Journal of Advanced Research in Applied Sciences and Engineering Technology

Journal homepage:
https://semarakilmu.com.my/journals/index.php/applied_sciences_eng_tech/index
ISSN: 2462-1943

Exploring the Role of Open Innovation in Enhancing Organizational and Entrepreneurial Outcomes: A Bibliometric Study

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ARTICLE INFO

Keywords:
Open innovation; organizational performance; bibliometric analysis; scientometrics; policy implications; strategic innovation

ABSTRACT

This bibliometric study analyzes the impact of open innovation on organizational and entrepreneurial performance from 2012 to 2023, drawing on 44 Scopus-indexed documents. Employing VOSviewer and R's Bibliometrix software, we go beyond traditional publication counts to provide a detailed examination of research trends and patterns. The integration of Bradford's Law and Lotka's Law enhances our understanding of publication dynamics and author productivity within the field. Our findings indicate a substantial annual publication growth of 22.11%, reflecting increasing global interest in open innovation's role in improving business competitiveness. Contributions from diverse geographies, including China, Iran, Italy, and Jordan, highlight the widespread application of open innovation across different cultural and economic contexts. The study identifies key themes such as 'organizational performance' and 'collaboration networks,' demonstrating how open innovation can significantly enhance organisational outcomes. This research advances scientometric methods and provides policy recommendations to support innovative ecosystems, enhancing organizational growth and adaptability. It offers insights for future research into the causal impacts of open innovation and suggests policy measures to bolster organizational innovation capabilities.

1. Introduction

Open innovation has emerged as a critical concept in research, particularly regarding how organisations manage and implement innovative practices. It has been extensively studied across various fields, such as engineering, science, and business [1-3]. However, much of the existing research has focused on large corporations, creating a gap in understanding its impact on smaller businesses and diverse service sectors [4-6]. Open innovation is increasingly recognised as essential for enhancing organisational performance, especially in a world marked by rapid technological advancements, shifting market conditions, and globalisation [7,8].

The central debate around open innovation concerns its potential to drive organisational competitiveness and adaptability. Companies face numerous challenges, including economic

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https://doi.org/10.37934/araset.64.2.199218

fluctuations and swift technological changes, necessitating innovative strategies to remain competitive and foster growth [9]. Digital technology and the internet present both opportunities and challenges for companies aiming to achieve high performance [10,11]. Innovation, driven by factors such as customer needs, new technologies, policy changes, and environmental conditions, can lead to new products, improved processes, and innovative management methods [12]. However, the direct link between open innovation and enhanced organisational performance, particularly in entrepreneurial ventures, has not been fully elucidated [13-15].

Despite a growing body of research on open innovation, several critical gaps persist. First, a comprehensive and systematic analysis is needed to quantify how open innovation influences performance across different metrics. Previous studies have highlighted its significance but often lack detailed examination of its impact across diverse organisational types and industries [16-17]. The research on open innovation remains fragmented, complicating the understanding of its full potential and identifying understudied areas within various sectors [18]. More context-specific research is required to explore how open innovation's application varies across different organisations and sectors [19,20]. Finally, the gap between theoretical models and their real-world implementation needs deeper investigation to understand how open innovation strategies translate into tangible performance improvements [21-23].

This study aims to address these gaps by employing advanced methods for analysing and mapping scientific research. Using tools such as VOSviewer and R's Bibliometrix software, this bibliometric study analyses the impact of open innovation on organisational and entrepreneurial performance from 2012 to 2023, based on 44 Scopus-indexed documents. By integrating Bradford’s Law and Lotka’s Law, the study enhances understanding of publication dynamics and author productivity within the field [24].

Research Questions:

i) How does open innovation influence organisational performance across different metrics?
ii) What are the key themes and trends in open innovation research from 2012 to 2023?
iii) How does the application of open innovation vary across different organisational types and sectors?
iv) What policy measures can support the implementation of open innovation strategies in various business contexts?

The study utilises bibliometric analysis to systematically review the existing literature, identifying research trends and patterns. It analyses publication growth, geographical contributions, and key themes such as 'organisational performance' and 'collaboration networks'. The findings provide insights into the practical applications of open innovation in enhancing organisational outcomes and suggest policy recommendations to support innovative ecosystems [25,26]. This approach bridges the gap between theory and practice, offering actionable insights for businesses to unlock the full potential of open innovation.

2. Methodology

2.1 Methodological Approach

This study employs a bibliometric analysis to systematically review the literature on the relationship between open innovation and organisational or entrepreneurial performance. Bibliometric analysis provides an objective, systematic, and reproducible method to understand the evolution, trends, and patterns within a specific field of study [11,27]. It is particularly suited for dynamic fields like open innovation due to its ability to analyse large datasets comprehensively. This

method tracks publication patterns and authorship over time, offering a detailed examination of thematic developments crucial for understanding open innovation in organisational contexts [28,29].

To enhance the analysis, Bradford's Law will be used to identify core journals contributing significantly to open innovation research, while Lotka's Law will assess the scientific productivity of authors in the field [30,31]. These statistical laws provide a nuanced understanding of publication patterns and authorship contributions. The bibliometric study aims to answer the following research questions:

i) How has the concept of open innovation evolved in academic literature over time?
ii) What are the key themes and trends in research on open innovation's impact on organisational and entrepreneurial performance?

2.2 Data Collection and Analysis

Primary data for this study will be collected from the Scopus database, recognised for its comprehensive and reliable indexing of prestigious journals across various disciplines [32]. This study focuses on Scopus-indexed documents due to Scopus's comprehensive coverage of peer-reviewed journals and its robust tools for bibliometric analysis. However, it is acknowledged that valuable insights from other databases, such as Web of Science and Google Scholar, might not be captured. Future research could expand the dataset by incorporating additional databases to provide a broader perspective on open innovation research.

The search strategy includes the following search string: *TITLE-ABS-KEY("Open Innovation") AND TITLE-ABS-KEY("Organizational performanc") OR TITLE-ABS-KEY("Entrepreneurial performanc*")**. Non-relevant document types, such as editorials, book chapters, corrections, and errata, are excluded from the search. The collected data will then be exported in CSV format for further analysis. The data will be processed using VOSviewer (Version 1.6.19) and the Bibliometrix R package (Version 4.1.0). Bibliometrix provides robust tools for bibliometric analysis, including co-citation networks, content analysis, and mapping research collaborations [33,34]. VOSviewer will be used for network analysis, visualising co-authorships, citations, and thematic clusters within the collected literature. These tools allow for a detailed and visually engaging representation of key trends and patterns in the literature.

2.3 Methodological Process Stages

The bibliometric analysis will be conducted in three stages:

i) Data Extraction and Initial Analysis: Data will be extracted from the Scopus database, focusing on key metrics such as document types, citation counts, publication years, authorship details, research areas, and source titles. This initial analysis provides a comprehensive overview of the field, highlighting significant trends and patterns for further exploration [35].
ii) Network and Thematic Analysis: Building on the initial data, this stage involves advanced network and thematic analyses using VOSviewer and Bibliometrix. It explores relationships between authors, institutions, and countries, as well as identifying influential documents and thematic clusters. This stage directly addresses research questions regarding the evolution and key trends in open innovation [36].
iii) Advanced Bibliometric Techniques: Techniques such as co-occurrence, co-citation, and bibliographic coupling will map the intellectual structure of the open innovation field. These methods provide insights into the connections between concepts, the influence of seminal

works, and the emergence of new research themes. This comprehensive analysis answers research questions about thematic evolution and the impact of open innovation on organisational and entrepreneurial performance, while pointing to future directions in the field [37,38].

Advanced bibliometric tools like VOSviewer and Bibliometrix enhance the understanding of open innovation's evolution by enabling in-depth analyses such as co-occurrence data examination, keyword analysis, and visualisation of research landscapes. These tools facilitate a nuanced understanding of significant themes, influential authors, and emerging research directions [39-42]. The findings provide a detailed picture of the open innovation research landscape and support future research endeavours [43-46].

3. Results

This section outlines the results of a comprehensive bibliometric analysis conducted on the Scopus database as of January 3rd, 2024. The analysis spans over a decade (2012–2023), focusing on the intersection of open innovation and its broader implications. A total of 44 documents from 34 distinct sources were analysed, providing detailed insights into the academic discourse surrounding open innovation.

The findings highlight an impressive average annual growth rate of 22.11% in publications, demonstrating a rising scholarly interest in the field. Each document has been cited an average of 19.07 times, indicating the significant impact and relevance of these studies within the academic community. The relatively young average document age of 3.48 years further underscores the modern and rapidly evolving nature of this research area. Key bibliometric metrics are summarised in Table 1 below.

Table 1
Overview of articles collected

Metric	Value
Timespan	2012–2023
Total sources (Journals, Books, etc)	34
Total documents analyzed	44
Average document age	3.48 years
Average Citations per Document	19.07
Total references	3385
Document types	
- Articles	44
Keywords analysis	
- Author's keywords (DE)	172
Authors' contribution	
- Total authors	133
- Authors of single-authored documents	3
- International co-authorship rate	40.91%
- Average co-authors per document	3.14

Source: Authors' elaboration

The analysis also reveals significant collaboration patterns. Approximately 40.91% of documents involve international co-authorship, reflecting the global nature of open innovation research. Furthermore, the average of 3.14 co-authors per document highlights the collaborative approach within this field. The inclusion of 172 author keywords points to the diversity of themes explored in these studies, showcasing the multifaceted nature of open innovation research.

3.1 Annual Scientific Production

From 2012 to 2023, research on open innovation and its impact on organisations has grown significantly, starting with just one article in 2012 and rising to 11 in 2022. A notable spike occurred between 2020 and 2023, with 31 articles published, including 26 in the last three years, reflecting intensified academic interest. Early research primarily focused on foundational concepts of open innovation, but recent studies, particularly in 2022, have shifted toward its practical applications and impacts on organisational performance. This trend indicates a move from theoretical exploration to application-oriented studies, highlighting the growing relevance of open innovation in addressing real-world challenges.

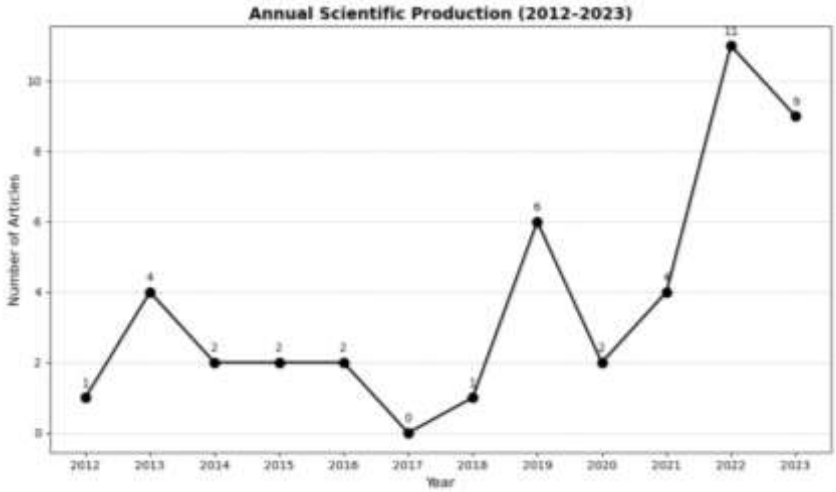

Fig. 1. Annual scientific production (2012-2023)

The spike in publications in 2020-2023 may be attributed to the global COVID-19 pandemic, which necessitated rapid innovation and collaboration to address new challenges. Similarly, earlier spikes in 2013 align with foundational works that established open innovation as a key framework in organisational strategy. The keyword analysis highlights 'open innovation' as the most common term, appearing 30 times, followed by 'organizational performance' with 16 occurrences. These frequencies underscore their prominence as focal topics and their increasing relevance in research discussions. Additionally, the emergence of keywords such as 'entrepreneurial orientation' and 'knowledge management' indicates an interdisciplinary approach to studying open innovation. Other frequently used terms, including 'innovation,' 'SMEs,' and 'knowledge management,' further reflect the diverse range of topics explored in this field (Figure 2).

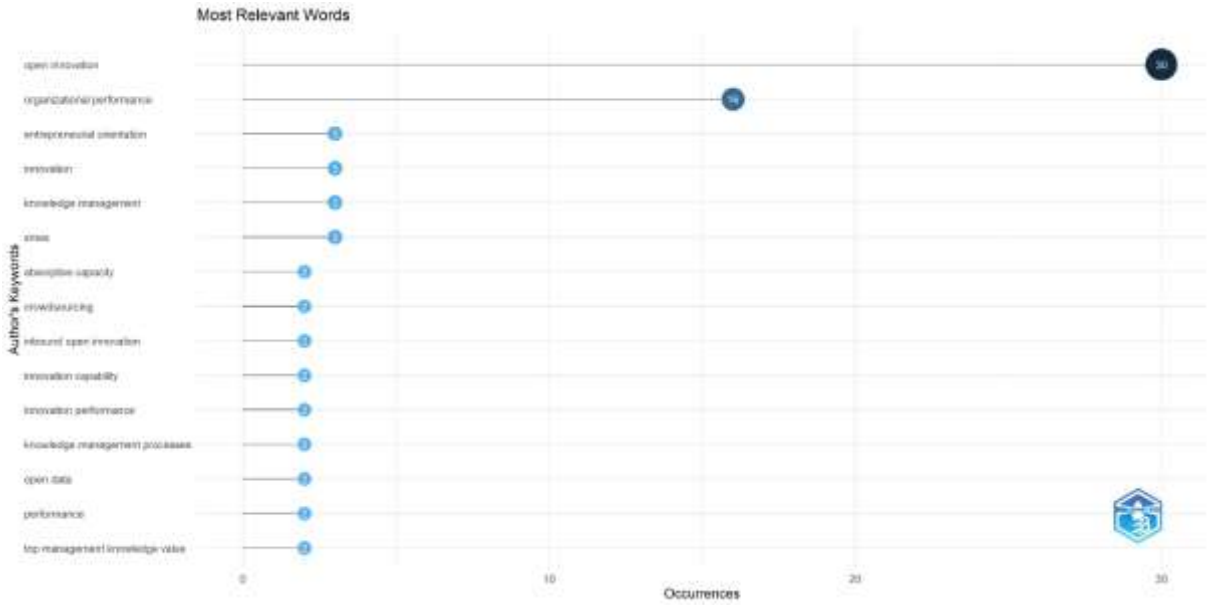

Fig. 2. Most relevant keywords

The trend analysis over the years, from 2013 to 2022, shows a shift in research themes. Initially, the focus was primarily on the basic concepts of open innovation. More recently, in 2022, there has been a shift towards exploring how open innovation affects organizational performance, indicating a new direction in research focus (Figure 3).

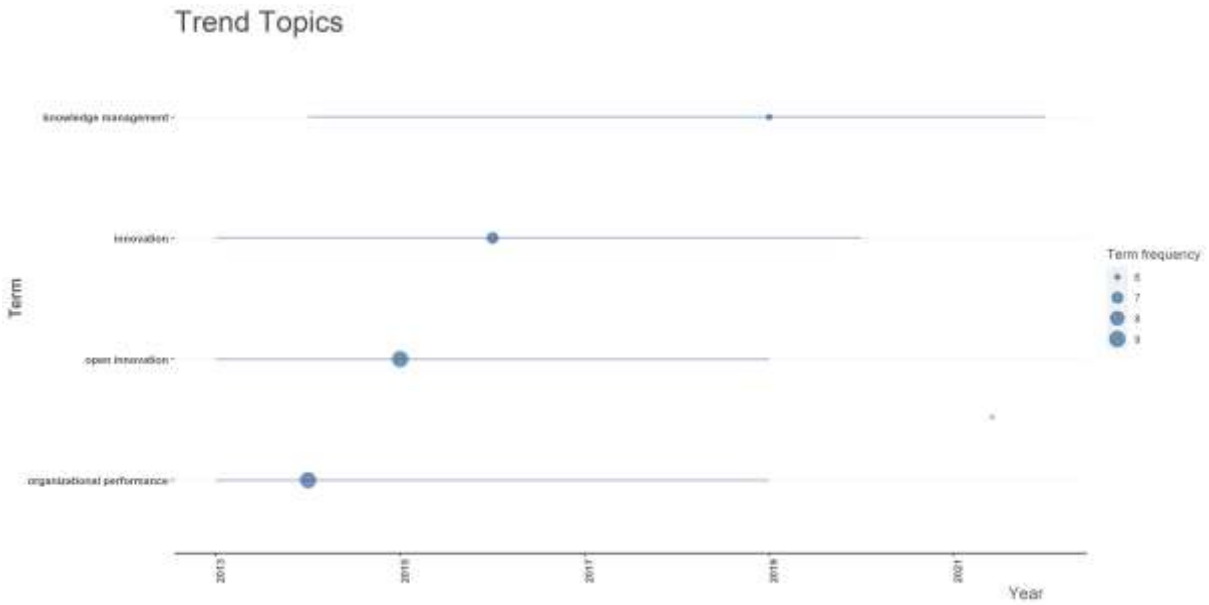

Fig. 3. Trend topics in terms used in 2013 - 2022

Figure 4 presents a thematic map, using Callon's analysis to show the importance and connection of different themes. 'Open innovation' stands out as a major theme, showing it is a central topic in current research. Other themes such as 'business', 'performance assessment', 'industrial performance', and 'organization' are also significant, each holding an important place in the study of open innovation and its effect on organizations. The thematic maps and keyword trends indicate a strategic shift in research focus from basic concepts of open innovation to more nuanced themes like business performance, industrial applications, and organizational impacts.

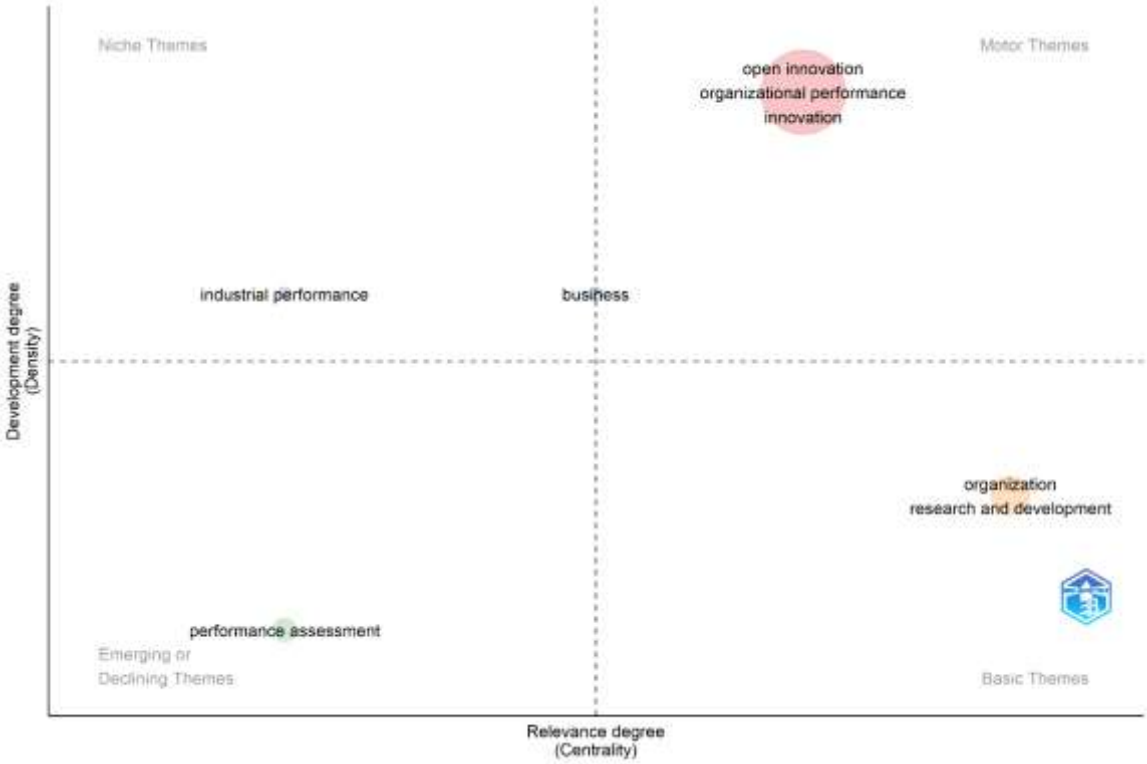

Fig. 4. Thematic map of the most relevant words

3.2 Journals with the Most Published and Cited Articles

The Journal of Open Innovation: Technology, Market, and Complexity leads in publication volume with five articles, followed by Sustainability (Switzerland) with four articles. Other notable contributors include European Sport Management Quarterly and Lecture Notes in Business Information Processing, each publishing two articles. These journals reflect the expanding discourse on open innovation and its application across diverse organisational contexts, including areas such as sports management and sustainable development.

In terms of citations, the Journal of Business Research dominates with 254 citations, underscoring its significant influence in the field. One of the highly cited articles from this journal is Singh *et al.* [3], which explores the role of top management knowledge sharing in driving open innovation and its impact on organisational performance. Its citation count is likely due to its relevance to both organisational theory and practical management, appealing to a wide range of scholars and practitioners. Similarly, Information and Management, with 145 citations, features influential studies like Cui *et al.* [41], which aligns open innovation strategies with IT systems, providing a strategic framework for technological innovation. These papers are widely cited because they address pressing and interdisciplinary challenges, such as digital transformation and strategic innovation, which are critical to the evolving business environment.

European Sport Management Quarterly, with 90 citations, showcases the application of open innovation in niche areas such as sports organisations, as seen in Wemmer *et al.* [37]. This paper gained traction due to its novel exploration of coopetition (collaborative competition) in non-profit sports organisations, offering insights into managing innovation in resource-constrained settings. These highly cited papers are recognised for advancing key theoretical frameworks, addressing real-world challenges, and appealing to both academia and industry.

The h-index analysis further underscores the impact of journals like the Journal of Open Innovation: Technology, Market, and Complexity, which demonstrates both high productivity and scientific relevance. Collectively, these findings highlight the pivotal role of journals like Journal of Open Innovation and Sustainability (Switzerland) in shaping the research landscape for open innovation. Their articles continue to drive discussions and inspire future research across a variety of sectors (Figure 5, 6, 7).

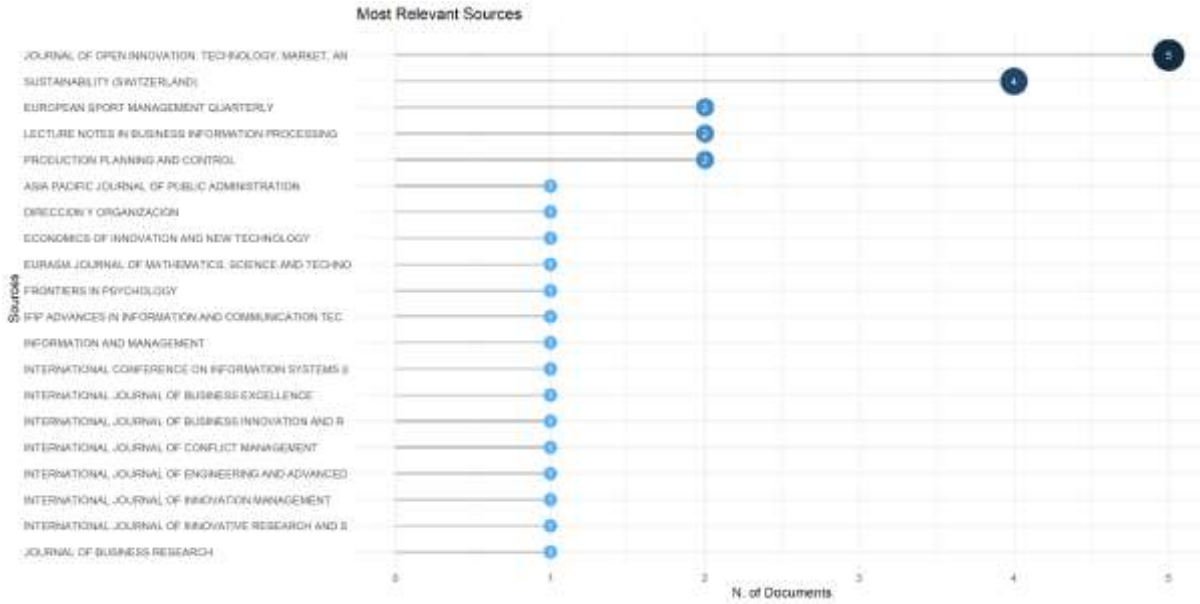

Fig. 5. Journals with the most relevant sources

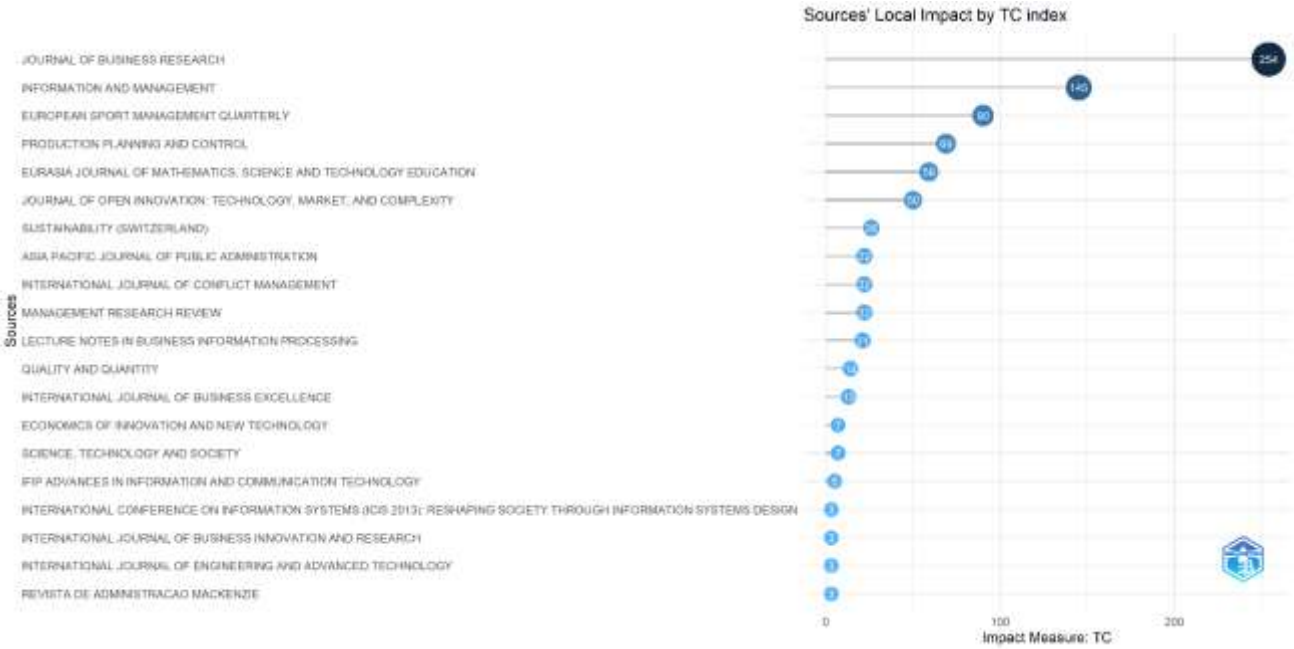

Fig. 6. Most local cited sources

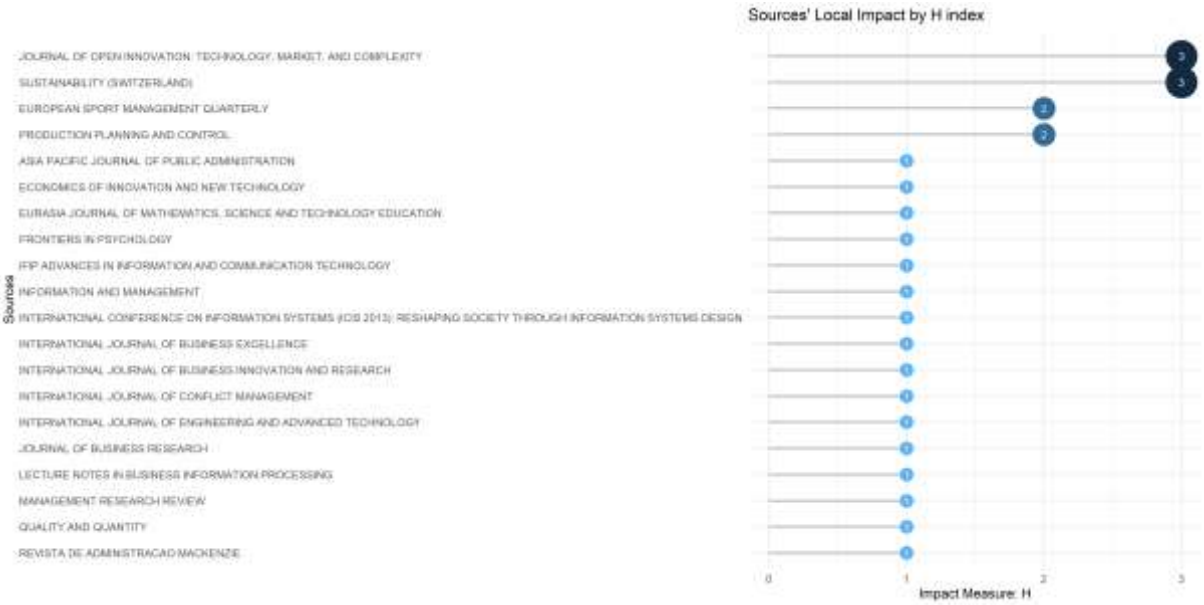

Fig. 7. Source local impact by H index

3.3 Countries with the Highest Scientific Production

China leads scientific contributions to open innovation research with five articles followed by significant input from Iran, Italy, and Jordan. This diversity of contributions enriches the global perspective on open innovation. In terms of citations, the United Arab Emirates (UAE) and Australia stand out for their high average citation rates, reflecting the significant international impact and influence of their research (Figure 8, 9). The global distribution of contributions, led by China and complemented by Iran, Italy, and Jordan, highlights the international and interdisciplinary nature of open innovation research, while the high citation averages for the UAE and Australia underscore their research's recognition and global reach.

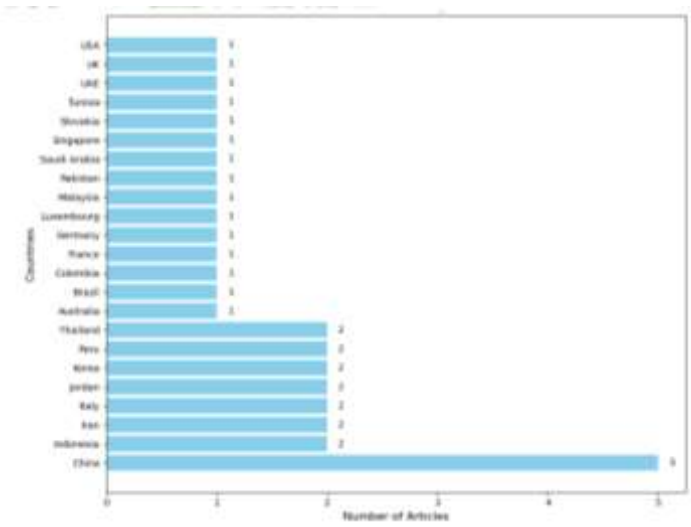

Fig. 8. Scientific production by countries

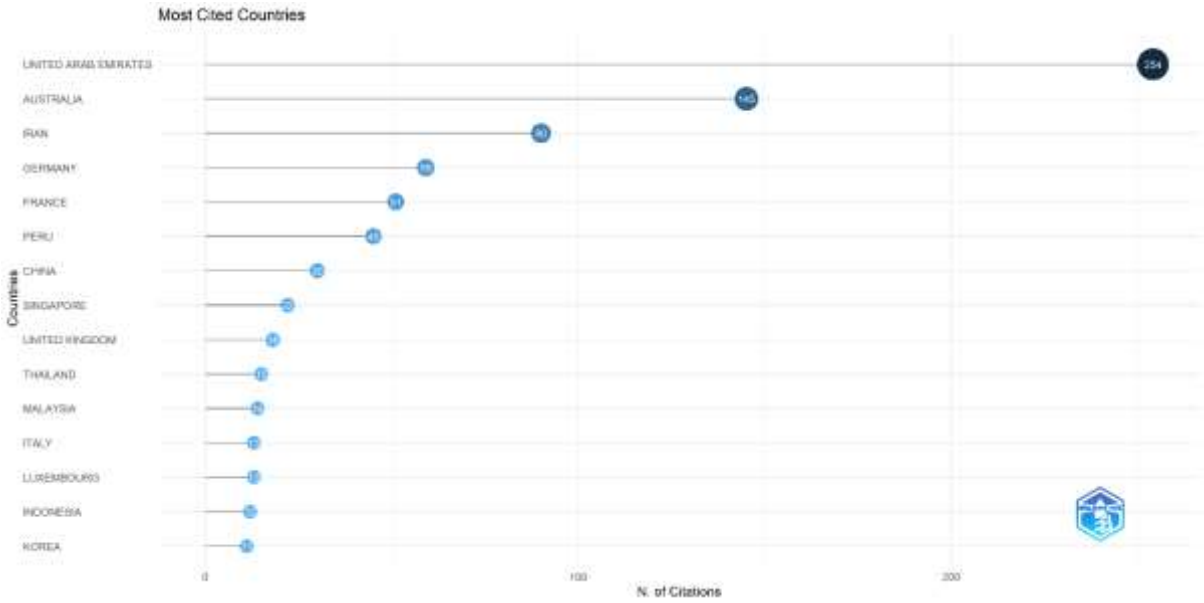

Fig. 9. Most cited countries

3.4 Most Relevant Authors and Documents

The analysis of keywords within the articles reveals 'open innovation', 'organizational performance', and 'entrepreneurial orientation' as the most frequently occurring themes. These keywords highlight the central focus areas and evolving themes in the literature. The trend topics analysis indicates a growing interest in 'organizational performance' and 'open innovation' in recent years. Furthermore, the thematic map offers a visual representation of these topics, showcasing their centrality and density within the research landscape and providing insights into the core and peripheral themes in the field (Figure 10, 11, Table 2, and table 3).

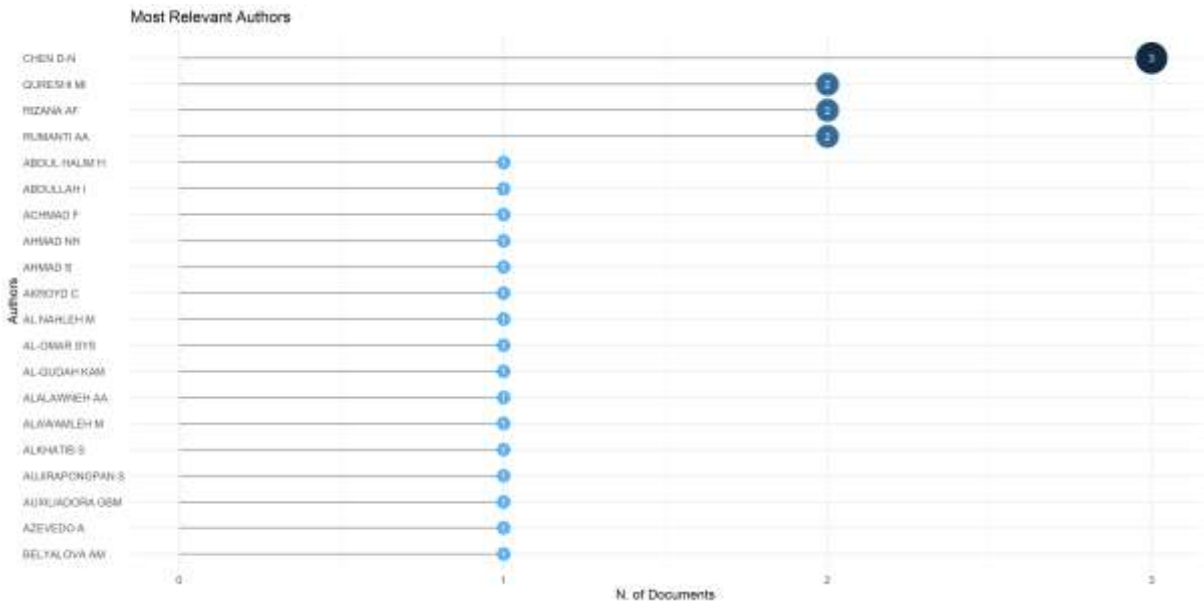

Fig. 10. Most relevant authors

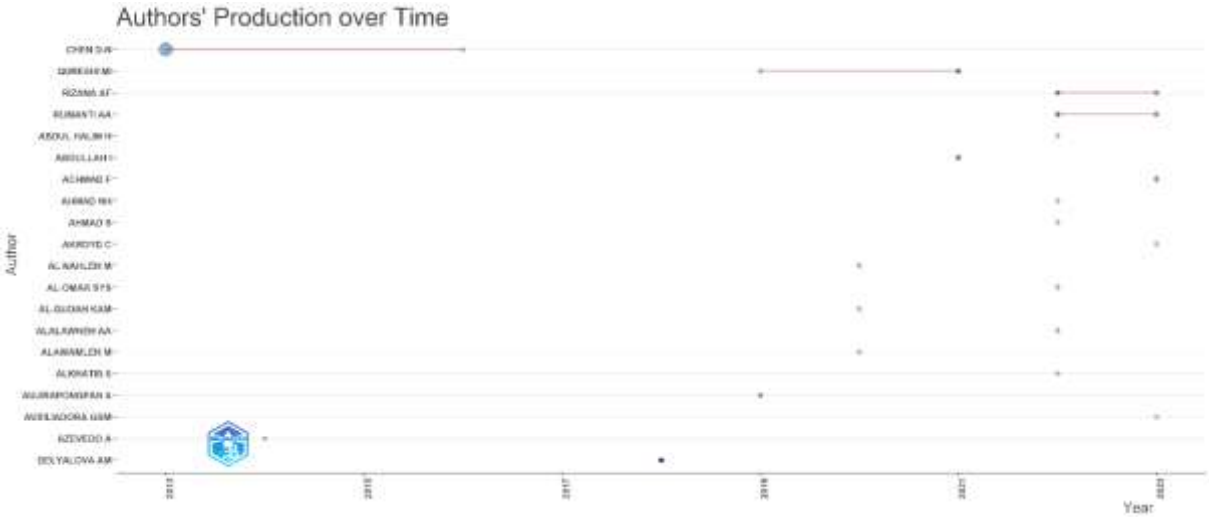

Fig. 11. Top authors' scientific production over time

Table 2
Top-ten most cited documents

Paper	DOI	Total citations	TC per year	Normalized TC
SINGH SK, 2021, J BUS RES	10.1016/j.jbusres.2019.04.040	254	84.67	3.25
CUI T, 2015, INF MANAGE	10.1016/j.im.2014.12.005	145	16.11	1.84
DAVOUDI SMM, 2018, EURASIA J MATH SCI TECHNOL EDUC	10.29333/ejmste/83651	59	9.83	1.00
WEMMER F, 2016, EUR SPORT MANAGE Q	10.1080/16184742.2016.1164735	59	7.38	2.00
JASIMUDDIN SM, 2019, PROD PLANN CONTROL	10.1080/09537287.2019.1582097	51	10.20	2.91
DELSHAB V, 2022, EUR SPORT MANAGE Q	10.1080/16184742.2020.1768572	31	15.50	5.41
SEKLI GFM, 2021, J OPEN INNOV: TECHNOL MARK COMPLEX	10.3390/joitmc7040221	23	7.67	0.29
SCOTT G, 2013, MANAGE RES REV	10.1108/MRR-10-2011-0224	22	2.00	1.91
HAMEDUDDIN T, 2020, ASIA PACIFIC J PUBLIC ADM	10.1080/23276665.2020.1754867	22	5.50	1.76
WANG T, 2021, INT J CONFL MANAGE	10.1108/IJCMA-09-2019-0165	22	7.33	0.28

Certain papers, such as Singh SK's 2021 article in the Journal of Business Research, received disproportionately high citations (254 citations) compared to others within a short span, which could point to seminal work or a highly impactful study in this domain. The average citations per document (19.07) underscore the significant impact and relevance of these publications in the scholarly

community. A relatively young average document age (3.48 years) with this high citation rate suggests that findings are quickly recognized and integrated into ongoing research.

Table 3
Top-ten affiliations

Affiliation	Articles
Telkom University	6
American University Of Madaba	4
University Of Salerno	4
National University Of Singapore	3
Tongji University	3
Universiti Sains Malaysia	3
University Of Kurdistan	3
Yarmouk University	3
International Islamic University	2
Jiangsu University Of Science And Technology	2

The Sankey Diagram (Fig. 12) visually delineates the relationships within open innovation research, highlighting 'open innovation' and 'organizational performance' as the predominant themes connected together with a multitude of authors and studies. The diagram underscores the prominence of these themes by showcasing their extensive connections across the field. Key contributors such as Chen D-N are central to the network, with significant ties to highly cited works and journals, including the 'Journal of Open Innovation: Technology, Market, and Complexity'[36]. This diagram effectively encapsulates the collaborative network and thematic priorities that define modern open innovation research.

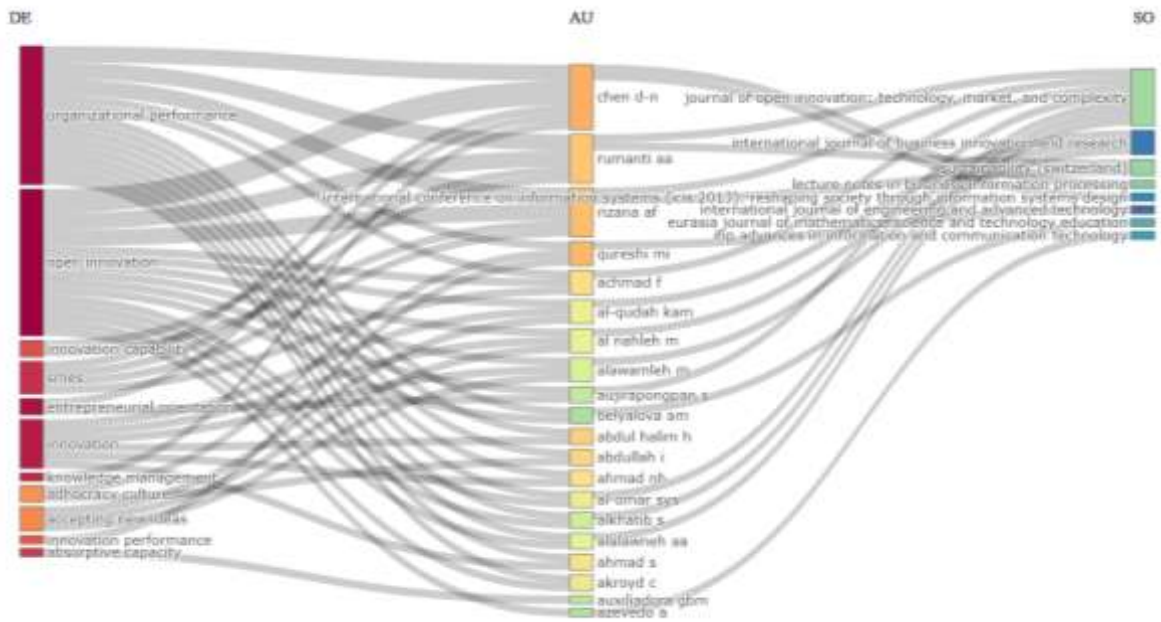

Fig. 12. Sankey's diagram: relation between authors, words, and documents

3.4 Network Analysis
3.4.1 Collaboration Networks

Collaboration networks are crucial in fostering robust scientific knowledge production. Our study reveals a complex network of collaborations between authors and countries, highlighting the global

nature of research in this field. Figure 13 illustrates these collaborations, with blue representing articles published within a single country and pink indicating international collaborations. This analysis shows that 10 articles involve multiple countries, suggesting a significant level of international cooperation in this research area.

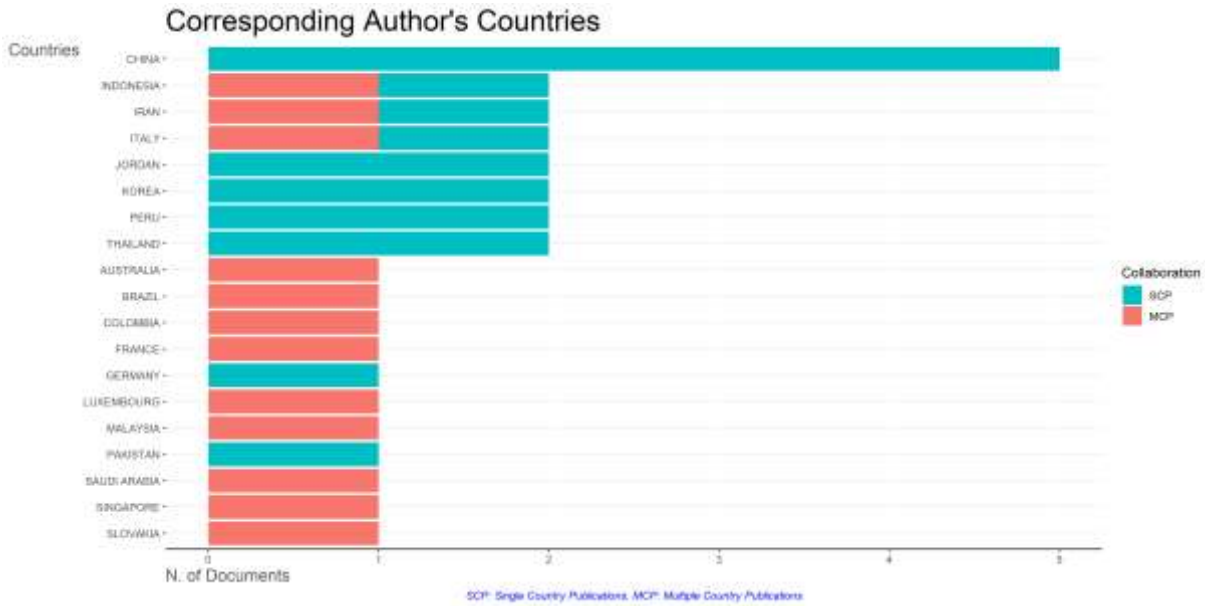

Fig. 13. Corresponding author's country

3.4.2 Author Networks

Figure 14 presents a network map of authors involved in the research. The size of each circle represents the number of articles by each author, with larger circles indicating higher publication counts. This visual representation helps identify key researchers in the field and the extent of their collaborations. For instance, authors like Rizana AF and Rumanti AA appear importantly, indicating their active involvement in multiple studies [23,36].

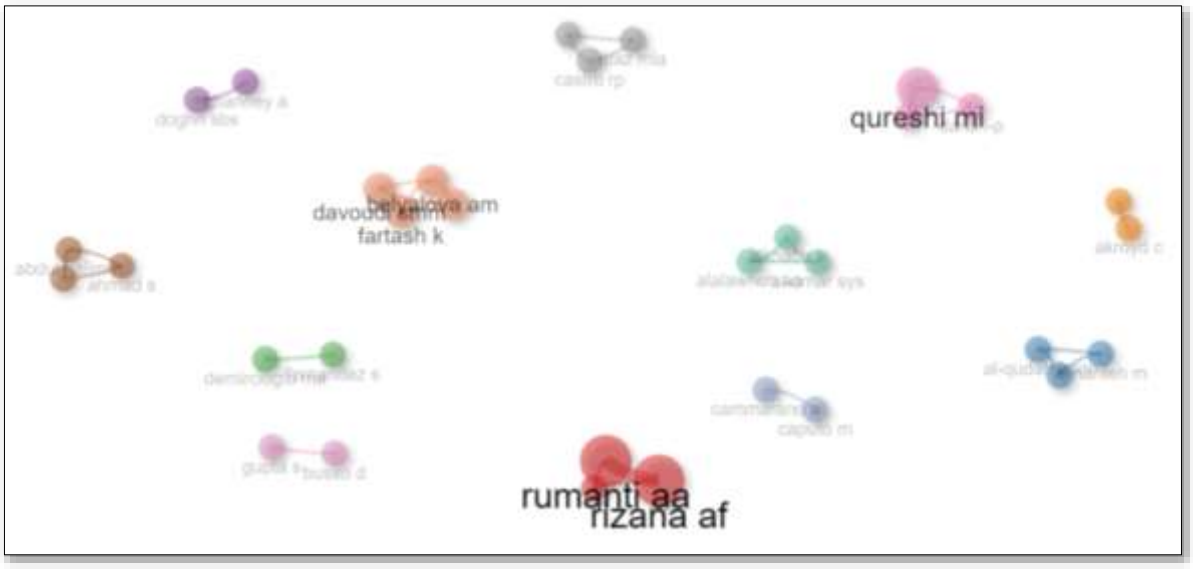

Fig. 14. Network of authors

3.4.3 Co-citation Analysis

The document map based on bibliographic coupling, presented in Figure 15, offers valuable insights into the relationships between various publications through their co-citation patterns. This map highlights clusters of documents that are frequently cited together, with a minimum of five citations required to identify an area of strong research focus. The analysis reveals five distinct clusters, each represented by a unique colour, reflecting different thematic areas within the field of open innovation. The size of each circle corresponds to the frequency of co-citations, providing an indication of the influence and relevance of each document within the broader research landscape. These clusters not only illustrate the intellectual structure of the field but also help identify seminal works and emerging research themes that shape ongoing discourse.

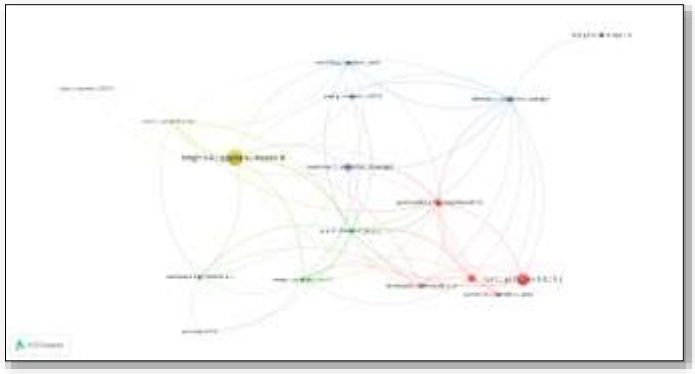

Fig. 15. Document map based on bibliographic coupling

This bibliometric study, investigating the intersection of open innovation with organisational and entrepreneurial performance from 2012 to 2023, presents significant findings. The rising trajectory of scholarly work, illustrated by an average annual growth of 22.11% in publications and an average citation count of 19.07 per document, signifies the growing impact and modern relevance of this research area. The most prolific journals, leading with publications and citations, are the *Journal of Open Innovation: Technology, Market, and Complexity* and *Sustainability (Switzerland)*, respectively, with the former boasting the highest h-index, indicative of its influential contribution to the field. The spikes in research outputs in certain years can be correlated with significant global or regional economic events, such as the 2008 financial crisis' long-term effects on innovation strategies or the COVID-19 pandemic's influence during 2020–2023.

The exploration of keywords reveals 'open innovation' and 'organisational performance' as pivotal themes, reflecting the central discourse within the academic community. The prominence of themes like 'entrepreneurial orientation' and 'knowledge management' reflects the growing recognition of open innovation as a strategy for fostering entrepreneurship and organisational learning. Entrepreneurial orientation aligns with open innovation by encouraging risk-taking, proactiveness, and innovation in uncertain environments. Similarly, knowledge management has become integral as organisations increasingly leverage both internal and external knowledge to enhance competitive advantage. This trend is amplified by the digital transformation era, where knowledge flow and entrepreneurial agility are pivotal for innovation.

The shift in focus towards these themes over the last decade, particularly the increase in publications in 2022, underlines a keen research interest in the practical implications of open innovation for organisational growth. This trend is further validated by the thematic map analysis, which places 'open innovation' in a dominant position, surrounded by related business and

performance themes. The predominant appearance of keywords such as 'open innovation' and 'organisational performance' over others like 'entrepreneurial orientation' and 'knowledge management' indicates shifting focus areas within the research community. This shift suggests a deeper exploration into the systemic impacts of open innovation on organisational structures and outcomes.

In the global research landscape, China leads in publication volume, followed by contributions from Iran, Italy, and Jordan, showcasing a rich diversity of international input. Citation metrics place the United Arab Emirates and Australia at the forefront, highlighting the broad impact of their research outputs. The significant contributions from China and Italy, contrasted with emerging inputs from Iran and Jordan, suggest varying regional focuses and methodologies in open innovation research. Such geographical variability could be influenced by local economic conditions, policy environments, and academic collaborations. This underscores a vital and collaborative international research community actively contributing to the evolving narrative of open innovation in organisational contexts [3,4]. Changes in international trade policies, intellectual property law reforms, and increased governmental support for innovation ecosystems may also play crucial roles in shaping the research landscape of open innovation [36,38]. These correlations suggest that open innovation is not only a response to but also a strategic tool for navigating global market uncertainties, highlighting its dual role in theoretical and practical realms.

The key themes resonating through the literature are 'open innovation', 'organisational performance', and 'entrepreneurial orientation'. These recurring keywords signal a research emphasis on how open innovation strategies influence the efficiency and competitiveness of organisations and entrepreneurs. The thematic trends, particularly the spotlight on 'organisational performance', suggest an academic inclination toward assessing the tangible outcomes of open innovation practices. Moreover, the identified trends point toward an interdisciplinary approach, where open innovation intersects with sustainability, knowledge management, and small and medium-sized enterprises (SMEs), underlining its expansive influence across various business domains [39,40].

The findings indicate that open innovation significantly enhances organisational performance, which is crucial for SMEs that often rely on external collaborations to compensate for limited internal resources [41-44]. Implementing open innovation can help SMEs spur creativity and competitiveness more effectively. For larger organisations, the integration of open innovation can streamline R&D processes and foster innovation at scale. These organisations can lead the way in setting industry standards for open innovation practices, influencing broader market trends. The impact of open innovation varies between these industries due to their inherent operational differences. Service industries, which often rely more heavily on intellectual capital and customer interactions, can benefit from the agility and customer-centric innovations that open innovation facilitates. In contrast, manufacturing industries may utilise open innovation to improve product development cycles and integrate technological advances [45,46]. These insights suggest that the strategic adoption of open innovation should be tailored to the specific needs and capabilities of different organisational types and sizes, which can lead to significant improvements in efficiency and market responsiveness.

Open innovation not only impacts business management and organisational theory but also extends its influence to policy development and technological innovation [45-48]. The findings enhance understanding of how open innovation can be integrated into strategic management practices to improve competitiveness and adaptability. This is particularly relevant in dynamic markets where technological disruption is prevalent. Insights from this study can inform policymakers on the importance of supporting open innovation ecosystems through incentives for R&D collaborations and protecting intellectual properties while promoting a culture of innovation sharing.

Open innovation is pivotal in the era of digital transformation, where technologies such as AI, IoT, and blockchain are reshaping industries. The study's findings can help tech companies and startups leverage open innovation for technological advancements and new product developments. The interdisciplinary impact of open innovation underscores its role as a crucial lever in not only fostering organisational growth and efficiency but also in driving forward policy and technological innovations. These areas benefit from open innovation by incorporating a wider array of knowledge and capabilities, which can significantly accelerate the pace of innovation.

This study's findings underscore the increasing importance of open innovation as a subject of scholarly inquiry, reflecting its evolving nature and its expanding impact on the modern business landscape. The literature indicates a high growth in this field, with open innovation now being an important lens through which organisational and entrepreneurial performance is examined and understood. This shift indicates that the academic discourse is not only measuring the immediate impact of open innovation but also its long-term implications for organisational learning, competitiveness, and strategic positioning [49,50].

The findings align with recent research employing VOSviewer to uncover key themes and trends in emerging disciplines. For instance, Rahman *et al.,* [51] explored motion capture technology in Industry 5.0, and Doganer Duman *et al.,* [52] applied VOSviewer to software selection in logistics, demonstrating its interdisciplinary applicability. These studies, along with our findings, highlight VOSviewer’s versatility in mapping and analysing the intellectual structure of diverse research fields.

3.5 Practical Implications for Industries

The application of open innovation varies significantly across industries, reflecting their unique operational characteristics and needs. In technology-driven sectors such as IT, open innovation accelerates product development and enhances market responsiveness through external collaborations and user-driven innovation. For example, technology firms frequently utilise open-source platforms to co-develop solutions with external contributors, fostering a dynamic ecosystem of shared innovation. Conversely, in resource-intensive industries like manufacturing, open innovation drives efficiency by integrating supplier and customer inputs into production processes, leading to cost reductions and improved productivity.

Several countries have implemented successful policies to foster open innovation. For example, the European Union's Horizon 2020 program incentivised collaboration between SMEs, academia, and large enterprises, resulting in cross-industry innovation networks [53]. Similarly, South Korea's Innovation Voucher program supported SMEs by providing financial and advisory resources to engage in collaborative R&D with external partners [54]. These policies demonstrate the importance of creating financial, institutional, and regulatory frameworks to support open innovation ecosystems.

3.6 Future Research Directions

This study highlights several promising avenues for future research to deepen the understanding of open innovation and its impact on organisational and entrepreneurial performance. First, future studies could explore the causal relationship between open innovation practices and specific organisational outcomes, such as employee productivity or innovation speed, through the use of longitudinal data. While this study identifies a positive association between open innovation and performance, the underlying causal mechanisms remain underexplored. Employing longitudinal or experimental designs could help uncover pathways, such as how particular open innovation practices

enhance organisational adaptability or entrepreneurial success. Such research would provide deeper insights into the mechanisms driving these relationships.

Second, there is a need for cross-sectoral comparative studies to evaluate how open innovation manifests differently across industries, such as manufacturing, services, and technology-driven sectors. These comparisons could reveal industry-specific practices, challenges, and opportunities in implementing open innovation. Additionally, research could examine the role of cultural and regional factors in shaping the adoption and success of open innovation strategies, with a particular focus on emerging economies where innovation ecosystems are rapidly evolving.

Third, future research could extend the use of tools like VOSviewer to explore emerging fields and interdisciplinary trends. Recent studies have applied VOSviewer to areas such as climate change, Industry 5.0, and sustainability [55,56], showcasing its utility in analysing complex and evolving research landscapes. These applications suggest opportunities for leveraging VOSviewer to investigate how open innovation intersects with transformative technological and societal trends, such as digitalisation, artificial intelligence, and environmental sustainability.

Finally, future work could harness advanced machine learning and AI techniques to analyse larger and more diverse datasets. These approaches could provide nuanced insights into emerging trends, collaborations, and thematic shifts in open innovation research. By integrating AI-driven analytics, future studies could reveal hidden patterns and offer predictive insights, further advancing the field. Collectively, these directions aim to bridge the gap between theoretical understanding and practical implementation, fostering a more comprehensive and actionable approach to open innovation.

4. Conclusions

This bibliometric analysis, spanning 2012 to 2023, highlights substantial growth in research on open innovation and its impact on organisational and entrepreneurial performance. The findings demonstrate that open innovation significantly enhances organisational performance across various metrics, with an average annual publication growth rate of 22.11% and an average citation count of 19.07 per document, reflecting its growing academic and practical importance. Key themes and trends identified include 'organisational performance,' 'entrepreneurial orientation,' and 'knowledge management,' underscoring the interdisciplinary nature of open innovation research. The application of open innovation differs across organisational types and sectors, emphasising the necessity for tailored strategies for both SMEs and large corporations. Policy measures to support open innovation include fostering R&D collaborations, offering incentives for innovation, and safeguarding intellectual property while promoting knowledge sharing. This study underscores the pivotal role of open innovation in enhancing organisational performance and calls for future research to explore causal relationships and interdisciplinary applications to unlock its full potential.

Despite its contributions, this bibliometric analysis has several limitations. First, the study relies exclusively on data from the Scopus database, which may omit relevant studies indexed in other databases, such as Web of Science or Google Scholar. Second, the analysis primarily uses quantitative methods, potentially overlooking qualitative insights into open innovation's specific applications, variations in organisational culture, and industry-specific practices. Third, the study focuses on publications from 2012 to 2023, which may exclude earlier foundational theories and frameworks that have influenced the field. Finally, metrics such as citation counts and h-index, while useful for evaluating research impact, do not always reflect the intrinsic quality or innovation of studies and can be influenced by external factors, such as citation practices and publication accessibility.

Acknowledgement
This research was not funded by any grant.

References
[1] Bogers, Marcel, Henry Chesbrough, and Carlos Moedas. "Open Innovation: Research, Practices, and Policies." *California Management Review* 60, no. 2 (2018): 5–16. https://doi.org/10.1177/0008125617745086
[2] Chesbrough, Henry. "To Recover Faster from COVID-19, Open Up: Managerial Implications from an Open Innovation Perspective." *Industrial Marketing Management* 88 (2020): 410–13. https://doi.org/10.1016/j.indmarman.2020.04.010
[3] Singh, S. K., Savita Gupta, Diego Busso, and Sanjay Kamboj. "Top Management Knowledge Value, Knowledge Sharing Practices, Open Innovation and Organizational Performance." *Journal of Business Research* 128 (2021): 788–98. https://doi.org/10.1016/j.jbusres.2019.04.040
[4] Brunswicker, Sabine, and Wim Vanhaverbeke. "Open Innovation in Small and Medium-Sized Enterprises (SMEs): External Knowledge Sourcing Strategies and Internal Organizational Facilitators." *Journal of Small Business Management* 53, no. 4 (2015): 1241–63. https://doi.org/10.1111/jsbm.12120
[5] Priyono, Agus, Ananda Moin, and Vina N. A. O. Putri. "Identifying Digital Transformation Paths in the Business Model of SMEs During the COVID-19 Pandemic." *Journal of Open Innovation: Technology, Market, and Complexity* 6, no. 4 (2020): 104. https://doi.org/10.3390/joitmc6040104
[6] Hameduddin, Tayyab, Sergio Fernandez, and Mehmet Akif Demircioglu. "Conditions for Open Innovation in Public Organizations: Evidence from Challenge.gov." *Asia Pacific Journal of Public Administration* 42, no. 2 (2020): 111–31. https://doi.org/10.1080/23276665.2020.1754867
[7] Schaffers, Hans, Marja Vartiainen, and Jacco Bus, eds. *Digital Innovation and the Future of Work.* CRC Press, 2022. https://doi.org/10.1201/9781003337928
[8] Frare, Ana Beatriz, and Chris Akroyd. "Performance Management and Open Innovation: Evidence from Brazilian Startups." *Management Decision*, ahead-of-print (2023). https://doi.org/10.1108/MD-07-2022-0892
[9] Egger, Roman, Igor Gula, and Dominik Walcher. "Towards a Holistic Framework of Open Tourism." In *Open Tourism: Open Innovation, Crowdsourcing and Co-Creation Challenging the Tourism Industry,* edited by Roman Egger, Igor Gula, and Dominik Walcher, 3–16. Springer, 2016. https://doi.org/10.1007/978-3-642-54089-9_1
[10] Del Vecchio, Pasquale, Giuseppe Mele, Valentina Ndou, and Giustina Secundo. "Creating Value from Social Big Data: Implications for Smart Tourism Destinations." *Information Processing & Management* 54, no. 5 (2018): 847–60. https://doi.org/10.1016/j.ipm.2017.10.006
[11] Della Corte, Valentina, Giuseppina Del Gaudio, Francesco Sepe, and Francesca Sciarelli. "Sustainable Tourism in the Open Innovation Realm: A Bibliometric Analysis." *Sustainability* 11, no. 21 (2019): 6114. https://doi.org/10.3390/su11216114
[12] Papa, Armando, Luca Dezi, Gian Luca Gregori, Julia Mueller, and Nadia Miglietta. "Improving Innovation Performance through Knowledge Acquisition: The Moderating Role of Employee Retention and Human Resource Management Practices." *Journal of Knowledge Management* 24, no. 3 (2020): 589–605. https://doi.org/10.1108/JKM-09-2017-0391
[13] Crupi, Antonio, Nicola Del Sarto, Alberto Di Minin, Gian Luca Gregori, Daniele Lepore, Luca Marinelli, and Fabio Spigarelli. "The Digital Transformation of SMEs–A New Knowledge Broker Called the Digital Innovation Hub." *Journal of Knowledge Management* 24, no. 6 (2020): 1263–88. https://doi.org/10.1108/JKM-11-2019-0623
[14] Xie, Xuemei, and Hui Wang. "How Can Open Innovation Ecosystem Modes Push Product Innovation Forward? An fsQCA Analysis." *Journal of Business Research* 108 (2020): 29–41. https://doi.org/10.1016/j.jbusres.2019.10.011
[15] Abdulkader, Bashar, Davide Magni, Vincenzo Cillo, Armando Papa, and Raffaele Micera. "Aligning Firm's Value System and Open Innovation: A New Framework of Business Process Management Beyond the Business Model Innovation." *Business Process Management Journal* 26, no. 5 (2020): 999–1020. https://doi.org/10.1108/BPMJ-05-2020-0231
[16] De Brito, Susana, and João Leitão. "Mapping and Defining Entrepreneurial Ecosystems: A Systematic Literature Review." *Knowledge Management Research & Practice* 19, no. 1 (2021): 21–42. https://doi.org/10.1080/14778238.2020.1751571
[17] Chesbrough, Henry W. *Open Innovation: The New Imperative for Creating and Profiting from Technology.* Harvard Business Press, 2003.
[18] Von Hippel, Eric. "Democratizing Innovation: The Evolving Phenomenon of User Innovation." *Journal für Betriebswirtschaft* 55 (2005): 63–78. https://doi.org/10.1007/s11301-004-0002-8
[19] Drucker, Peter, and Joseph Maciariello. *Innovation and Entrepreneurship.* Routledge, 2014. https://doi.org/10.4324/9781315747453

[20] Sekli, Gonzalo F. M., and Israel De La Vega. "Adoption of Big Data Analytics and Its Impact on Organizational Performance in Higher Education Mediated by Knowledge Management." *Journal of Open Innovation: Technology, Market, and Complexity* 7, no. 4 (2021): 221. https://doi.org/10.3390/joitmc7040221

[21] Wang, Tong, Jia Wu, Jing Gu, and Ling Hu. "Impact of Open Innovation on Organizational Performance in Different Conflict Management Styles: Based on Resource Dependence Theory." *International Journal of Conflict Management* 32, no. 2 (2021): 199–222. https://doi.org/10.1108/IJCMA-09-2019-0165

[22] Kurniawati, Anis, Imam Sunaryo, Iwan Inrawan Wiratmadja, and Dwi Irianto. "Sustainability-Oriented Open Innovation: A Small and Medium-Sized Enterprises Perspective." *Journal of Open Innovation: Technology, Market, and Complexity* 8, no. 2 (2022): 69. https://doi.org/10.3390/joitmc8020069

[23] Rumanti, Anita Ayu, Imam Sunaryo, Iwan Inrawan Wiratmadja, and Dwi Irianto. "Cleaner Production for Small and Medium Enterprises: An Open Innovation Perspective." *IEEE Transactions on Engineering Management* 70, no. 7 (2020): 2355–68. https://doi.org/10.1109/TEM.2020.3015048

[24] Nambisan, Satish, Donald Siegel, and Martin Kenney. "On Open Innovation, Platforms, and Entrepreneurship." *Strategic Entrepreneurship Journal* 12, no. 3 (2018): 354–68. https://doi.org/10.1002/sej.1300

[25] Granstrand, Ove, and Marcus Holgersson. "Innovation Ecosystems: A Conceptual Review and a New Definition." *Technovation* 90 (2020): 102098. https://doi.org/10.1016/j.technovation.2019.102098

[26] Anderson, Neil, Kristina Potočnik, and Jing Zhou. "Innovation and Creativity in Organizations: A State-of-the-Science Review, Prospective Commentary, and Guiding Framework." *Journal of Management* 40, no. 5 (2014): 1297–1333. https://doi.org/10.1177/0149206314527128

[27] Rahman, Md. Hafijur, Md. Rabiul Hasan, Nayem Imam Chowdhury, Mohammad Ariful Bashar Syed, and Md. Umme Farah. "Predictive Health Analysis in Industry 5.0: A Scientometric and Systematic Review of Motion Capture in Construction." *Digital Engineering* (2024): 100002. https://doi.org/10.1016/j.digieng.2024.100002

[28] Manosalvas, Verónica Cristina Ayala, Milena Vásquez Luis, Gloria Bautista Mora Auxiliadora, and Sandoval Sanabria Ricardo. "Absorptive Capacity in Inbound and Outbound Open Innovation in Emerging Economy Context [Capacidad de Absorción de la Innovación Abierta Entrante y Saliente en el Contexto de las Economías Emergentes]." *Revista Venezolana de Gerencia* 28, no. 103 (2023): 1069–84. https://doi.org/10.52080/rvgluz.28.103.10

[29] Zupic, Ivan, and Tomaž Čater. "Bibliometric Methods in Management and Organization." *Organizational Research Methods* 18, no. 3 (2015): 429–72. https://doi.org/10.1177/1094428114562629

[30] Gyau, Ernest B., Kumbwada Sakuwuda, and Eric Asimeng. "A Comprehensive Bibliometric Analysis and Visualization of Publications on Environmental Innovation." *Journal of Scientometric Research* 12, no. 3 (2023): 544–57. http://dx.doi.org/10.5530/jscires.12.3.052

[31] Gupta, Shweta, and Vijay Kumar Singh. "Quantitative Estimation of Trends in Artificial Intelligence Research: A Study of Bradford Distributions Using Leimkuhler Model." *Journal of Scientometric Research* 12, no. 2 (2023): 234–42. http://dx.doi.org/10.5530/jscires.12.2.023

[32] Fatima, Tayyaba, and Aimen Masood. "Impact of Digital Leadership on Open Innovation: A Moderating Serial Mediation Model." *Journal of Knowledge Management* (2023). https://doi.org/10.1108/JKM-11-2022-0872

[33] Aria, Massimo, and Corrado Cuccurullo. "bibliometrix: An R-Tool for Comprehensive Science Mapping Analysis." *Journal of Informetrics* 11, no. 4 (2017): 959–75. https://doi.org/10.1016/j.joi.2017.08.007

[34] Derviş, Hatice. "Bibliometric Analysis Using bibliometrix: An R Package." *Journal of Scientometric Research* 8, no. 3 (2019): 156–60. http://dx.doi.org/10.5530/jscires.8.3.32

[35] Phalswal, Sonam. "Mapping the Grassroots Innovation Research: A Bibliometric Analysis and Future Agenda." *Journal of Scientometric Research* 13, no. 3 (2023). http://dx.doi.org/10.5530/jscires.12.3.069

[36] Rumanti, Anita Ayu, Ahmad Fadillah Rizana, Lenny Septiningrum, Reynaldo Reynaldo, and Muhammad Miftahul Isnaini. "Innovation Capability and Open Innovation for Small and Medium Enterprises (SMEs) Performance: Response in Dealing with the COVID-19 Pandemic." *Sustainability* 14, no. 10 (2022): 5874. https://doi.org/10.3390/su14105874

[37] Wemmer, Frank, Ernst Emrich, and Jörg Koenigstorfer. "The Impact of Coopetition-Based Open Innovation on Performance in Nonprofit Sports Clubs." *European Sport Management Quarterly* 16, no. 3 (2016): 341–63. https://doi.org/10.1080/16184742.2016.1164735

[38] Sekli, Gonzalo F. M., and Israel De La Vega. "Adoption of Big Data Analytics and Its Impact on Organizational Performance in Higher Education Mediated by Knowledge Management." *Journal of Open Innovation: Technology, Market, and Complexity* 7, no. 4 (2021): 221. https://doi.org/10.3390/joitmc7040221

[39] Jasimuddin, Sajjad M., and Mahammad M. Naqshbandi. "Knowledge Infrastructure Capability, Absorptive Capacity and Inbound Open Innovation: Evidence from SMEs in France." *Production Planning & Control* 30, no. 10–12 (2019): 893–906. https://doi.org/10.1080/09537287.2019.1582097

[40] Li, Bing, Zhiwei Xu, Hui Wu, Ning Hong, and Marjan Skare. "Open Innovation: A Research Framework and Case Study of Huawei." *Technological and Economic Development of Economy* 29, no. 1 (2023): 278–306. https://doi.org/10.3846/tede.2023.17843

[41] Cui, Ting, H. J. Ye, H. H. Teo, and J. Li. "Information Technology and Open Innovation: A Strategic Alignment Perspective." *Information & Management* 52, no. 3 (2015): 348–58. https://doi.org/10.1016/j.im.2014.12.005

[42] Davoudi, Seyed Mohammad Mousavi, Kamran Fartash, Valentina Gennadyevna Zakirova, Anna Mikhailovna Belyalova, Rustam Anvarovich Kurbanov, Aleksandr Vladimirovich Boiarchuk, and Zhanna Mikhailovna Sizova. "Testing the Mediating Role of Open Innovation on the Relationship Between Intellectual Property Rights and Organizational Performance: A Case of Science and Technology Park." *Eurasia Journal of Mathematics, Science and Technology Education* 14, no. 4 (2018): 1359–69. https://doi.org/10.29333/ejmste/83651

[43] Alalawneh, Ahmad A., Shadi Y. S. Al-Omar, and Safwan Alkhatib. "The Complexity of Interaction Between Social Media Platforms and Organizational Performance." *Journal of Open Innovation: Technology, Market, and Complexity* 8, no. 4 (2022): 169. https://doi.org/10.3390/joitmc8040169

[44] García-González, Abel, and María Soledad Ramírez-Montoya. "Systematic Mapping of Scientific Production on Open Innovation (2015–2018): Opportunities for Sustainable Training Environments." *Sustainability* 11, no. 6 (2019): 1781. https://doi.org/10.3390/su11061781

[45] Tran, Hoai T., Enrico Santarelli, and Wei Xia Wei. "Open Innovation Knowledge Management in Transition to Market Economy: Integrating Dynamic Capability and Institutional Theory." *Economics of Innovation and New Technology* 31, no. 7 (2022): 575–603. https://doi.org/10.1080/10438599.2020.1841942

[46] Khan, M. Junaid, Saba Ahmad, Harlina Abdul Halim, and Nor Hakimah Ahmad. "The Effect of Service Innovation Orientation and Open Innovation on Innovation Performance of Medium and Small Private Hospitals in India." *SAGE Open* 12, no. 3 (2022). https://doi.org/10.1177/21582440221116110

[47] Humi, Saadia, and Allen Creasy. "Focusing on Alliance Management Strategies of Biotech Companies: Linking Performance with Best Practices and Innovation within the Biotechnology Industry in the USA." *Journal of Commercial Biotechnology* 28, no. 3 (2023): 261–73. https://doi.org/10.5912/jcb2106

[48] Tian, Jiawei, and Xiaolong Gao. "Research on Knowledge Sharing Efficiency Evaluation of Open Innovation Community: A Case of Xiaomi Community." In *Lecture Notes in Business Information Processing*, vol. 480, 14–26. 2023. https://doi.org/10.1007/978-3-031-32299-0_2

[49] Muktiarni, Mariam, Noviana Indah Rahayu, Ahmad Ismail, and Aji Kurniawan Wardani. "Bibliometric Computational Mapping Analysis of Trend Metaverse in Education Using VOSviewer." *Journal of Advanced Research in Applied Sciences and Engineering Technology* 32, no. 2 (2023): 95–106. https://doi.org/10.37934/araset.32.2.95106

[50] Mariappan, Prakash, Mohamad Zaini Khairani, Noor Mohd, Mune Chanthiran, and Anna Noreen Cubalit. "Uncovering Emerging Trends in Technology and Art Education: A Bibliometric Mapping Analysis." *Journal of Advanced Research in Applied Sciences and Engineering Technology* 41, no. 1 (2024): 64–75. https://doi.org/10.37934/araset.41.1.6475

[51] Rahman, Md. Hafijur, Md. Rabiul Hasan, Nayem Imam Chowdhury, Mohammad Ariful Bashar Syed, and Md. Umme Farah. "Predictive Health Analysis in Industry 5.0: A Scientometric and Systematic Review of Motion Capture in Construction." *Digital Engineering* (2024): 100002. https://doi.org/10.1016/j.digieng.2024.100002

[52] Doganer Duman, Bilge, Muhammet Adak, and Ahmet Güleç. "VOSviewer Analysis of Studies on Software Selection in the Logistics Sector." *Logistics, Supply Chain, Sustainability and Global Challenges* (2024): 0. https://doi.org/10.2478/jlst-2024-0002

[53] Fieldsend, Andrew F., Eileen Cronin, Edit Varga, Sándor Biró, and Elke Rogge. "'Sharing the Space' in the Agricultural Knowledge and Innovation System: Multi-Actor Innovation Partnerships with Farmers and Foresters in Europe." *The Journal of Agricultural Education and Extension* 27, no. 4 (2021): 423–42. https://doi.org/10.1080/1389224X.2021.1873156

[54] Durst, Susanne, and Wolfgang Gerstlberger. "Financing Responsible Small- and Medium-Sized Enterprises: An International Overview of Policies and Support Programmes." *Journal of Risk and Financial Management* 14, no. 1 (2021): 10. https://doi.org/10.3390/jrfm14010010

[55] Hsieh, Yu-Ling, and Shu-Chien Yeh. "The Trends of Major Issues Connecting Climate Change and the Sustainable Development Goals." *Discovery Sustainability* 5 (2024): 31. https://doi.org/10.1007/s43621-024-00183-9

[56] Rahman, Md. Hafijur, Amir Ghasemi, Fang Dai, and Jaehyun Ryu. "Review of Emerging Technologies for Reducing Ergonomic Hazards in Construction Workplaces." *Buildings* 13 (2023): 2967. https://doi.org/10.3390/buildings1322967