Communication Technology (ICT) adoption in Indonesia over the past decade. Employing bibliometric techniques, including co-citation analysis and keyword co-occurrence analysis, this study identifies key research trends and emerging topics within the intersection of digital skills development and ICT adoption in the Indonesian context. The findings shed light on pivotal themes such as digital literacy, e-learning, government policies, and vocational training, offering valuable insights for policymakers, educators, and researchers as Indonesia navigates its digital transformation journey. This analysis serves as a crucial resource for informed decision-making and the formulation of strategies to promote digital skill acquisition and ICT integration in Indonesia's socio-economic landscape. The method used in this particular research was mainly conducting the Systematic Literature Review using the Vos Viewer analysis from numerous papers that were retrieved from the Scopus Journal. The paper retrieved ranging more or less from the past 8 years.
Index Terms— Bibliometric, Digital, ICT, Indonesia

I. INTRODUCTION

Indonesia, being a developing nation, has set a goal to attain the status of a developed country by the year 2045. According to Bappenas (the National Development Planning Agency), the Global Power Index is targeted to be within the top 15 positions in 2045, encompassing knowledge and technology advancement skills in Indonesia. As Indonesia stands on the precipice of the digital transition, the significance of digital skills and competencies has never been more pronounced. This decade's trends have redefined the way every talent work, communicate, and conduct business, presenting both challenges and opportunities. Every talent in Indonesia needs to be prepared and challenged to be flexible in acquiring digital skills, including advancement in Information and communication technology (ICT) in Indonesia.

Indonesia will transform and face automation and the future of work in 2030. In response to the situation, Indonesia developed a program called Vision Indonesia Gold 2045 in 2020. This vision is supported by four major pillars, which are as follows: human development and science and technology, economic equality, and strengthening resilience and national governance [1]. Human capital is an intangible asset that must be cultivated extensively. Therefore, companies must invest in the development of their human capital, which has a significant impact on the performance of the company [2]. The Indonesian government is now focusing on developing excellent human

resources and adapting to rapid technological changes. Competence in human resource management is one of the best ways for succeeding in competing worldwide [3].

As we progress into the 21st century, the acceleration of technological development, especially in the era of the industrial revolution 4.0, has made globalization an unstoppable force. This era is particularly noted for significant advancements in technology and information, as highlighted by [4]. The influx of globalization has intensified competition, necessitating the need for superior knowledge and skills. Among the essential skills for this century, as identified by [5], are information and communication technology and information literacy, which are pivotal as working tools in the digital age.

The integration of information technology is recognized for its impact on economic efficiency and the state of companies [6]. The Information and Communication Technology Development Index (ICTDI) of Indonesia for the year 2020 witnessed a notable increase, reaching 5.59 as compared to the 2019 index of 5.32. This upswing in the ICTDI for 2020 is attributed to the commendable achievements across its three sub-indices: (1) the ICT access and infrastructure sub-index, reflecting Indonesia's ICT readiness, soared to 5.67; (2) the usage sub-index, indicating the level of ICT utilization in the country, reached 5.34; and (3) the skills sub-index, mirroring the proficiency required in ICT in Indonesia, achieved a score of 5.92. The prevalence of information and communication technology (ICT) in the professional environment has created a significant need for a workforce highly proficient in ICT skills. By understanding digital skills acquisition (e.g., 21st-century skills, digital skills, digital competence, digital literacy, e-skills, and internet skills) and ICT adoption, it can become a paramount foundation for policymakers, educators, and researchers in Indonesia for future research and strategic planning.

Method

A. Systematic Literature Review

A systematic review of the scientific literature in a specific area is important for identifying research questions, as well as for justifying future research in said area [7]. A systematic literature review endeavours to comprehensively compile all pertinent evidence that aligns with predetermined eligibility criteria in order to address a specific research inquiry [8]. Systematic literature reviews (SLRs) provide a method for aggregating scientific evidence to address specific research questions. This approach is marked by its transparency and reproducibility. It aims to encompass all existing published evidence on a subject while also evaluating the credibility of this evidence [9]. This method aligns with our research objectives as it aids in consolidating Vos Viewer analysis on all academic research that assesses the factors influencing ICT and contemporary digital skills from the Scopus Journal. The selected research for review spanned approximately the previous decade.

B. Bibliometric Analysis

This study offers an extensive bibliometric examination of how digital skills and Information and Communication Technology (ICT) adoption have evolved in Indonesia over the

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last ten years. The use of bibliometric analysis is crucial as it scrutinizes data sourced from the Scopus database, allowing us to pinpoint knowledge gaps and the state of digital skills and ICT research for practical application in a developing nation. We conducted a thorough analysis and generated visual representations of the data related to ICT and Digital Skills in Indonesia using the biblioshiny, which serves as the web interface for Bibliometrix, and VOSViewer. Details on these tools are provided in the next section.

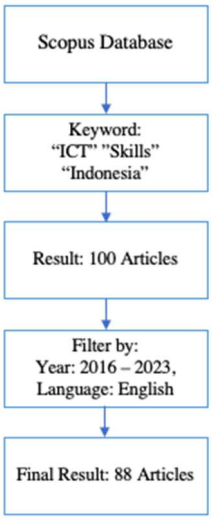

Fig.1 Scopus Database

RESULT

Over the past half-decade, the scholarly exploration of Information and Communication Technology (ICT) Skills within the Indonesian context has witnessed a substantial surge, reflecting a burgeoning academic interest in the subject. Employing a comprehensive bibliographic analysis of research articles extracted from the Scopus database, this paper unveils a remarkable trajectory of growth in the literature (Fig.1). Commencing with a modest output of 2 publications in 2016, this scholarly endeavour has expanded exponentially, culminating in a noteworthy 66 research articles by the end of 2021. Notably, the zenith of this academic pursuit was attained in 2021, symbolizing the apex of scholarly engagement. Although a slight deceleration was observed in 2022, with a decrease to 7 publications, the ensuing year, 2023, bears testament to a resurgence in scholarly vigour, marked by an upswing to 11 publications, reaffirming the enduring significance of ICT Skills as a topic of scholarly inquiry within the Indonesian academic landscape.

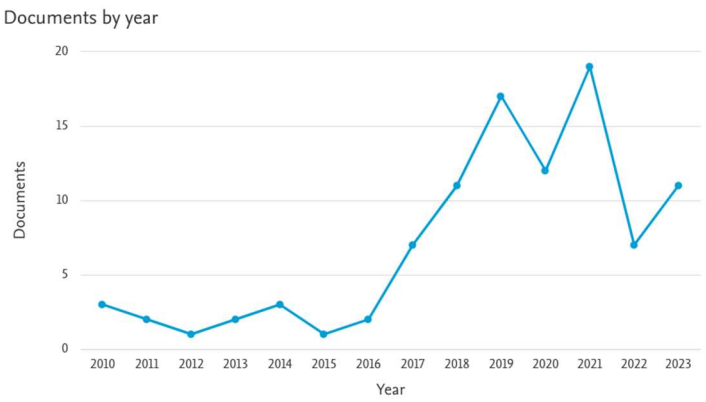

Fig.2 Growth in Publications on ICT Skills in Indonesia

In Table 1, delineating the Subject Area distribution of publications on ICT Skills in Indonesia, it becomes evident that Social Sciences dominate with the highest percentage at 33.8%, closely followed by Computer Science at 16.3%. This discernible trend underscores the intricate relationship between ICT Skills and computer technology, illuminating the pervasive influence of the digital sphere across diverse social contexts. Conversely, the least prominence in this domain is observed in Decision Science and Earth and Planetary Sciences, each accounting for a mere 2.5%. This nuanced analysis not only reaffirms the symbiotic alliance between ICT Skills and computer technology but also accentuates the interdisciplinary nature of this evolving field of study.

Table 1. Subject Area of Publication

Subject Area	Percentage	Subject Area	Percentage
Environmental Sciences	3.8%	Physic and Astronomy	9.4%
Social Sciences	33.8%	Business, Management and Accounting	6.3%
Earth and Planetary Sciences	2.5%	Decision Sciences	2.5%
Engineering	6.3%	Mathematics	4.4%
Computer Science	16.3%	Arts and Humanities	6.3%
Other	8.8%		

In our analysis of document affiliations, Universitas Pendidikan Indonesia emerged as a leading contributor, having contributed 9 papers to the discourse on ICT Skills. Following closely,

Universitas Indonesia made a significant impact with 6 articles. Remarkably, the study identified a total of 15 affiliations actively engaging with this subject, underscoring the widespread scholarly interest in the realm of ICT Skills. Intriguingly, even beyond Indonesia's borders, Universiti Kebangsaan Malaysia stood out as the third-largest contributor, having published 5 papers on the topic. The remainder of the publications originated from various esteemed institutions within Indonesia, including Universitas Negeri Malang, Universitas Negeri Jakarta, IPB University, Universitas Negeri Semarang, Bina Nusantara University, Universitas Sriwijaya, and Universitas Riau. This diverse and expansive collaboration signifies the robust international and domestic academic engagement surrounding the exploration of ICT Skills, reflecting its multifaceted relevance and significance in contemporary research (Fig. 2).

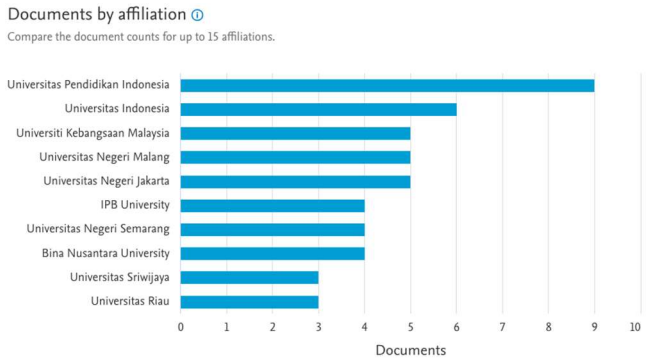

Fig. 3 Documents by Affiliations

Despite the deliberate specification of the keyword 'Indonesia' to focus our analysis on ICT Skills within the Indonesian context, the outcomes revealed a noteworthy diversification beyond national borders. While Indonesia undoubtedly led in the number of publications (86 publications), our search, after incorporating the term 'Indonesia,' unveiled an unexpected global dimension. Publications on ICT Skills extended beyond Indonesia's territorial confines, with significant contributions originating from various international locations. Notably, countries such as Malaysia, Australia, Japan, Thailand, China, Fiji, Iraq, Singapore, and South Korea emerged as substantial contributors to the discourse. This broader geographic footprint underscores the international resonance of ICT Skills as a subject of paramount importance, transcending regional boundaries and garnering scholarly attention on a global scale.

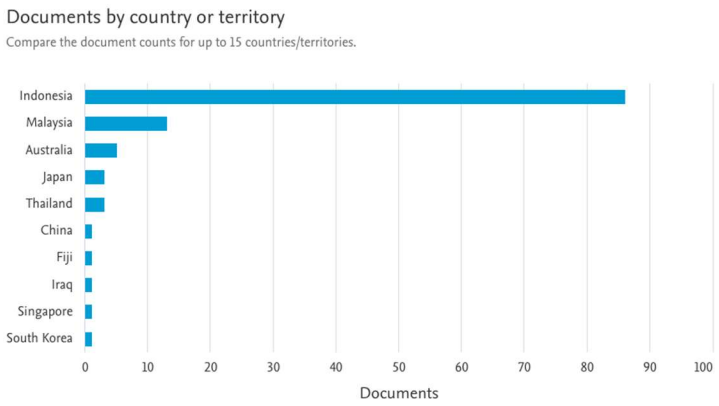

Fig. 4 Documents by Country

B.1 Keyword Analysis

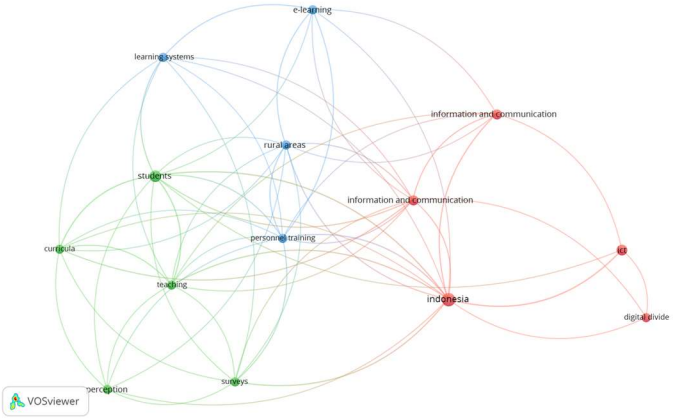

Fig.5 Network Visualization of Keyword Analysis

The Vosviewer outcome result gives a fascinating result also includes keyword connectivity and clustering. The network representation of the keyword analysis obtained from the VOSviewer results is explained in Figure 4. It presents the phrases and concepts that appear frequently, giving an overview of the study patterns and prevailing topics in the dataset. This keyword tabulation provides a summary overview of the main topics and focal points, acting as a reference point for comprehending the wider context and subtleties of the analysis results. After the keywords were analyzed, we found a total of 14 terms in three different clusters (Table 2).

Table 2. Cluster of Keyword Analysis

Cluster 1 (N = 5)	Cluster 2 (N = 5)	Cluster 3 (N = 4)
Digital Divide	Curricula	E-Learning
ICT	Perception	Learning Systems

Indonesia	Students	Personal Training
Information and Communication Technologies	Surveys	Rural Areas
Information and Communication Technology	Teaching	

The bibliometric study utilizing VOSviewer visualization highlights the research subjects that are popular in scientific publications about ICT and digital skills in Indonesia. One essential method for depicting item density on a map is density visualization. According to [1], As in the network and overlay visualizations, items are represented by their labels in the item density visualization as well. The item density visualization uses colours to represent the item density at each point. Colours are by default blue, green, and yellow. A point's colour approaches yellowness in direct proportion to the number of items nearby and the higher the weights of those items. In the opposite manner, a point's colour approaches blue the fewer items it shares with its neighbours and the lower their respective weights are. Figure 5 showcases the density visualization demonstrating that Indonesia, ICT, and Students are the main areas of study. These themes are indicated by high-density item weights that are shown in yellow. This implies that a great deal of discussion and publication has been done on the research themes of Indonesia, ICT, and Students.

To summarise, the table and density visualisation presented offer significant insights into the research subjects and patterns found in scientific publications pertaining to ICT and digital skills in Indonesia. We can gain a deeper understanding of the wider context and subtleties of the VOSviewer analysis outcomes by offering a thorough overview of the main topics and areas of emphasis.

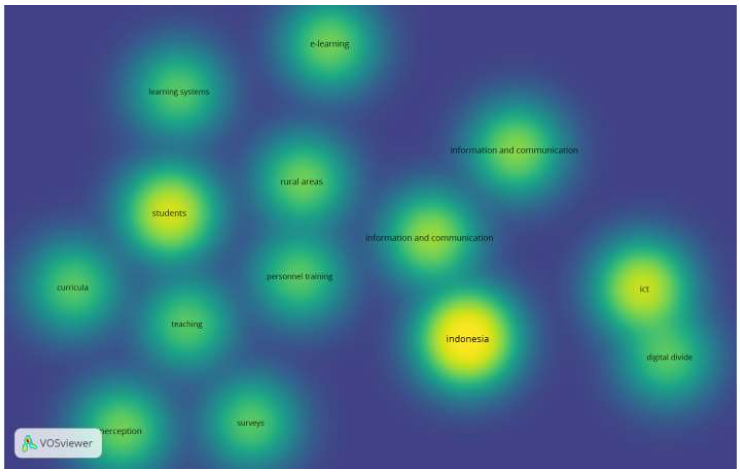

Fig 6. Density Visualization of Keyword Analysis

B.2 Co-Authorship Analysis

The Development of academics through writing a journal paper often requires collaboration between authors. To have a better understanding of the collaboration networks of authors in academic journals focusing on Digital Skills and ICT in Indonesia, we visualized collaborations on a network map. To ensure a thorough analysis, we reviewed every article, even those that were not cited. This approach avoids excluding potentially important articles. The network map in Figure 6 as can be seen only showcases one cluster which consists of 3 authors based on our thresholds and requirements namely Hasibuan, Nurjanah, and Santoso. With the findings, we can conclude that there are still gaps in the research field in Indonesia due to only a small number of articles. This shows that there is still much to explore and discover in this area.

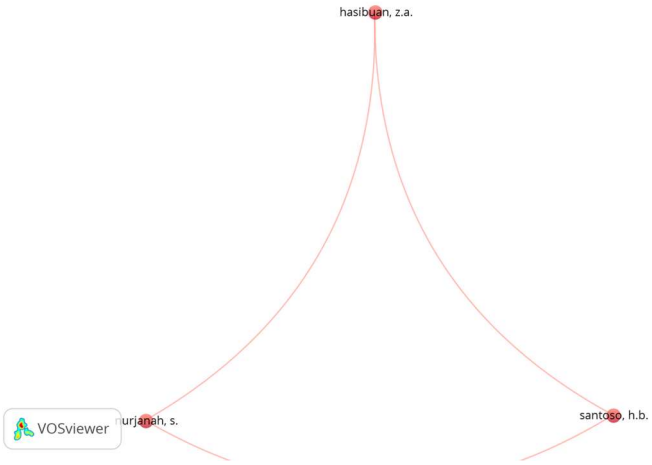

Fig 6. Co-Authorship Network Analysis

Conclusion

In summary, this paper illuminates the impressive trajectory of scholarly exploration within the Indonesian context regarding Information and Communication Technology (ICT) Skills. Over the past five years, the field has experienced exponential growth, with research output increasing from a modest 2 publications in 2016 to a substantial 66 articles by the close of 2021. The peak of this academic pursuit was reached in 2021, indicative of robust scholarly engagement. While there was a minor decline in 2022, the resurgence witnessed in 2023 reaffirms the enduring significance of ICT Skills within the Indonesian academic landscape. The subject area distribution underscores the strong connection between ICT Skills and computer technology, with Social Sciences leading at 33.8% and Computer Science closely following at 16.3%. This underscores the profound influence of the digital sphere across various social contexts, underscoring the interdisciplinary nature of this evolving field of study.

Furthermore, our exploration initially focused on Indonesia, and extended beyond national boundaries, revealing a global dimension to the discourse. This demonstrates that ICT Skills are not only of national importance but also an internationally relevant subject, drawing scholarly

attention from diverse regions beyond Indonesia. In essence, this analysis highlights the growing importance of ICT Skills in both the Indonesian and international academic landscapes, reflecting its dynamic and interdisciplinary nature. It underscores the need for sustained scholarly inquiry to address the evolving challenges and opportunities presented by this field in the digital era, transcending geographic borders and fostering global collaboration.

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