

Fostering Sustainable Development Goals (SDGs) innovation at the Local Higher Education Institution in “Knowledge” trend a bibliometric analysis over the past eight years

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Abstract: Fostering Sustainable Development Goals (SDGs) innovation is a significant conversation at the international level. Meanwhile, public institutions play a crucial role in the science of public administration in the context of SDGs, particularly universities, which are important in producing innovation based on these goals. However, to produce innovation, it is necessary to map scientific papers within the relevant knowledge domains. By using the bibliometric review method, 74 papers were identified. This study showed that there were still relatively few scientific papers that supported fostering SDGs in Higher Education, both in terms of quality and quantity. This was particularly true for discussion on achieving SDGs 1, 2, 3, 5, 6, 7, 8,10, 12, 13, 14, 15, and 16 as well as scientific papers based on multidisciplinary science.

1 Introduction

The essential meaning of sustainable development is the principle of meeting current needs without compromising the ability of future generations to meet their own needs [1, 2]. A more nuanced examination of sustainable development showed three core tenets, namely environmental protection, social inclusion, and economic growth. The sustainable development paradigm has originated globally, transitioning from Millennium Development Goals (MDGs) to Sustainable Development Goals (SDGs). This change was initiated by countries during the public space discussions at the UN (United Nations) General Assembly in 2015 [3]. The ambition of these countries can be seen in their vision to achieve sustainable development by 2030 [1]. From the discussions, 17 goals emerged, ranging from *Zero Poverty to Partnership for the Goal* [4]. The presence of the 17 goals correlates with the governance perspective. The importance of governance studies in the field of SDGs has been explored through the study, “Modern Concepts of Public Administration in the Context of Sustainable Development” [5]. In this study, the problem of SDG in the context of public administration science can be achieved when the roles of the state, public, private, and community institutions in governance are properly implemented. Public institutions play a significant role and have scientific independence. The establishment of SDGs centers in 47 universities in Indonesia showed their independence in science and their role as centers of

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excellence [6]. Moreover, universities can generate or improve innovation for the future through science aimed at sustainable development [7–13]. More specifically, innovation in higher education targets the goals of SDGs [2, 14] where innovation encompasses not only products but also science-oriented towards sustainable development [15, 16].

Many publications systematically used literature review mapping with a bibliometric method to produce innovation oriented towards sustainable development. Substantive studies in higher education [11, 15–20] showed innovation was essential for creating sustainable development. Although these studies do not specifically discuss the results of innovation in achieving SDGs, they emphasize the significance of collaboration with businesses and the causal relationship between education and innovation. In addition, there are two key SDG indicators, namely SDG 9 related to "industry, innovation and infrastructure" and SDG 4 related to "quality education". Based on previous studies, 1) The literature review showed the urgency of innovation-oriented towards sustainable development, which can take the form of science, 2) Universities played a crucial role in producing scientific innovation, emphasizing their status as centers of excellence, 3) To produce science-based innovation, bibliometric methods can be implemented, 4) The discussion of innovation often specified achieving certain SDG goals. However, there was no comprehensive discussion that addressed the science-based research gap in university innovation to achieve SDGs. This gap can be used as a basis for academics and practitioners to produce quality scientific papers as a precursor to innovation. Therefore, the expert is interested in the title *"Fostering Sustainable Development Goals (SDGs) innovation at the Local Higher Education Institution in "Knowledge" trend a bibliometric analysis over the past eight years"*

2 Methods

A systematic literature review method was used due to the synthesis and comparison of evidence utilized for practice and policy information [21]. The type of systematic literature review used in this study was bibliometric, which utilized statistical and quantitative methods in aspects that focus on 1) descriptive statistical analysis, 2) performance analysis, 3) cluster mapping, and 4) science mapping. This method strengthens the theoretical and practical aspects of the study [22]. Furthermore, studies that used bibliometrics have been widely conducted, including those on sustainable development leading to energy management [15], environmentally friendly financial processes [16], research trends in the creative industry [23], trends related to financial literacy [24], as well as bibliometric surveys in the field of innovation and universities [11, 18–20]. Most of the studies used Scopus and Web of Science for data mining. In addition, the use of Vos Viewer facilitated the mapping of the resulting data. The steps carried out consisted of 3 stages:

2.1 The academic database search, started with the Scopus search engine using ALL and other relevant keywords.

In this stage, 352 papers were found in the Scopus search engine. The resulting research document was as follows: *ALL ("Sustainable Development" OR sdfs OR sustainability AND "local higher education institution" OR "local university" AND innovation).*

2.2 Included data extraction and software analysis.

This step started with the limitation and screening of the model, reducing the number of papers to 74. The resulting research document was as follows: *ALL ("Sustainable Development" OR sdgs OR sustainability AND "local higher education institution" OR "local university" AND innovation) AND PUBYEAR > 2016 AND PUBYEAR < 2025 AND (LIMIT-TO (SUBJAREA , "SOCI")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (OA , "all"))*

2.3 The results and content analysis.

The results were obtained by analyzing papers from 2017-2024, which were then further examined using data from Scopus searches and VosViewer analysis.

3 Result and Discussion

3.1 Discussing total citations, total papers and comparing total citations and total papers

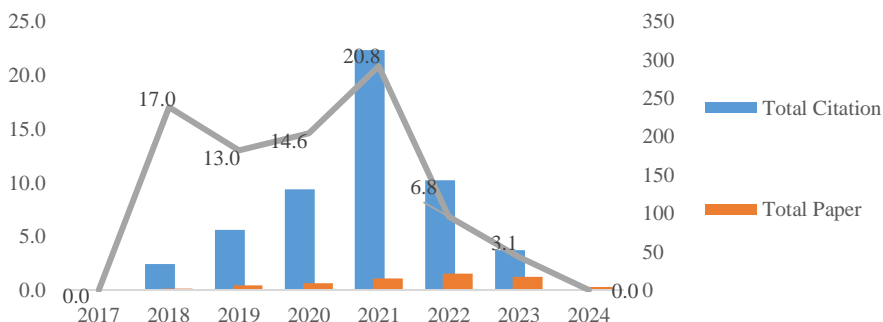


Fig. 1. Comparison of the Number of Papers and Citations for 2017-2024

The number of citations showed that the quality of the journal was improving. Figure 1 shows that the number of papers had different trends in the number of citations. Additionally, there was a unique phenomenon where in 2021, there were 15 papers with a total of 312 citations, contrasting with 2022, which produced 21 papers but only 143 citations. Also, 2021 had the highest average number of citations per paper, with each paper receiving an average of 20.8 citations. The data showed that the second-highest average number of citations per paper occurred in 2018, with each paper receiving an average number of 17 citations. The minimum number of citations was observed in 2017 and 2024. Empirically, no citations were generated in 2017 because no papers were produced that year, while 4 papers were produced in 2024. Based on the data, it can be concluded that the number of papers produced did not lead to a large number of citations. Secondly, the number of citations can be influenced by the quality of a paper, and thirdly, the number of citations was influenced by the year in which the paper was published.

Table 1. Journal Name, Number of Papers, Citation Score, SJR, and SNIP in 2017-2024

No	Journal Name	Publisher	Rank	Number of Paper	Cite Score
1	Sustainability Switzerland	MDPI	Q1	31	6.8
2	Journal of Open Innovation Technology Market And Complexity	Elsevier	Q1	4	11
3	International Journal of Emerging Technologies In Learning	International Association of Online Engineering	(Disc 2024)	2	5
4	Journal of Rural Studies	Elsevier	Q1	2	9.8
5	Stem Education	American Institute of Mathematical Sciences	Q4	2	1.1
6	Studies in Higher Education	Taylor & Francis	Q1	2	10.2
7	Asian Journal of University Education	UiTM Press	Q2	1	4.3
8	Chinese Geographical Science	Science China Press	Q1	1	6.1
9	Cities	Elsevier	Q1	1	11.2
10	City Culture and Society	Elsevier	Q1	1	4

Table 1 shows that among the 74 papers, about 37 were related to SDGs in the framework of higher education institutions. Out of the 37 publishers, 10 have the highest number of papers produced. The journal *Sustainability Switzerland* ranked first in terms of the number of papers, with 31 papers in total and a Q1 ranking. The journal *Cities* ranked first in the Citescore category with a score of 11.2 and an SJR of 1.733, while *Studies in Higher Education* ranked first in the SNIP category with a score of 2.628. Meanwhile, the *Stem Education Journal*, despite having a Q4 ranking, managed to rank fifth in SDGs paper analysis ranking.

Table 2. Table of Number of Citations, Publisher, and Result

Number of Citations	Publisher/ Rank	Result
69 Cited; 2020; [25]	MDPI/Q1	Social innovation management for Indonesian Micro, Small, and Medium Enterprise (MSMEs) was implemented by LIPI to create sustainable economic development in East and West Java. In East Java, the role of local universities is very important in filtering assessments related to business capital, income, and technology needs. However, there is still a need to strengthen cooperation between state and non-state actors in participating in decision-making in the field of MSMEs social innovation in Indonesia.
27 Cited; 2022; [26]	Taylor & Francis/Q1	Innovation in the development of town/village to become sustainable tourism areas can be implemented through cooperation between the role of local universities and town/village governments.
26 Cited; 2021; [27]	MDPI/Q1	There is no concept of innovation, but there are updates on high-quality entrepreneurship modules leading to sustainable entrepreneurship (leading to innovation) resulting from cooperation between universities and overseas partners. However, the weakness occurs when local universities do not partner with overseas universities.
24 Cited; 2019; [7]	MDPI/Q1	Innovation in the development of smart grids to support sustainable energy can be strengthened by patent collaborations (a type of cooperation) between universities, research institutions, and companies. The emphasis is still on the small role of universities.

Number of Citations	Publisher/ Rank	Result
23 Cited; 2021; [28]	Taylor & Francis/Q1	Innovation can be created in higher education with the start of the transformation of hybrid educational design in the context of globalization, pandemic turbulence, and sustainable living. With the presence of this design, specifically in systems, institutions, and resources, the hope is not to debate knowledge scientifically, but to promote the innovation produced by higher education institutions.
20 Cited; 2022; [29]	Springer/Q1	Innovation in the form of digitally based educational tools, mobile augmented reality (m AR) to support online learning in higher education can improve learning outcomes.

Table 2 shows that among the 74 papers related to innovation, SDGs, and higher education, there were 6 papers with the highest number of citations, published by MDPI, Taylor & Francis, and Springer, all of which have Q1 quality. Therefore, the 6 papers were of good journal quality. Secondly, the journals with the highest number of citations emphasized the discussion of innovation management applied by LIPI for MSMEs to improve a sustainable economy. At this point, the role of universities is more about collaboration in selecting quality MSMEs to be funded in the future. Thirdly, among the 6 papers, 5 papers discussed innovation [7, 25, 26, 28, 29], while 1 paper did not explicitly discuss innovation, but included updates that led to innovation [27]. Also, there is the importance of the role of universities in the field of innovation, including collaboration with research institutions [25], local governments [26], or both [7]. There was a specific discussion related to higher education institutions, which generated innovation through hybrid learning designs [28], sustainable entrepreneurship concepts [27], and innovative digital-based learning tools [29]. Therefore, it can be observed that the urgency of higher education in producing innovation to support SDGs covered different aspects, including the role of universities in achieving several SDGs, namely SDG 3 on good health and well-being, SDG 9 on industry, innovation, and infrastructure [25, 26], SDG 4 on quality education [27, 28, 29], SDG 8 on decent work and economic growth [25], as well as SDG 17 on partnership for the goals [25, 26]. In this context, it can be observed that impactful publications on sustainable development can be produced through multidisciplinary science, particularly on topics that are still under-explored.

3.2 Subject area

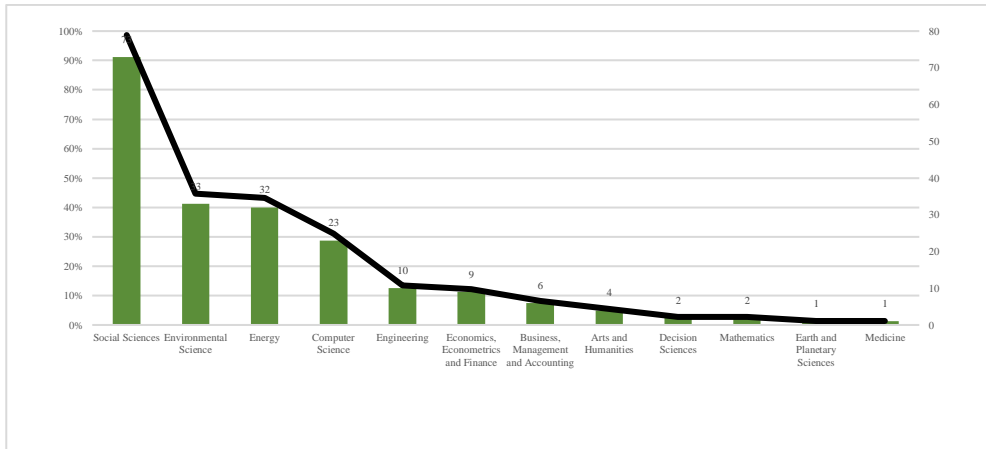


Fig. 2. Publication Trends 2017-2024 based on Subject Area

Based on social science keywords, 74 papers covered various content discussions. The number of papers discussing social sciences was 99%, environmental sciences were 45%, energy was 43%, computer science was 31%, mechanical engineering were 14%, economics, econometrics, and finance were 12%, business, management, and accounting were 8%, arts and humanities were 5%, decision sciences was 3%, mathematics was 3%, earth and planetary sciences was 1%, and medicine 1%.

3.3 Content analysis Based on Cluster

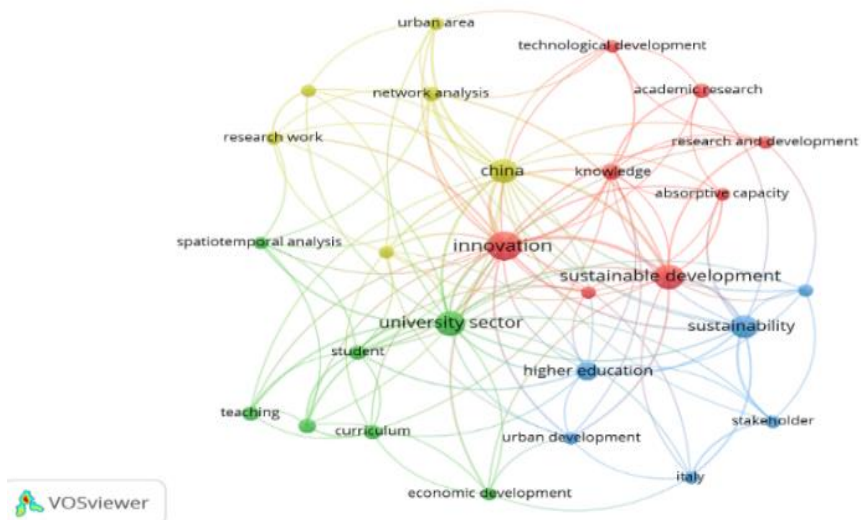


Fig. 3. Network Visualization 74 Paper SDGs based on VosViewer

Based on the 74 papers, there were about 4 clusters that discussed SDGs and innovation in higher education. The four clusters were divided by the colors red, blue, green, and yellow. Moreover, each cluster described various topics often discussed in the papers. Cluster 1 in red color had 26 papers with 8 keywords. Innovation had 17 papers [7, 8, 32–38, 9–13, 17, 30, 31], Sustainable Development had 12 [7, 8, 42, 43, 9–13, 39–41], Knowledge had 5, Absorptive Capacity had 3 [9, 30, 39], Research and Development had 3 [8, 17, 41], Academic Research had 3 [28, 30, 44], Technological Development had 3 [17, 44, 45], and Decision Making had 3 papers. Cluster 2 in blue had 19 papers with 6 keywords. Sustainability had 10 papers [7, 13, 26, 30–40, 46–48], Higher Education had 7 [35, 48–53], Stakeholder had 3 [26, 46, 52], Urban Development had 3 [10, 12, 53], Italy had 3 [12, 26, 46], and Government had 3 papers [41, 52, 54].

Cluster 3 in green had 19 papers with 7 keywords. University Sector had 12 papers [18, 26, 55, 56, 27, 33, 36, 37, 40, 41, 49, 53], Curriculum had 4 [35 57–59], student had 4 [27, 35, 36, 49], Teaching had 4 [18, 36, 58, 60], Economic Development had 3 [12, 33, 59], Spatio-temporal analysis had 3 [27, 34, 56], and Entrepreneur had 4 paper [27, 36, 57, 59]. Cluster 4 in yellow had 15 papers with 6 keywords. China had 11 papers [7, 9, 61, 34, 36, 37, 41–43, 45, 52], Network analysis had 4 [7, 34, 42, 45], Urban area had 3 [31, 55 61], Research work had 3 [31, 55, 62], Strategic approach had 3 [10, 35, 55], and finally the questionnaire survey had 3 papers [10, 37]. Knowledge in the areas of innovation, higher education, and sustainable development was in cluster 1, where the keyword ‘knowledge’ was not very dominant. To further explore the keyword ‘knowledge,’ the relationship in the field of innovation, higher education, and sustainable development was presented in Figure 4.

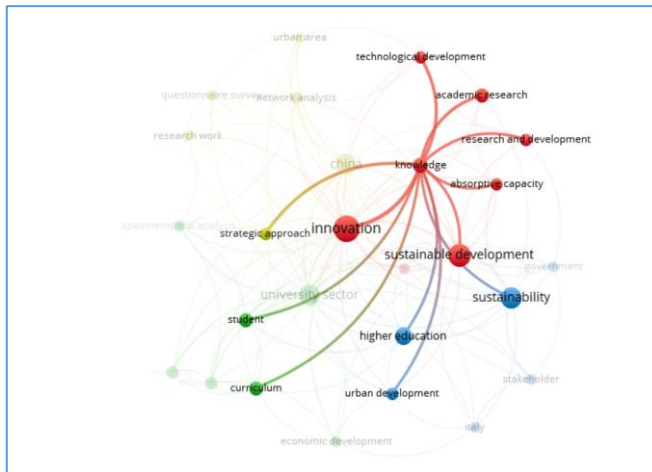


Fig. 4. Relationship with science

Figure 4 shows there was a relationship between science and the keywords innovation, sustainable development, sustainability, higher education, urban development, curriculum, students, strategic approach, absorptive capacity, technological development, academic research, as well as research and development. At least 5 papers included keywords such as innovation, sustainable development, sustainability, higher education, urban development, curriculum, student, technological development, academic research and development. Moreover, one discussion included studies related to international events that provide knowledge to be developed into sustainable innovation design for the regions in collaboration with local universities [10]. Another study examined Gen Z's knowledge related to e-wallets,

showing a significant gap in understanding among Gen Z [44]. This study produced different knowledge access channels for companies, with or without investment, which can generate SOI to increase future investment [30]. Additionally, it explored the development of a knowledge base that can be used to promote the development of sustainable technology [17]. Based on these data, it can be observed that 1) Science can promote the production of innovation and implementation of the use, and 2) Among the four clusters, only 5 papers addressed knowledge, showing that many areas of research related to innovation production remained unexplored, and 3) Among these 5 papers, the achievements related to SDGs were substantively related to SDGs 9, 11, and 17.

4 Conclusion

In conclusion, a high number of citations for a paper and a high publisher ranking showed good quality and significantly contributed to advancing science and creating innovation in higher education. Based on the papers of the highest quality, it was evident that they can support the achievement of SDGs 4, 9, and 17. Furthermore, in terms of knowledge, achievements were particularly evident in SDGs 9, 11, and 17. It can be observed that there was a gap in the quality of studies related to higher education innovation, particularly concerning achieving SDGs through knowledge. There was a research gap in achieving SDGs 1, 2, 3, 5, 6, 7, 8-10, 12, 13, 14, 15, and 16, with limited use of knowledge as a basis for producing innovation. Therefore, improvements in both quality and quantity can be achieved through scientific collaboration between social sciences and other subjects. In addition, the subject mapping showed limited collaboration between social sciences and subjects like Business, Management and Accounting, Arts and Humanities, Decision Sciences, Mathematics, Earth and Planetary Sciences, as well as Medicine.

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