Bibliometrics Analysis of Digital Technology in Entrepreneurship

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Abstract: Digital technologies are frequently used in business, particularly for product advertising, sales, marketing, operations management, and improved customer service. This study used bibliometric visualization to map the position of digital technology in worldwide entrepreneurship studies published and indexed by the Web of Science. Bibliometric methodologies and research data analysis were carried out using the VOS viewer application's analysis search results service and the Web of Science. The Web of Science database included research data for 558 documents published between 2015 and 2024. The findings revealed that England, People R China, Finland, France, and Sweden were the most productive nations, with institutional affiliations, and individuals publishing digital technology in entrepreneurship studies. Most document categories and subject areas in digital technology in entrepreneurship studies were open-access documents. The findings highlight significant contributions to entrepreneurship by advancing the literature and highlighting key research fronts, offering insights that previous reviews still needed to fully grasp. The analysis and graphical displays provide valuable insights into how digitization affects entrepreneurship. The topic's novelty and the gap revealed in previous research on digital technology on entrepreneurship prompted us to take an integrated strategy that included bibliometric analysis.

Keywords: Digital Technology, Technological Revolution, Business, Bibliometric.

1. Introduction

Digital technology has significantly changed the manner in which entrepreneurs learn and prepare to be successful by providing quick access to information, virtual business simulations, global collaboration, and digital marketing. It has also transformed how businesses operate, innovate, and compete in the global marketplace [1]. Traditional market entrance barriers have been split down by digital technologies, allowing entrepreneurs from all over the world to have access to global marketplaces. The mixture of artificial intelligence (AI), blockchain, and the Internet of Things (IoT) is sparking an emerging era of innovation in industries. This integration provides benefits including greater security, transparency, automation, and efficiency in corporate processes [2]. Entrepreneurs are using these technologies to develop innovative business strategies and creative goods. Because of digital

technologies, entrepreneurs, researchers, and investors may collaborate worldwide. Platforms like LinkedIn and GitHub enable professionals to connect, share skills, and collaborate on projects across geographical borders. This has resulted in a more integrated entrepreneurial environment, which promotes innovation and growth. The development of digital fundraising tools, such as crowdfunding sites [3]. and Peer-to-peer lending networks has made finance more accessible to entrepreneurs around the world. In contrast to, and drawing on an examination of, recent literature, this work aims to identify the presence of active research areas through the overall field of entrepreneurship using bibliographic coupling analysis (BCA).

This study aims to conduct a detailed bibliometric analysis of the existing literature on digital technology in entrepreneurship. It seeks to map this field's intellectual structure and knowledge domains, highlighting the most influential publications, authors, and research institutions. The study will explore the historical and thematic evolution of this domain, identifying emerging trends, research gaps, and future directions Furthermore, it will examine the intellectual connections and information transmission patterns of numerous sub-themes and research streams within the larger framework of digital technology in entrepreneurship. This bibliometric analysis will provide an in-depth analysis of the present research landscape, revealing useful insights for researchers, policymakers, and practitioners working to improve the digital entrepreneurial ecosystem.

Digital technology has transformed many areas of entrepreneurship, including corporate operations, innovation, and market competitiveness. This transition has been stimulated by several critical technologies, including artificial intelligence (AI), blockchain, and the Internet of Things. These technologies have several benefits, including increased security, transparency, automation, and efficiency in company processes, allowing entrepreneurs to build creative strategies and products [4]. AI in marketing analyses consumer behavior, enabling data-driven decisions and personalized experiences. assisting firms in tailoring their marketing strategies to specific target segments, ultimately increasing customer satisfaction and business growth [5]. Blockchain technology supports safe and transparent transaction platforms, which can decrease fraud and boost stakeholders' trust [6]. The Internet of Things (IoT) enable interconnected devices to communicate and exchange data, increasing operational efficiency and opening up new commercial prospects via advanced analytics [7]. Digital technologies are crucial for worldwide collaboration and networking. Platforms such as LinkedIn and GitHub allow professionals to connect, share skills, and cooperate on projects across borders, resulting in a more connected and dynamic entrepreneurial ecosystem [8]. Moreover, digital fundraising tools such as crowdfunding platforms and peer-to-peer lending networks have democratized access to finance, making it easier for entrepreneurs throughout the world to get funding [9]. Digital technology’s influence on entrepreneurship extends to education. Digital learning platforms and virtual business simulations provide aspiring entrepreneurs with critical skills and information, positioning them for success in the digital age [10]. This democratization of education and resources lowers traditional market entry barriers, allowing more people to pursue entrepreneurship [11].

2. METHODOLOGY

This research uses bibliometric analysis to provide an overview of digital technology in entrepreneurship. The study data used in this paper were downloaded from the Web of Science Core Collection database, which covers several sub-databases. Previously, bibliometric analyses relied on two most generally recognized international databases: Web of Science and Scopus [12]. Google Scholar contains questionable and unreliable citations

[13]. This study is focused on the data from the Web of Science, which comprises only the most influential and high-quality publications from past studies [14].
To select the kind of digital technology in entrepreneurship research to be evaluated, we recovered all the papers that used the keywords "digital technology" or "technological revolution" simultaneously when concentrating on digitalization in entrepreneurship and, in addition, the keywords "business" when focusing on technology usage related to entrepreneurship. This analysis aims to provide insights into the evolution and impact of technological advancements on business practices by understanding and evaluating research trends, key authors, influential journals, and thematic developments at the intersection of digital technology and entrepreneurship. The population includes all papers up to year 2024. The Web of Science (WOS) database on the subject was extracted on April 13, 2024. This study examined 1281 documents based on their title, topic, and abstract linked to digital technology entrepreneurship. Further, this analysis has included data only on open-access documents and articles published in English. The analysis then included all subject areas, resulting in the remaining 558 documents. The resulting database (n=558) was then exported and analyzed using Vos Viewer software, which displays massive bibliometric maps in an understandable format [15].
Performance Analysis has been used to identify the annual publication of digital technology in entrepreneurship. Science Mapping – citation analysis has been used to figure out the top countries, leading journals, and influential authors and titles. Moreover, Science Mapping – Co-authorship analysis of countries has been used to assess the structure and pattern of country collaboration in this field. Science Mapping – Co-occurrence analysis has been used to figure out the conceptual structure of keywords. Science Mapping – Bibliographic coupling of countries has been used to understand countries' coupling structures and how often countries share similar literature in this field of digital technology in entrepreneurship.

3. RESULTS

The results presented in this paper have taken into account eight analyses. Firstly, the paper analyzes the situation and progress of digitalization in entrepreneurship in the literature, concentrating on technology adoption in entrepreneurship, and analyzing the trends in yearly publications. Secondly, it focuses on the leading countries demonstrating their significant research output and technological ecosystems. The third part studies the influential authors, it concentrates on the most cited papers in digital technology. The fourth impactful journal is the leading journal in these general and specific topics. Fifthly, regarding country collaboration the paper considers the co-authorship networks of countries and institutions. The sixth section investigates the bibliographic coupling of authors. The seventh one examines the co-occurrence analysis of author keywords in digital technology on entrepreneurship.

3.1 Trends in Yearly Publications

This study analyzed 558 documents from the Web of Science database. From 2015 to 2023, research on digital technology and entrepreneurship increased dramatically, with peak years in 2022 and 2023. This tendency demonstrates a growing appreciation of the value of digital tools in company innovation. The previous years (2015-2019) saw limited research, presenting a developing topic, however the current fall in 2024 shows stabilization or a shift in focus. Perhaps, the evidence demonstrates the growing importance of digital technology in entrepreneurship. The trends are predicted to continue expanding in 2024 (Figure 1).

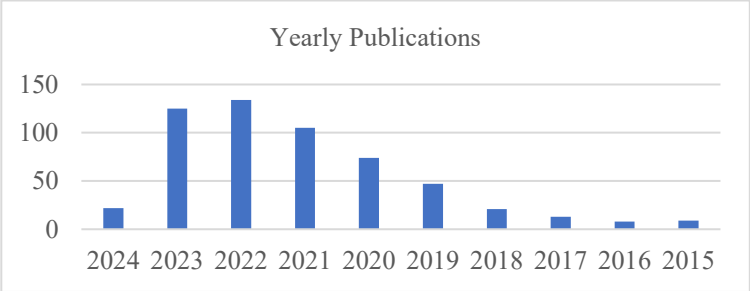

Figure 1 (Source: Web of Science)

Figure 1 shows trends in near publications in digital technology in entrepreneurship which I have taken from 2015 to 2024 remarkably the highest publications in the year 2022 followed by 2023 and 2021. This indicates a growing research interest in integrating digital technology within business enterprises.

3.2 Leading Countries

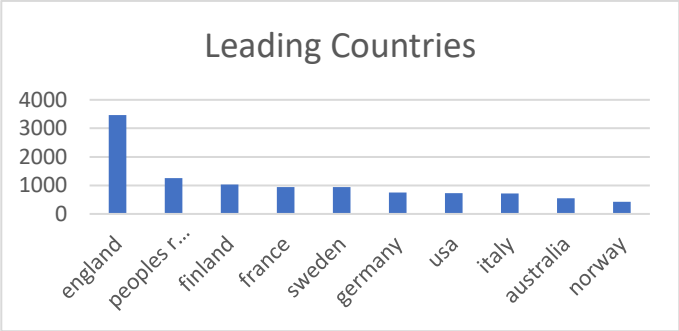

Figure 2 Source (Vos viewer)

Figure 2 shows the leading countries in the field, as identified using Vos Viewer software, with a minimum of five publications. The country which has published highest number of articles on digital entrepreneurship is England, with 3468 publications and also the highest number of citations. This is followed by significant contributions from other countries, like the People's Republic of China with 1260 publications and Finland with 1035, suggesting a strong interest in digital technology in entrepreneurship. In addition, France and Sweden have emerged as major participants with considerable citation impacts.

3.3 Influential Authors

Table 1. Top 10 Most Influential Authors on Digital Technology in Entrepreneurship Topic

Rank	Authors	TC	TP
1	Rayna, Thierry	431	1
2	Striukova, Ludmila	431	1
3	Li, Feng	325	2
4	Holmstrom, Jonny	312	1
5	Nylen, Daniel	312	1
6	Kowalkowski, Christian	272	2
7	Sklyar, Alexey	271	1

8	Sorhammar, David	271	1
9	Tronvoll, Bard	271	1
10	Henfridsson, Ola	268	3

Table 1 presents the influential authors in the field of digital technology in entrepreneurship, with a minimum of five articles considered. At the top is Rayna, Thierry, with a total of 431 citations from a single publication. Following closely is Striukova, Ludmila, who also has 431 citations from one publication. Other notable authors include Li, Feng, with 325 citations from two publications, and Holmstrom, Jonny, with 312 citations from a single publication. Nylen, Daniel has 312 citations from one publication, while Kowalkowski, Christian has 272 citations across two publications. Sklyar, Alexey, Sorhammar, David, and Tronvoll, Bard each have 271 citations from one publication and Henfridsson, Ola rounds out the list with 268 citations from three publications.

3.4 Impactful Journals:

Table 2. Top 12 Impactful Journals on Digital Technology in Entrepreneurship Topic

Sl .No.	Source	TCN	TPN	C/P	Cite score	SNIP	SJR	H	Q
1	Sustainability	961	70	13.73	5.8	1.198	0.664	169	Q1
2	Technological Forecasting and Social Change	703	11	63.91	17.2	3.008	2.644	179	Q1
3	Journal of Business Research	629	4	157.25	16.0	3.238	2.895	265	Q1
4	Business horizons	477	3	159	18.0	2.887	2.475	118	Q1
5	MIS Quarterly	289	3	96.333	18.7	4.612	3.793	271	Q1
6	10th Cirp Conference on Industrial Product-Service Systems, Ips2 2018	279	2		3.5	----	-	-----	----- -
6	Technovation	252	2	126	12.3	3.428	2.41	159	Q1

7	Journal of the Association for Information Systems	218	1	218	9.0	2.244	1.741	97	Q1
8	Journal of Information Technology	191	2	95.5	7.8	2.072	1.375	92	Q1
9	International Journal of Operations & Production Management	159	3	53	10.8	1.934	2.618	163	Q1
10	Technology Innovation Management Review	132	4	33	5.9	1.034	0.556	20	Q1
11	Journal of Business Ethics	129	2	64.5	12.0	2.976	2.59	253	Q1
12	Frontiers in Psychology	117	11	16.09	4.5	1.422	0.891	184	Q2

The most impactful journals were identified using VOSviewer software, focusing on publications from the past five years and selecting 12 highly significant journals. The Journal of Sustainability ranked as the most impactful, with 70 publications, 961 total citations, and a Q1 impact factor. It is followed by Technological Forecasting and Social Change, with 11 publications, 703 total citations, and a Q1 impact factor. The Journal of Business Research has 4 publications, 621 total citations, and a Q1 impact factor, while Business Horizons has 3 publications, 477 total citations, and a Q1 impact factor. MIS Quarterly also ranks highly, with 3 publications, 289 total citations, and a Q1 impact factor.

3.5 Country collaborations

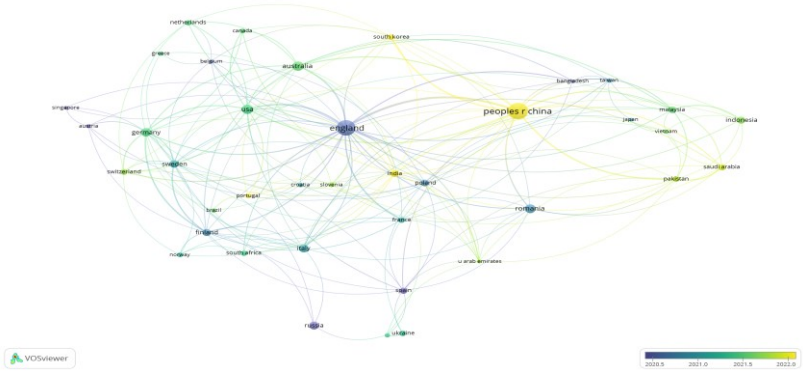

Figure 3: Source (viewer software)

Country collaboration was analyzed using VOSviewer software, focusing on a minimum of 10 countries. England emerged as the leading country with 3,468 total citations, 94 publications, and a total link strength of 90. It was followed by other countries, including China, with 1,260 total citations, 106 publications, and a link strength of 68. The USA had 723 citations, 35 publications, and a link strength of 41. Australia contributed with 550 citations, 34 publications, and a link strength of 34, while Germany had 751 citations, 29 publications, and a link strength of 34. Finland followed with 1,035 citations, 21 publications, and a link strength of 31. India recorded 255 citations, 17 publications, and a link strength of 26, closely followed by Pakistan with 138 citations, 14 publications, and a link strength of 26. Sweden had 940 citations, 23 publications, and a link strength of 26, while Malaysia recorded 161 citations, 17 publications, and a link strength of 25.

3.6 Bibliographic Coupling of Countries and Documents

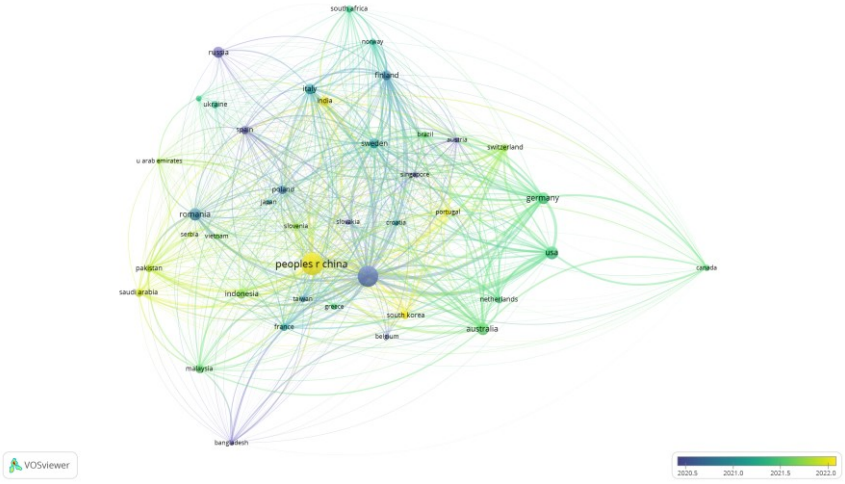

Figure 4 Source (Vos viewer)

Another approach to assess the strength of the connection between topics or, in this case, the works of authors is through bibliographic coupling, a concept first introduced by [16]. Bibliographic coupling refers to a method of analyzing the relationship between two or more research papers based on the number of shared references they cite. This method focuses on the primary documents—the citing papers—rather than the secondary, cited works. Figure 3 presents a visualization of the bibliographic coupling of countries and documents, generated using VOS viewer software. It is evident that China ranks highest in terms of bibliographic coupling, followed by Germany, the USA, India, Finland, Sweden, and Poland.

3.7 Co-Occurrence of Author Keywords

The distribution of the most popular keywords was examined in this analysis using co-occurrence data (keywords that occur within the same document). The aim is to highlight the most relevant research topics in the area of digital technology by concentrating exclusively on the author keywords appearing below the abstract. This technique counts the number of papers in which two keywords appear together (keywords highlighted by the authors in each paper); considering the 558 digital technology in entrepreneurship-related publications, VOS

viewer software revealed the existence of keywords. The main keywords are displayed in Figure 4, along with the size of the nodes. The larger the node and the keyword, the greater the weight (the number of papers a keyword appears in). Thicker lines indicate more frequent co-occurrence (the number of papers a keyword appears in together with another keyword). The stronger the relationship between the nodes (the number of papers these two keywords appear in together, and relatively comparing co-occurrence with other keywords) is indicated by the smaller distance between them. The same colour of the nodes and keywords indicates that they belong to the same cluster (group of related keywords).

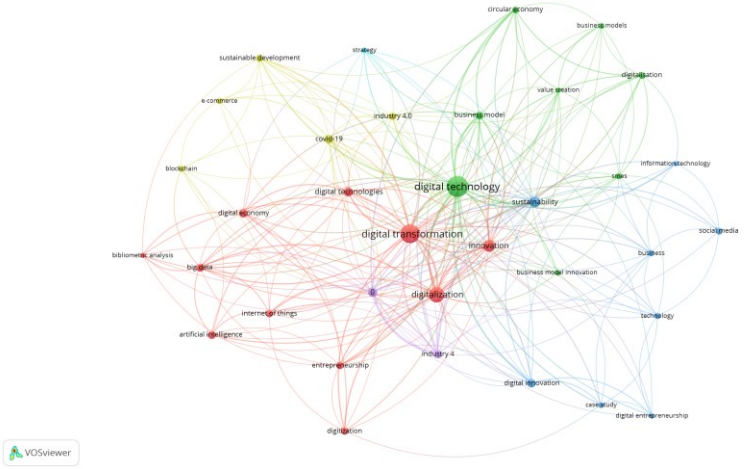

Figure 5: Source (Vos viewer)

Figure 5 shows a visualization of the co-occurrence of author keywords, generated using VOSviewer software, with a minimum threshold of 10 keywords. A higher co-occurrence indicates a stronger correlation between the keywords. Among the most frequently used keywords are "digital technology in entrepreneurship," "digital technology," "digital transformation," "digitalization," "entrepreneurship," "sustainability," "Industry 4.0," "digital innovation," "innovation," and "digital entrepreneurship." This method allows researchers to identify commonly used keyword combinations by authors [17]. The study aims to explore trends and patterns in the relationship between digital technology and entrepreneurship by analyzing these keyword co-occurrences.

3.8 Top 15 highly cited documents

The top five highly cited documents, abstracted using VOSviewer software with a minimum threshold of five citations, showcase key advancements in digital innovation and business model transformation. Leading the list is the article by Rayna, Thierry, and Striukova, Ludmila titled From Rapid Prototyping to Home Fabrication: How 3D Printing is Changing Business Model Innovation (published in Technological Forecasting and Social Change*),* which has garnered 431 citations. Following this is Nylen, Daniel, and Holmstrom, Jonny's work, Digital Innovation Strategy: A Framework for Diagnosing and Improving Digital Product and Service Innovation (published in Business Horizons), with 312 citations.

Third on the list is Sklyar, Alexey, Kowalkowski, Christian, Tronvoll, Bard, and Sorhammar, David's article, Organizing for Digital Servitization: A Service Ecosystem Perspective *(*published in Journal of Business Research*)*, which has 271 citations. Li, Feng's The Digital Transformation of Business Models in the Creative Industries: A Holistic Framework and Emerging Trends (published in Technovation) follows with 245 citations. Finally, Huang,

Jimmy, Henfridsson, Ola, Liu, Martin J., and Newell, Sue contribute the highly cited work Growing on Steroids: Rapidly Scaling the User Base of Digital Ventures Through Digital Innovation (published in MIS Quarterly), also with 245 citations. These articles collectively represent key contributions to the understanding of digital transformation and innovation strategies in modern business contexts.

4 DISCUSSION AND CONCLUSIONS

This study used bibliometric methodologies and the VOS viewer program to examine research on digital technology in entrepreneurship published in the Web of Science between 2015 and 2024. Key findings include a considerable increase in publications, with England, China, Finland, France, and Sweden leading the way. Influential writers and journals were found, indicating widespread worldwide collaboration. Major subjects such as digital transformation and innovation were discussed. Bibliographic coupling revealed strong intellectual connections, particularly between Europe and Asia. The study adds value by mapping the field's intellectual structure and identifying developing trends, providing significant insights for scholars, policymakers, and practitioners. Future studies should include assessments of more datasets and emerging technologies.

This study investigates the impact of digital technology in entrepreneurship, concentrating on how it influences technical revolutions and reshapes business environments. It suggests how digital developments have become essential for entrepreneurial success and innovation in modern Business environments. The article analyzed and defined the concept of digital technology and focused on previous analyses of the structure of digital entrepreneurship and innovation, concentrating on using bibliometric methods to map intellectual trends and identify key research clusters.

Moreover, the article investigated the prior bibliometrics about digitalization in general and digital technology in entrepreneurship. Due to an absence of studies in the literature and the importance of the bibliometric method, we created a bibliometric study and visualization of digital technology-related publications, with an emphasis on their relationship to entrepreneurship. The results suggest the following conclusions. The literature has consistently included debates, discourses, and criticism over the term "digital technology" [2,3]. This research dives into the complex process of digital technology adoption in entrepreneurship, highlighting the necessity for a multidisciplinary approach that considers economic, social, and environmental factors. It emphasizes the detailed nature and interdependence of various aspects in determining entrepreneurial success [18] and the relevance of focusing on technology-specific characteristics in digital platform conception [3]. Despite this, particularly in light of prior bibliometric studies, the findings indicate that research into digital technology issues is maturing, shifting away from definition and conceptual papers and toward more applied and empirical work [19].

The trends in digital technology in entrepreneurship indicate a considerable increase in publications, with 2022 producing the most, followed by 2023 and 2021. This is consistent with earlier studies that found an increased interest in digital innovation, particularly during and after the [17]. However, your emphasis on entrepreneurship is more distinct, demonstrating the increased integration of digital technologies in business initiatives when contrasted with broader research on digital transformation [20]. This explosion demonstrates the practical value of digital entrepreneurship in a post-pandemic economy.

The study identifies England as the leading contributor to digital entrepreneurship research, followed by China and Finland. This is consistent with previous research, such as [17,20], which emphasized England and China's leadership in digital innovation. Meanwhile, the study highlights considerable contributions from France and Sweden, which may have been overlooked in prior studies. The rising participation of various European countries

indicates a shift toward more regionally diverse research outputs, which is most likely driven by regional policies that encourage technology-led entrepreneurship.

Rayna, Thierry, and Striukova, Ludmila are the top-cited authors, each with 431 citations, which is consistent with recent research that has highlighted the influence of single high-citation publications [21]. Similar patterns of concentrated citations around notable authors such as Holmstrom, Jonny, and Nylen, Daniel correspond to findings from an earlier study by [22], who discovered an increase in niche leaders in digital transformation and entrepreneurship. A striking distinction is the prevalence of numerous authors with fewer publications but more citations, indicating a shift toward highly specialized research. This trend indicates that specific subfields of digital entrepreneurship, such as Industry 4.0 and digital innovation, are gaining prominence.

Results indicate The Journal of Sustainability as the most influential, which is consistent with prior research by [23], who also emphasized its importance in interdisciplinary domains such as sustainability and entrepreneurship. Similarly, technical Forecasting and Social Change rates are high in your analysis, which is consistent with prior findings [22] that emphasize the importance of technical advances and digital entrepreneurship. However, the prevalence of Business Horizons and MIS Quarterly in your results represents a departure from conventional entrepreneurial publications such as the Journal of Small Business Management, which are more focused on digital transformation and business strategy. This reflects the expanding character of entrepreneurship research, which is increasingly merging technology and innovation.

The study of country collaboration, with England dominating in citations and publications, is consistent with previous research, such as [22], which showed the UK's prominent involvement in digital entrepreneurship. Similarly, China's considerable contribution is consistent with the findings of [21], demonstrating its expanding importance in digital technology research. However, the comparatively low citation strength for the United States in the study contrasts with previous publications such as [24], in which the United States was frequently a top performer. The emergence of nations with significant connection strengths, such as Finland and Germany, indicates greater investment in digital innovation across Europe, as underlined by [25]. These variances could be due to changes in regional policies or movements in global research priorities.

The bibliographic coupling of authors implies the existence of two core groups of authors. The bibliographic coupling study, which shows China as the leading country, followed by Germany, the United States, India, and Finland, is consistent with previous studies by [21], which identified China and Germany as important contributors to digital innovation. subsequently, the rise of countries such as India and Poland is a recent development, most likely due to increased research into digital entrepreneurship in these regions. [23]did not emphasize these countries as much, indicating a shift in global research dynamics toward more diversified international collaboration, fueled by government backing for digital transformation initiatives.

The study of co-occurring keywords such as "digital technology," "digital transformation," and "sustainability" is consistent with previous research. For instance, [17] highlighted these aspects as important in innovation and entrepreneurship research. [22] highlighted the relevance of "Industry 4.0" and "digital innovation," which is consistent with those results. whereas one noticeable distinction is the greater significance of "digital entrepreneurship" in this study, which reflects a post-pandemic move toward digital business models, as highlighted by [23]. This trend indicates an increased emphasis on the convergence of technology and entrepreneurship.

The analysis of the top-cited publications, lead by Rayna and Striukova's work on 3D printing and business model innovation, is consistent with prior findings, such as Giones and Brem (2017), which underline the importance of new technologies in business transformation.

Similarly, Nylen and Holmstrom's essay on digital innovation strategy reflects the increased emphasis on digital products and services, as noted by [21]. Sklyar et al.'s focus on digital servitization contrasts with prior, more product-oriented studies by taking a more service-centric approach. Huang et al. emphasize the need of rapid digital venture scaling, which is a recent issue that has gained popularity with the post-pandemic shift to digital platforms [17].

The emphasis on digital instruments such as platforms, social media, and the Internet, combined with dynamic capabilities, encourages the use of novel business models to improve corporate performance. In addition, the study investigates the rise of a digital entrepreneurial ecosystem powered by smart cities, big data, and artificial intelligence, as well as its critical role in nurturing start-ups in the context of the digital divide [26].

5 FUTURE SCOPE AND LIMITATION

Future studies may expand bibliometric analysis to include more databases such as Scopus to provide a more complete picture. Exploring the impact of emerging technologies such as blockchain and AI on entrepreneurship is significant. Regional analysis can provide insight into specific global trends and concerns. longitudinal research studies are required to better understand the long-term effects of digital technologies on business operations. Encouraging interdisciplinary research can result in novel solutions. This study's limitations include database constraints, an emphasis on English-language and open-access materials, and the field's dynamic character, which necessitates periodic updates to ensure relevance. Using qualitative methodologies in addition to bibliometric analysis can provide more in-depth insights.

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