Volume 9, Nomor 1, Juni 2024, 37-57
ISSN 2407-4292 (Print), ISSN 2721-6780 (Online)
Doi: https://doi.org/10.33701/j-3p.v9i1.3385
Available Online: http://ejournal.ipdn.ac.id/jpdpp

RESEARCH ON THE PENTAHELIX USING VOSVIEWER AND BIBLIOSHINY

Dhia Alifia Izdihar Hasna[1] and Imam Yuadi*[2]
[1]Universitas Airlangga, Jl. Airlangga No.4 - 6, Airlangga, Kec. Gubeng, Surabaya, Jawa Timur 60115, Indonesia; email: dhia.alifia.izdihar-2020@fisip.unair.ac.id
[2]Universitas Airlangga, Jl. Airlangga No.4 - 6, Airlangga, Kec. Gubeng, Surabaya, Jawa Timur 60115, Indonesia; email: imam.yuadi@fisip.unair.ac.id

*Correspondence
Received: 05-06-2023; Accepted: 09-06-2024; Published: 29-06-2024

Abstract: *This study aims to track the advancement of "Pentahelix"-related research. Scopus searches were used for this research. A flowchart illustrating the stages of the bibliometric analysis employed in this study's research methodology is provided. Software like Biblioshiny and VOSviewer are utilized as research aids. Forty-seven documents were included in the search results, exported as RIS and BibTex files, and processed using the VOSviewer and Biblioshiny software. It is known from the search results that there are 5 clusters and six authors who work together to write scholarly publications on "Pentahelix." "Pentahelix" research varied from year to year. Padjajaran University is the affiliate with the most publications. Indonesia has the most publications, followed by Australia, China, Ethiopia, Kenya, Korea, Malaysia, Mexico, Spain, England, and Italy. IOP Conference Series: Earth and Environmental SCI is a publication source with many scientific papers on the "Pentahelix," it is the affiliate with the most publications. Indonesia has produced the most "Petahelix" papers overall. The findings of this study will help government sector activists work together to advance the timely study of their respective scientific domains.*

Keywords: *Pentahelix, VosViewer, Biblioshiny, Scopus.*

Abstrak: Penelitian ini bertujuan untuk mengidentifikasi kemajuan penelitian yang terkait dengan konsep "Pentahelix". Penelitian ini dilakukan dengan melakukan pencarian di database Scopus. Metode penelitian yang digunakan adalah analisis bibliometrik yang dijelaskan melalui diagram alur. Perangkat lunak VOSviewer dan Biblioshiny digunakan sebagai alat bantu dalam penelitian ini. Hasil pencarian menghasilkan 47 dokumen yang kemudian diekspor dalam format RIS dan BibTex dan dianalisis menggunakan perangkat lunak VOSviewer dan Biblioshiny. Dari hasil analisis, ditemukan bahwa terdapat 5 kelompok penelitian yang terkait, dengan 6 pengarang yang memiliki kolaborasi dalam menulis karya ilmiah tentang "Pentahelix". Selain itu, penelitian tentang "Pentahelix" mengalami fluktuasi dari tahun ke tahun. IOP Conference Series: Earth and Environmental SCI merupakan sumber publikasi dengan jumlah karya ilmiah tentang "Pentahelix" yang paling banyak, dan Universitas Padjajaran adalah afiliasi dengan publikasi terbanyak. Indonesia adalah negara dengan jumlah publikasi terbanyak tentang "Pentahelix", diikuti oleh Australia, China, Ethiopia, Kenya, Korea, Malaysia, Mexico, Spanyol, Inggris, dan Italia. Hasil penelitian ini diharapkan dapat memberikan panduan bagi para praktisi dan peneliti di sektor pemerintahan dalam mengembangkan bidang keilmuan yang relevan dengan perkembangan zaman.

Kata Kunci: Pentahelix, VosViewer, Biblioshiny, Scopus.

I. Introduction

Social change can only be achieved with effort. Cooperation with multiple parties is necessary to bring about change. The emergence of technological breakthroughs that blur the boundaries between the physical and digital worlds has marked the beginning of the fourth industrial revolution. The Democratization of artificial intelligence, widespread use of robots, the Internet of Things, additive manufacturing, nanotechnology, and blockchain are some technologies currently transforming manufacturing. Collaboration is critical to enabling society to progress and develop. There are various models of multi-stakeholder collaboration. One is the Pentahelix concept (Supriyanto & Iskandar, 2022). This concept involves cooperation among various fields and parties, including Academia, Business, Community, Government, and Media, collectively known as ABCGM.

One sector that is currently trying to implement the Pentahelix collaboration concept is the tourism sector. The implementation effort is mentioned in the Regulation of the Minister of Tourism of the Republic of Indonesia Number 14 of 2016, which regulates the guidelines for sustainable tourism destinations. This regulation emphasizes the importance of cooperation among the academic, business, community, government, and media (ABCGM) sectors as drivers of the tourism system. The goal is to optimize their roles in ensuring the quality of tourism activities, facilities, and services and creating sustainable tourism experiences and benefits for society and the environment.

The change in self-concept experienced by Auggie Pullman, the main character in the novel "Wonder" by R.J. Palacio, greatly influenced his personality from insecure to confident. Initially, Auggie was depicted as a timid and insecure child due to facial deformities caused by Treacher Collins syndrome. This negative self-concept is formed from his life experiences, which are full of strange looks, ridicule and discriminatory treatment from the people around him. After years of homeschooling, Auggie's lack of self-confidence becomes apparent when he feels afraid and anxious to start attending public school, Beecher Prep. The Pentahelix Collaboration model involved collaboration between government, private sector, academia, community, and media and was initially created for tourism development based on the ideas of Arief Yahya, who served as Minister of Tourism in 2016 (Kelvin et al., 2022; Setianingsih et al., 2022; Soemaryani, 2016). However, this collaboration model can also be applied across all sectors in Indonesia. Collaboration among these elements can create synergy to address

government issues and achieve good governance in Indonesia (Hidayat et al., 2021; Velby & Yuadi, 2023).

According to the research by Hardianto et al. (2019), Triple-Helix focuses on the interaction between higher education institutions, industry, and government in innovation. The quadruple helix adds a fourth helix: culture and public-based media. The Quintuple Helix involves collaborating elements from the Quadruple Helix with the addition of the community's natural environment. The Pentahelix adds the element of media. With the interaction between government, tourism industry, universities, media, society, and the environment, organizational management becomes more optimal and attracts more stakeholders to engage in activities (Hardianto et al., 2019).

In the study (Capetillo et al, 2021), it is explained that the Pentahelix strategy, consisting of 1) industry, 2) academia, 3) government, 4) entrepreneurs, and 5) venture capital, is aligned under one vision to create an innovation ecosystem capable of harnessing the benefits of emerging technological waves This strategy has evolved into a Pentahelix system that combines Entrepreneurs and Venture Capital to stimulate stable demand for new technologies within the regional economic ecosystem, resulting in an increasing number of technology startups nurtured by risk capital.

As explained through research (Chamidah et al., 2020), whether acknowledged or not, the world continues to experience dynamic and complex development. Global progress demands material gains and calls for equity across all sectors. It is undeniable that strengths and weaknesses are difficult to avoid. In short, nothing in this world is perfect for carrying out roles and activities without relying on others. Pentahelix is a group of stakeholders with expertise in their respective fields. These advantages, however, are accompanied by drawbacks that are limited in specific dimensions. Therefore, cooperation is needed to unify the elements of Pentahelix (academia, government, business, and media) into a cohesive and impactful collaboration (Kelvin et al., 2022).

With the advancement of a world increasingly bound by technology, there are certainly many tasks that a single stakeholder needs help to accomplish. These stakeholders must collaborate with other actors to effectively carry out organizational, economic, and governmental activities. Many partnerships are being formed among stakeholders, not only between government and private sectors but also among smaller institutions, to create good governance (Mu'alim & Habibussalam, 2021). In line with this phenomenon, it can be observed

that the Pentahelix collaboration model is also evolving following the needs of each year, especially with the digitization of all sectors. Over the past five years, research on the Pentahelix collaboration model has experienced significant growth (Vani et al., 2020). Therefore, this writing aims to examine the research development on the Pentahelix collaboration model, which can be accessed through the Scopus database, a renowned index of scholarly publications. It is hoped that the findings of this research will benefit academics interested in studying collaboration among actors, governments, or activists in this field, enabling them to understand and observe the current global trends in collaborative research.

II. Literature Review

Basic Concepts of Pentahelix

In realizing the Pentahelix that involves five essential aspects, as explained in the introductory subsection, an individual approach is necessary to bridge these five elements into a sophisticated and synergistic unity. This study maps research approaches through various theoretical perspectives, such as the theory of participation, which, by definition, focuses on activities that evoke emotions and involve individuals/groups in an event.

Engagement is the community's active participation in determining development policy strategies carried out by the government. The concept of community participation is divided into three subcategories, specifically political participation, social participation, and civic participation. In terms of the development of the tourism industry, the role and involvement of the community can provide better opportunities to maximize untapped potential.

Pentahelix in Tourism Management

The well-organized planning and development process, guided by the alignment of Paris theory and stakeholder theory, offers opportunities for the universal dissemination of knowledge in the tourism industry through enhancement (d'Angella & Go, 2009; Stylidis et al., 2015; Theodoulidis et al., 2017). Public participation and opinions are necessary and closely related to stakeholder theory, as they encompass perspectives on program development, project planning, community involvement, and various other activities that undoubtedly require more significant and optimal development through community participation.

Stakeholder involvement is necessary to plan and implement programs together. This cooperation will create a symbiotic mutualism between stakeholders, as their participation becomes a means to establish communication, gain support from the community, and collect

data/ideas in carrying out organizational activities that result in sustainable decision-making and accommodate the interests of all parties (Barney & Harrison, 2020; Freeman et al., 2021; Laplume et al., 2008).

III. Research Methodologies

Flowchart Research Methods

Figure 1 provides a comprehensive explanation regarding the research flow. In the initial stage, the researcher clearly defines the problem or topic to be addressed in the study. The researcher discovers that there are few studies examining the Pentahelix collaboration model. Some studies only discuss the Pentahelix collaboration model in specific sectors. Therefore, the researcher investigates this issue and subsequently determines the theme. The Bibliometric approach is chosen for this research to gain an overview of collaboration using the Pentahelix model in Indonesia. Bibliometric analysis is a mapping effort to determine the relationships between publications based on keywords, authors, institutions, countries of origin, and similar factors. These relationships are visualized through maps and graphs using specific computer programs (Van Eck & Waltman, 2014).

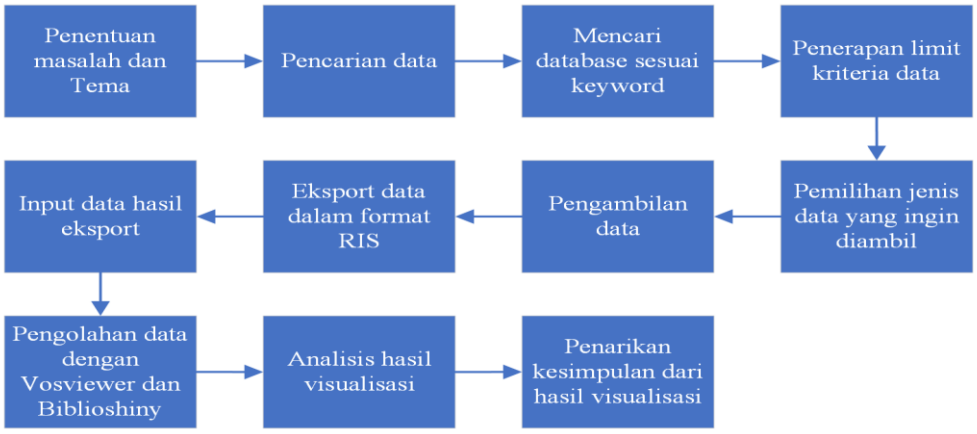

Figure 1. Research Methods Flowchart

The data used in this analysis consists of 47 publications on the Pentahelix model, which were retrieved from the Scopus database and are accessible via the website *www.scopus.com*. The number of documents was obtained through a series of processes, namely identification, screening, eligibility, and inclusion, as indicated in Figure 2. This article was written with the assistance of the VOSviewer and Biblioshiny applications based on bibliometric analysis based on searching for publications specifically discussing the Pentahelix

collaboration model. Subsequently, the researcher conducted discussions and drew conclusions related to the conducted research.

Data from the Scopus database was limited to the years 2018 to 2023. The keywords "Penta helix" or "Pentahelix" were used to search for the data to be studied. Researchers used restrictions to obtain the most relevant databases. The keywords were then filtered based on the research title, keywords, and abstract. Researchers do not specify a language requirement because most countries have likely collaborated with the Pentahelix model, thus allowing the possibility of finding data from countries that use international languages.

Further analysis is then conducted by examining the growth of research related to the Pentahelix model collaboration and establishing criteria for data in the study. Completeness criteria for research data include relevant titles, publication years that match the researcher's set limitations, authors, keywords, abstracts, affiliations, and the number of research citations, which are then exported in RIS format. The data is then viewed and analyzed using the VOSviewer (version 1619) and Biblioshiny programs, which include co-occurrence and co-authorship, as well as the most commonly used themes and keywords from the exported data entered into the Scopus database.

Identification of Sources for Scoping

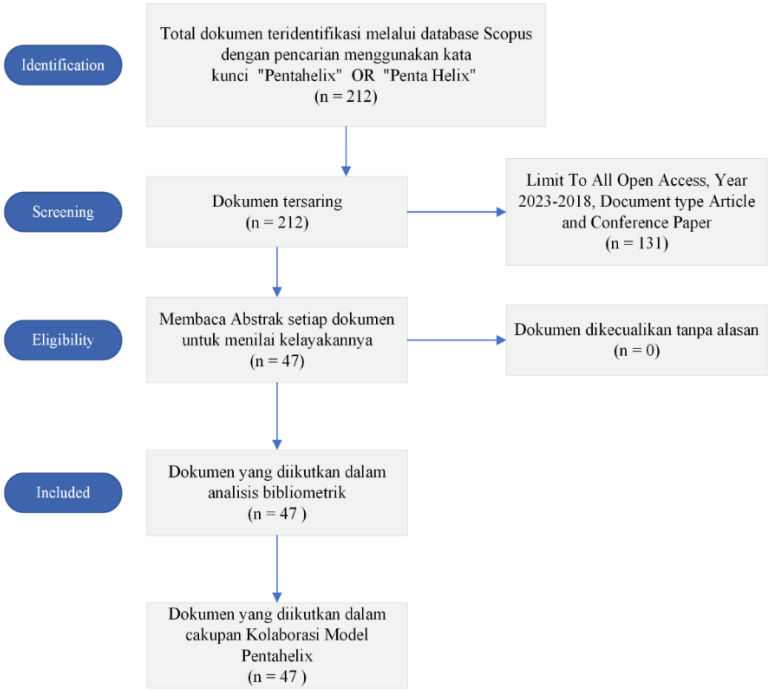

Figure 2. PRISMA Flowchart For Bibliometric Analysis And Scoping Review Of Pentahelix Model Collaboration

Because this review emphasizes the conceptual relationship between ACAP and OR, the author selected sources for the scoping review, explicitly focusing on knowledge-based views and dynamic capability theory within the chosen university's thinking, "Pentahelix" or "Penta helix" collaboration under the study of public administration, business, or other social science perspectives. All documents identified in the bibliometric review explicitly focused on this scope were compiled and extracted from review databases. Additionally, relevant articles from the chosen university authors were taken from the selected publication reference list. Publications that provided full-text access and relevant articles were excluded. The review included articles from the search results based on the final scope (Figure 2).

IV. Result and Discussion

Key Information and Research Topic Trends

Table 1. Main Information of Publication

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2018:2023
Sources (Journals, Books, etc)	21
Documents	47
Annual Growth Rate %	14.87
Document Average Age	3.02
Average citations per doc	2.957
References	1694
DOCUMENT CONTENTS	
Keywords Plus (ID)	213
Author's Keywords (DE)	112
AUTHORS	
Authors	160
Authors of single-authored docs	3
AUTHORS COLLABORATION	
Single-authored docs	4
Co-Authors per Doc	3.68
International co-authorships %	17.02
DOCUMENT TYPES	
article	23
conference paper	24

The leading information from the data presented in Table 1 indicates that the observed research was conducted from 2018 to 2023, with 47 documents originating from 21 sources, such as journals and books. The annual document growth rate reached 14.87%, demonstrating

an increased interest in the observed topic during that period. The average age of the documents is 302 years, with an average of 2,957 citations per document, indicating a stable level of relevance and impact from these works. Furthermore, these documents contain 213 additional and 112 author keywords, highlighting the diversity and complexity of the investigated topic. One hundred sixty authors were involved in those documents, with only three written by one author. Collaboration among authors also occurs significantly, with an average of 3.68 authors per document and an international collaboration rate of 17.02%. Regarding the types of documents, there are 23 articles and 24 conference papers.

Meanwhile, Table 2 presents the dominant research topic trends in the observed documents. Sustainable Development is the most frequently occurring topic, with a frequency of 7, showing an increase in publications in 2020 and remaining consistent in the same year. Tourism is also a significant topic, with a frequency of 5, showing increased publications in 2021. Indonesia consistently appears in these publications, with a stable growth rate from 2021 to 2022. This data provides a clear overview of the focus and trends in research conducted during the reviewed period.

Table 2. Research Topic Trends

Item	Freq	Year_q1	Year_med	Year_q3
Sustainable Development	7	2020	2020	2020
Tourism	5	2021	2021	2021
Indonesia	8	2021	2022	2022

Keyword Analysis (Co-Occurrence)

Fifteen keywords met the criteria, with a minimum of 10 keywords appearing out of a total of 1527 keywords. These fifteen keywords are then divided into five clusters, each marked with a different color to indicate its relationship to the other clusters: red, blue, yellow, green, and purple. Three different types of visualizations—network visualization, overlap visualization, and density visualization—present these bibliometric mapping findings. Each term is identified by a colored circle, the size of which corresponds to how often the keyword appears in the title and abstract. These terms appear more often in titles and abstracts when the font size and circle shape are larger.

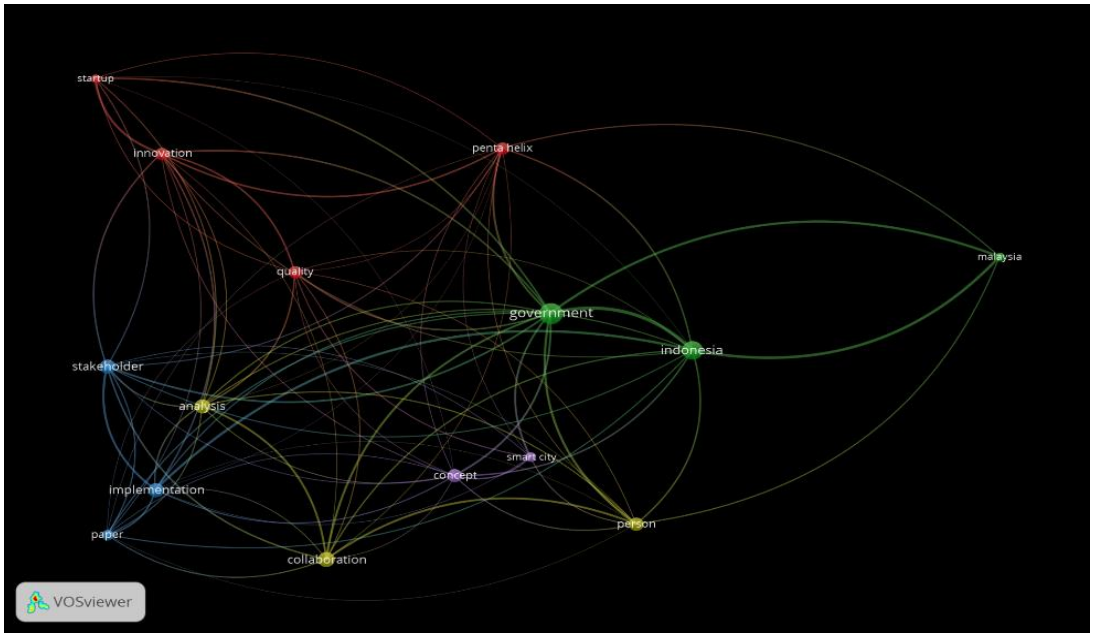

Figure 3. Analysis Based on Keywords Using Network Visualization on VOSviewer

The keyword analysis findings were obtained by network visualization, as shown in Figure 3. The findings of the network visualization study show that clusters have formed based on the research topics. These research findings demonstrate that the 15 discovered keywords are divided into five groups.

Cluster 1 indicates the groups in each study cluster. Cluster 1 consists of three topics: Government, Indonesia, and Malaysia. Cluster 2 consists of two topics: smart city and concept. Cluster 3 consists of three topics: Person, Collaboration, and Analysis. Cluster 4 consists of three topics: Stakeholders, Implementation, and Paper. Lastly, cluster 5 consists of three topics: Penta helix, Quality, Innovation, and Start-up.

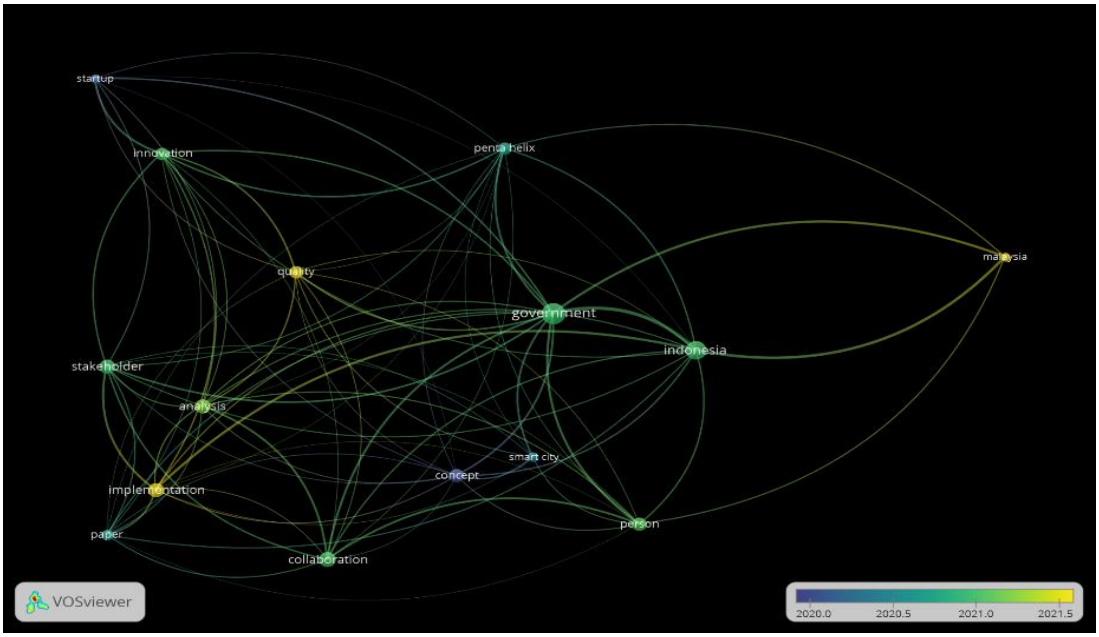

Figure 4. Analysis Based on Keywords Using Overlay Visualization on Vosviewer

From Figure 4, the analysis of keywords using overlay visualization revealed trends related to this research over the years. Studies on pentahelix in the Scopus database exhibit dynamic characteristics, with an increasing trend year by year.

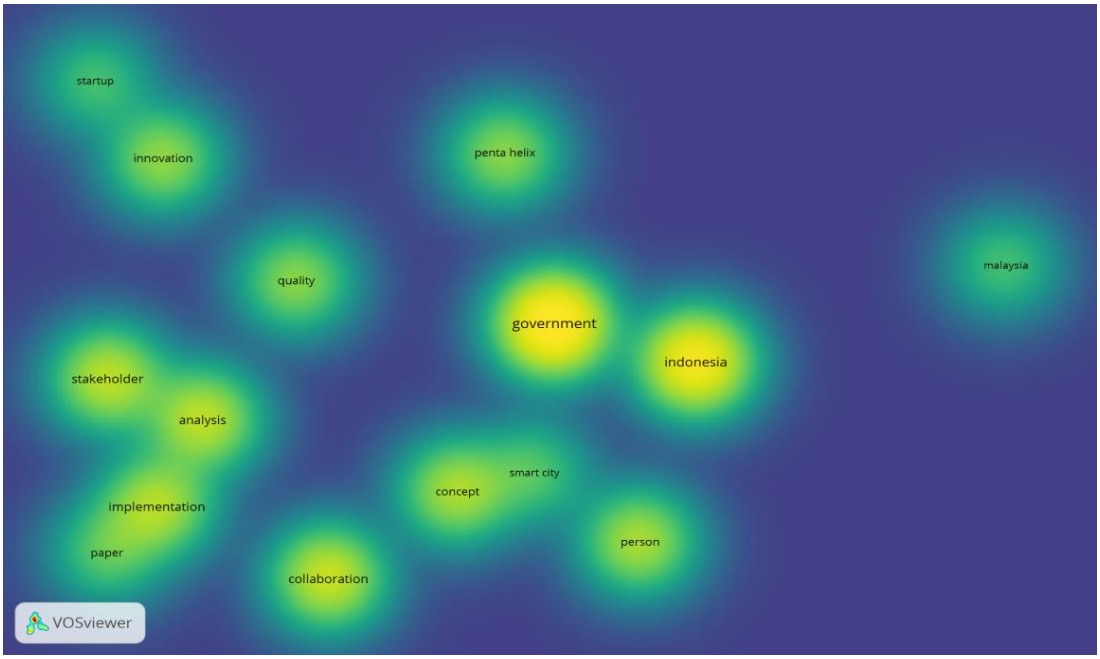

Figure 5. Analysis Based on Keywords Using Density Visualization In Vosviewer

The keyword analysis results were found using density visualization, as shown in Figure 5. The results of the keyword analysis using density visualization show the depth of the research,

where the more vivid and robust the color that appears in the circle, the more research there is related to that keyword. This graph shows that the words "government" and "Indonesia" have different and distinct colors. The search results show that research on governance is widely available.

Analysis by Author (Co-Authorship)

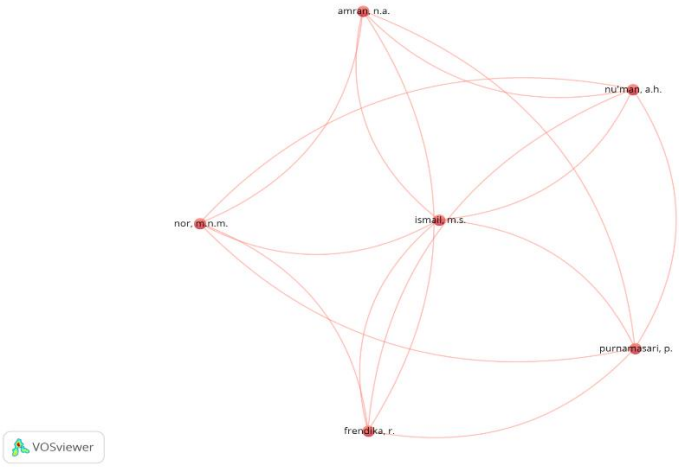

Figure 6. Analysis Based on Keywords Using Network Visualization on Vosviewer

Figure 6 shows that six authors have collaborated in writing scientific papers (co-authorship) about "Penta helix," which are members of one cluster. The authors known to have a collaborative relationship include Ismail, M.S., Purnamasari, P., Frendika, R., Nor, M.N.M., Amran, N.A., and Nu'man, A.H.

Publication Growth by Year

Table 3. Analysis by Year

Year	Article
2023	2
2022	14
2021	17
2020	10
2019	3
2018	1

Scientific publications fluctuate yearly, sometimes increasing and sometimes decreasing in specific years. The highest number of articles on Pentahelix was published in 2021, with 17 articles, followed by 14 in 2022 and 10 in 2020. There is a significant difference

in publication numbers regarding Pentahelix in Scopus, particularly in 2019 and 2018, with only 3 and 1 articles, respectively. At the end of 2023, the author collected data (03/2023) and found two articles about Pentahelix published on the Scopus platform. Given its importance in this era, it is hoped that research on collaboration within the Pentahelix framework will continue to increase.

Annual Publication by Source

Based on data analysis using Biblioshiny, there are ten journal sources that record the largest number of scientific publications on the topic "Pentahelix" in the Scopus database. Information on the journal source that has the largest number of scientific publications on "Pentahelix" can be found in Figure 7.

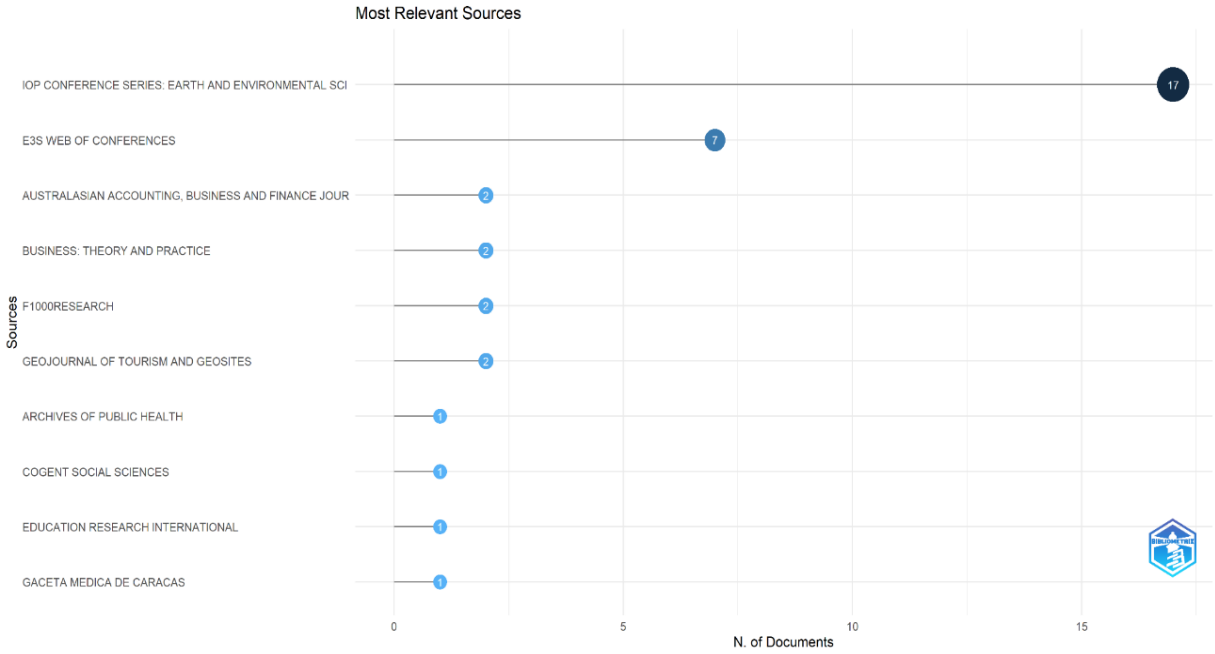

Figure 7. Analysis Based on Source on Biblioshiny

Based on the data in Figure 7 and Table 4, the most relevant sources in the context of the observed research are the I.O.P. Conference Series: Earth and Environmental Science, with 17 articles. This indicates that conferences in earth and environmental sciences serve as a significant platform for research related to the investigated topic. E3S Web of Conferences is also a significant source, with seven relevant articles. Meanwhile, several journals, such as Australasian Accounting, Business and Finance Journal, Business: Theory and Practice, and F1000Research, each contribute two articles, demonstrating diversity in the sources of information used in the research. Several sources contribute only one article, such as Archives of Public Health, Education Research International, and Journal of Sustainable Tourism, which

indicate that the observed topic receives attention from various research fields. This data highlights the importance of collaboration between conferences, journals, and other research platforms in supporting sustainable development and tourism research.

Table 4. Most Relevant Source

Sources	Articles
IOP CONFERENCE SERIES: EARTH AND ENVIRONMENTAL SCIENCE	17
E3S WEB OF CONFERENCES	7
AUSTRALASIAN ACCOUNTING, BUSINESS AND FINANCE JOURNAL	2
BUSINESS: THEORY AND PRACTICE	2
F1000RESEARCH	2
GEOJOURNAL OF TOURISM AND GEOSITES	2
ARCHIVES OF PUBLIC HEALTH	1
COGENT SOCIAL SCIENCES	1
EDUCATION RESEARCH INTERNATIONAL	1
GACETA MEDICA DE CARACAS	1
INDONESIAN JOURNAL OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE	1
INTERNATIONAL JOURNAL OF PROFESSIONAL BUSINESS REVIEW	1
INTERNATIONAL JOURNAL OF SUSTAINABLE DEVELOPMENT AND PLANNING	1
JOURNAL OF ASIAN FINANCE, ECONOMICS AND BUSINESS	1
JOURNAL OF SUSTAINABLE TOURISM	1
REGIONAL SCIENCE POLICY AND PRACTICE	1
REVISTA DE GESTAO	1
SCIENCE AND INNOVATION	1
SMART CITIES	1
SUSTAINABILITY (SWITZERLAND)	1
SYMMETRY	1

Journals Classification by Bradford Law

Table 5. Classification bt Bradford Law

SO	Rank	Freq	Cum Freq	Zone
1	2	3	4	5
IOP CONFERENCE SERIES: EARTH AND ENVIRONMENTAL SCIENCE	1	17	17	Zone 1
E3S WEB OF CONFERENCES	2	7	24	Zone 2
AUSTRALASIAN ACCOUNTING, BUSINESS AND FINANCE JOURNAL	3	2	26	Zone 2

1	2	3	4	5
BUSINESS: THEORY AND PRACTICE	4	2	28	Zone 2
F1000RESEARCH	5	2	30	Zone 2
GEOJOURNAL OF TOURISM AND GEOSITES	6	2	32	Zone 2
ARCHIVES OF PUBLIC HEALTH	7	1	33	Zone 3
COGENT SOCIAL SCIENCES	8	1	34	Zone 3
EDUCATION RESEARCH INTERNATIONAL	9	1	35	Zone 3
GACETA MEDICA DE CARACAS	10	1	36	Zone 3
INDONESIAN JOURNAL OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE	11	1	37	Zone 3
INTERNATIONAL JOURNAL OF PROFESSIONAL BUSINESS REVIEW	12	1	38	Zone 3
INTERNATIONAL JOURNAL OF SUSTAINABLE DEVELOPMENT AND PLANNING	13	1	39	Zone 3
JOURNAL OF ASIAN FINANCE, ECONOMICS AND BUSINESS	14	1	40	Zone 3
JOURNAL OF SUSTAINABLE TOURISM	15	1	41	Zone 3
REGIONAL SCIENCE POLICY AND PRACTICE	16	1	42	Zone 3
REVISTA DE GESTAO	17	1	43	Zone 3
SCIENCE AND INNOVATION	18	1	44	Zone 3
SMART CITIES	19	1	45	Zone 3
SUSTAINABILITY (SWITZERLAND)	20	1	46	Zone 3
SYMMETRY	21	1	47	Zone 3

Based on the clustering analysis of sources using Bradford's Law, three zones can be identified in the distribution of relevant scientific journals related to the observed research topic. The first zone consists of a single primary source, namely the I.O.P. Conference Series: Earth and Environmental Science, which has a frequency of 17 articles. The second, larger zone comprises sources with lower article frequencies, ranging from 2 to 7 articles, such as E3S Web of Conferences, Australasian Accounting, Business and Finance Journal, Business: Theory and Practice, F1000Research, and GeoJournal of Tourism and Geosites. The third zone represents sources with the lowest article contributions, each having only one article. This zone includes various journals such as Archives of Public Health, Cogent Social Sciences, Education Research International, and others. Therefore, this clustering analysis provides a clear overview of the distribution structure of relevant scientific literature sources related to the research topic, indicating that most of the information is available from a small number of primary sources, followed by a more significant number of secondary sources, and then by an even smaller number of tertiary sources.

Publications by Affiliate

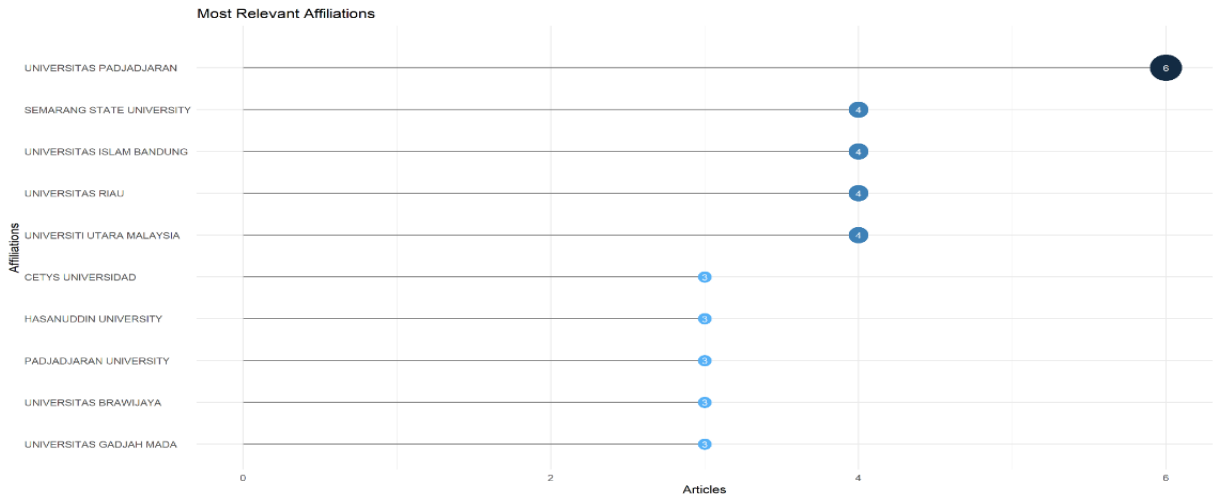

Figure 8. Analysis by Affiliate on Biblioshiny

Ten affiliates have the highest scientific publications on "Pentahelix" in the Scopus database. The affiliate that publishes the most scientific publications on "Pentahelix" is Padjajaran University. Based on Figure 8, it can be seen that Padjajaran University has published nine scientific publications. Furthermore, Semarang State University, Bandung Islamic University, Riau University, and Universiti Utara Malaysia have each published four scientific publications. With the same number, Hasanuddin University, Brawijaya University, and Gadjah Mada University have published three scientific publications.

Based on the analysis in Figure 8, the affiliated universities are dominated by large universities only. This shows that some other universities still do not discuss the "Pentahelix" collaboration much, where the topic of collaboration itself is a topic that will continue to develop with the development of the times. It is hoped that in the future, more universities will be affiliated to discuss the "Pentahelix" collaboration through scientific articles.

Relevance Based on Words (Most Relevant Words)

Figure 9. Analysis by Word on Biblioshiny

Table 6. Analysis Based on the Most Relevant Words

Words	Occurrences
Indonesia	8
Sustainable Development	7
Tourism	5
Human	3
Leisure Industry	3
Malaysia	3
Regional planning	3
Smart city	3

Based on the analysis of the most relevant words and keywords that appear consistently, as presented in Table 6, "Indonesia" appears the most, with eight occurrences highlighting this country's importance in sustainable development. This is also shown in Figure 9, where the word "Indonesia" appears in the largest size in the word cloud, highlighting the main focus of the literature analysis. Furthermore, "sustainable development" and "tourism" appear 7 and 5 times, respectively, indicating a strong focus on efforts to integrate tourism into sustainable development strategies. "Human" also appears three times, highlighting the humanitarian aspects of sustainable development and tourism. In addition, "leisure industry," "regional planning," "Malaysia," "regional planning," and "smart city" appeared three times each. This

article provides a comprehensive overview of the most relevant issues in the literature related to sustainable development and tourism, providing a solid foundation for further research and development in this area.

Publications Based on Country or Regional Relations

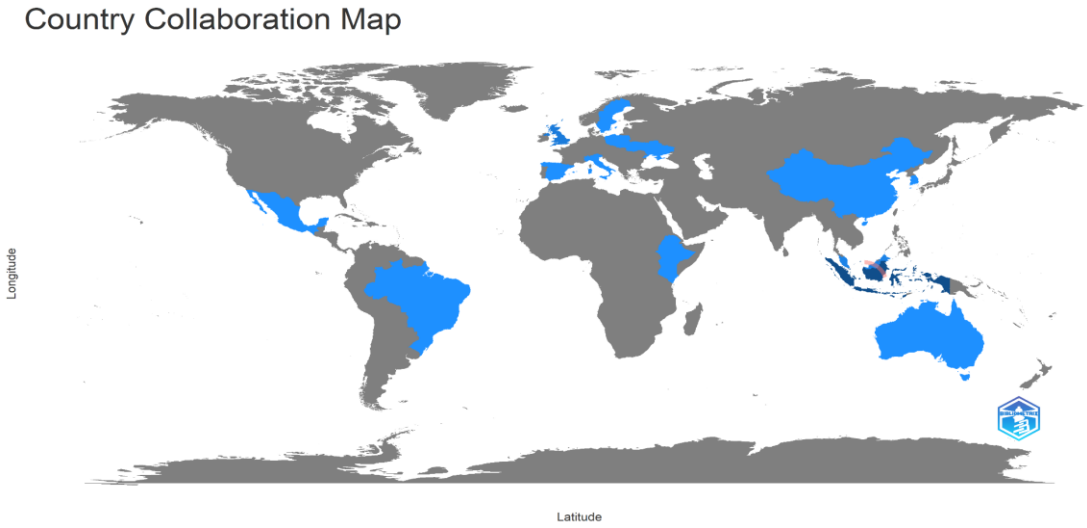

Figure 10. Analysis based on Regional/State Relations on Biblioshiny

Figure 10 shows that several countries have published scientific publications on "Pentahelix," namely Indonesia, Australia, China, Ethiopia, Kenya, Korea, Malaysia, Mexico, Spain, the United Kingdom, and Italy. A dark blue indicator indicates the number of publications about "Petahelix," and many of them come from Indonesia.

Table 7. Analysis based on Country/Regional Relations

From	To	Frequency
INDONESIA	AUSTRALIA	1
INDONESIA	CHINA	1
INDONESIA	ETHIOPIA	1
INDONESIA	KENYA	1
INDONESIA	KOREA	1
INDONESIA	MALAYSIA	2
KOREA	CHINA	1
MEXICO	SPAIN	1
UNITED KINGDOM	ITALY	1

Table 7 explains the citation relationship of a scientific article about "Pentahelix" published in several countries. Malaysia made the most citations, with two citations for scientific articles about "Pentahelix" originating from Indonesia.

Discussion

The research results regarding the collaborative scientific publication Pentahelix from 2018 to 2023 have several exciting findings. Firstly, the keyword Pentahelix is divided into 5 clusters, indicating variations in topics and research focus within the context of this collaboration. Secondly, the growth of scientific publications related to Pentahelix fluctuates each year. Research interests and focus in this collaborative field can change over time. These fluctuations may also reflect the dynamics and development within the collaboration domain among the involved actors. Thirdly, the IOP Conference Series: Earth and Environmental SCI journal is the most prolific source of publications related to Pentahelix. This indicates significant research interest and activity in collaboration within the context of environmental and earth sciences. Fourthly, Universitas Padjajaran is the affiliation that publishes the most scientific publications on Pentahelix. This demonstrates the university's active role in advancing research and collaboration in this field. Fifthly, Indonesia has the highest number of scientific publications on Pentahelix collaboration. This reflects the active contribution of researchers and academics in Indonesia in this field. Australia, China, Ethiopia, Kenya, Korea, Malaysia, Mexico, Spain, England, Italy, and the United States have significantly contributed to scientific publications on this topic.

In general, the findings of this research indicate that the Pentahelix collaboration has attracted the interest of researchers from various countries. Fluctuations in scientific publication growth can be a concern for a better understanding of changing trends and research focus. In the evolving context, further in-depth research on Pentahelix collaboration would benefit practitioners in government sectors and related fields by keeping up with the times and enhancing their understanding of interactor collaboration.

V. Conclusion

From the author's findings regarding the collaborative scientific publication Pentahelix published from 2018 to 2023, it can be concluded that the keyword Pentahelix is divided into 5 clusters. The growth of this scientific publication fluctuates each year. The collaboration Pentahelix primarily originates from the journal IOP Conference Series: Earth and Environmental SCI, with publishing affiliation held by Universitas Padjajaran Indonesia is the country with the highest number of scientific publications related to the Pentahelix

collaboration, followed by Australia, China, Ethiopia, Kenya, Korea, Malaysia, Mexico, Spain, the United Kingdom, Italy, and the United States.

Based on the research findings presented in the previous paragraph, we can understand that over the past six years, the growth of research publications related to the Pentahelix collaboration has been fluctuating. In the last three years, it has declined. In a dynamic world, collaboration among actors is necessary so that every individual or community can experience ease amidst uncertainty, with the assistance of relevant parties playing their roles. Therefore, further research on the Pentahelix collaboration, explicitly addressing this perspective in more detail, is deemed necessary The future research development can delve deeper into the fluctuations of scientific publication growth over a more extended period, with a focus on the factors influencing it A more comprehensive analysis of changes in trends and patterns within the Pentahelix collaboration can provide a better understanding of the dynamics of interactor relationships within the Pentahelix framework.

Furthermore, more focused research can be conducted to identify effective collaboration strategies between universities and other actors in creating a sustainable research ecosystem in the Pentahelix field. This may involve case studies on successful collaboration practices and barriers to developing Pentahelix collaborations. By gaining a deeper understanding of collaboration dynamics and influencing factors, future research development is expected to contribute more significantly to strengthening cross-sector cooperation in achieving sustainable development goals.

VI. Bibliography

Barney, J. B., & Harrison, J. S. (2020). Stakeholder Theory at the Crossroads. *Business & Society*, *59*(2), 203–212. https://doi.org/10.1177/0007650318796792

Capetillo, A., Abraham Tijerina, A., Ramirez, R., & Galvan, J. A. (2021). Evolution from triple helix into penta helix: the case of Nuevo Leon 4.0 and the push for industry 4.0. *International Journal on Interactive Design and Manufacturing (IJIDeM)*, *15*(4), 597–612. https://doi.org/10.1007/s12008-021-00785-x

Chamidah, N., Guntoro, B., & Sulastri, E. (2020). Marketing Communication and Synergy of Pentahelix Strategy on Satisfaction and Sustainable Tourism. *The Journal of Asian Finance, Economics and Business*, *7*(3), 177–190. https://doi.org/10.13106/jafeb.2020.vol7.no3.177

d'Angella, F., & Go, F. M. (2009). Tale of two cities' collaborative tourism marketing: Towards a theory of destination stakeholder assessment. *Tourism Management*, *30*(3), 429–440. https://doi.org/10.1016/j.tourman.2008.07.012

Freeman, R. E., Dmytriyev, S. D., & Phillips, R. A. (2021). Stakeholder Theory and the Resource-Based View of the Firm. *Journal of Management*, *47*(7), 1757–1770. https://doi.org/10.1177/0149206321993576

Hardianto, W. T., Sumartono, Muluk, M. R. K., & Wijaya, F. (2019). PentaHelix synergy on tourism development in Batu, East Java. *International Journal of Innovation, Creativity and Change*, *10*(6), 137–149.

Hidayat, M., Rozak, R. W. A., Kembara, M. D., & Baihaki, E. (2021). Pentahelix synergy in realizing ecovillage values in the Cijalingan village community of Cicantayan Sukabumi district. *IOP Conference Series: Earth and Environmental Science*, *683*(1), 012135. https://doi.org/10.1088/1755-1315/683/1/012135

Kelvin, K., Widianingsih, I., & Buchari, R. A. (2022). Kolaborasi Model Penta Helix Dalam Mewujudkan Smart Village Pondok Ranji. *J-3P (Jurnal Pembangunan Pemberdayaan Pemerintahan)*, 1–15. https://doi.org/10.33701/j-3p.v7i2.2587

Laplume, A. O., Sonpar, K., & Litz, R. A. (2008). Stakeholder Theory: Reviewing a Theory That Moves Us. *Journal of Management*, *34*(6), 1152–1189. https://doi.org/10.1177/0149206308324322

Mu'alim, Z. A., & Habibussalam, H. (2021). Tinjauan Literatur Sistematis Terhadap Pembangunan Kepariwisataan Yang Berkelanjutan. *J-3P (Jurnal Pembangunan Pemberdayaan Pemerintahan)*, 171–192. https://doi.org/10.33701/j-3p.v6i2.1756

Setianingsih, E. L., Herawati, A. R., & Hariani, D. (2022). Penta Helix Model Tourism Development In The City of Palembang. *Devotion : Journal of Research and Community Service*, *3*(13), 2221–2226. https://doi.org/10.36418/dev.v3i13.274

Soemaryani, I. (2016). Pentahelix model to increase tourist visit to bandung and its surrounding areas through human resource development. *Academy of Strategic Management Journal*, *15*(3), 249–259.

Stylidis, D., Belhassen, Y., & Shani, A. (2015). Three Tales of a City. *Journal of Travel Research*, *54*(6), 702–716. https://doi.org/10.1177/0047287514532373

Supriyanto, & Iskandar, F. (2022). Implementasi Kolaborasi Model Pentahelix Dalam Rangka Meningkatkan Pemberdayaan Umkm Ex Lokalisasi Dolly Pada Masa Pandemi Covid 19 (Studi Kasus DS.Point). *Governance : Jurnal Kebijakan Dan Manajemen Publik,* , *12*(1), 71–91.

Theodoulidis, B., Diaz, D., Crotto, F., & Rancati, E. (2017). Exploring corporate social responsibility and financial performance through stakeholder theory in the tourism industries. *Tourism Management*, *62*, 173–188. https://doi.org/10.1016/j.tourman.2017.03.018

Van Eck, N. J., & Waltman, L. (2014). CitNetExplorer: A new software tool for analyzing and visualizing citation networks. *Journal of Informetrics*, *8*(4), 802–823. https://doi.org/10.1016/j.joi.2014.07.006

Vani, R. V., Priscilia, S. O., & Adianto, A. (2020). Model Pentahelix Dalam Mengembangkan Potensi Wisata di Kota Pekanbaru. *Publikauma : Jurnal Administrasi Publik Universitas Medan Area*, *8*(1), 63–70. https://doi.org/10.31289/publika.v8i1.3361

Velby, A. C., & Yuadi, I. (2023). Meta-Analitik Collaborative Governance Dalam Pembangunan Berkelanjutan. *J-3P (Jurnal Pembangunan Pemberdayaan Pemerintahan)*, 19–41. https://doi.org/10.33701/j-3p.v8i1.3455