

The role of universities in realizing sustainability: Analysis of UI GreenMetric contributions and publications related to sustainability

Riri Fitri Sari^{1*}, Yogi Andrian Sidiyanto², and Jauzak Hussaini Windiatmaja¹

¹Department of Electrical Engineering, Universitas Indonesia, Depok, 16424, Indonesia

²UI GreenMetric, Universitas Indonesia, Depok, 16424, Indonesia

Abstract. This paper discusses how UI GreenMetric and sustainability publications interact to strengthen universities' contributions to global sustainability. It examines data from six universities, including Wageningen University & Research (Netherlands), Universitas Indonesia (Indonesia), Universitas Diponegoro (Indonesia), University of Malaya (Malaysia), Universitas Airlangga (Indonesia), and Universitas Negeri Surabaya (Indonesia), linking UI GreenMetric rankings with sustainability-related publications. Results in the 2022 UI GreenMetric Rankings show that Wageningen University & Research secured the top position, with an average of 2395 sustainability-related publications in the last three years and 3221 publications from Elsevier. Universitas Indonesia has 4725 total publications from Elsevier and 1525 publications related to sustainability from UI GreenMetric data. Other universities, such as Universitas Diponegoro, University of Malaya, Universitas Airlangga, and Universitas Negeri Surabaya, also showcased their commitment to sustainability through their publication records. This study concludes that higher-ranked universities tend to produce more sustainability-focused publications, indicating a positive relationship between sustainability commitment and research impact. Institutions with elevated UI GreenMetric rankings consistently prioritize sustainability, increasing research productivity in this field.

1 Introduction

The issues related to sustainability and the achievement of the Sustainable Development Goals (SDGs) have garnered global attention in recent decades [1]. Sustainability has emerged as one of the most pressing challenges facing humanity and our planet today [2]. The increasingly evident impacts of climate change, declining biodiversity, social inequality, and various other issues serve as reminders of the urgent need for immediate and serious action to protect our environment and enhance human well-being worldwide [3-4]. The SDGs agenda, adopted by the United Nations in 2015, established an ambitious

* Corresponding author: riri@ui.ac.id

framework consisting of 17 goals that encompass various aspects of human life, ranging from poverty eradication to environmental protection [5-8]. The seventeenth goals of SDGs are shown as shown in Figure 1. The SDGs aim to create a fairer, more sustainable, and inclusive world [9]. However, achieving these goals is not a straightforward task; it necessitates global cooperation, innovation, and in-depth research to address the diverse challenges faced in bringing about positive change [10-11].

One of elements in addressing these challenges is the crucial role played by universities worldwide. Universities have the potential to serve as centers of innovation, knowledge, and advocacy in the effort to achieve sustainable development [12-13]. Universities possess the capacity to generate in-depth and relevant scientific research in various fields related to sustainability, from environmental science to social economics [14]. Moreover, universities also play a role in educating future generations, who will be the leaders of tomorrow in the pursuit of sustainable development goals [15-16]. Integrated sustainability education in university curricula offers opportunities for students to comprehend the complexities of sustainability issues, develop critical thinking skills, and ignite their leadership spirit [17]. Universities can also serve as role models in implementing sustainable practices on their campuses, inspiring positive actions in society. Universities can become influential agents of change by bridging the academic world with the private sector, government, and civil society organizations [18]. Collaboration between universities and external parties can facilitate the transfer of knowledge, technology, and best practices that support sustainable development [19]. Hence, universities have a significant responsibility in establishing and maintaining broad and synergistic networks to achieve sustainability goals more effectively.



Fig. 1. Sustainable Development Goals [7]

One initiative for measuring and assessing universities' contributions to environmental sustainability is UI GreenMetric. This initiative aims to evaluate the

sustainability performance of universities worldwide through six indicators, including setting and infrastructure, energy and climate change, waste, water, transportation, and education and research. UI GreenMetric indicators are related to the SDGs as shown in Figure 2. UI GreenMetric provides universities a platform to gauge their environmental impact and encourages enhancements in sustainable practices.

The participation of universities in UI GreenMetric creates opportunities for them to share information about their sustainable efforts and exchange experiences with universities around the world. This facilitates collaboration and learning among universities, aiding in the identification of best practices that can be applied in various contexts. Additionally, UI GreenMetric ranking provides incentives for universities to continually improve their sustainability efforts, as their ranking can impact their image and reputation both nationally and internationally.

The number of sustainability-related publications in the last three years is one of the UI GreenMetric indicators. Scientific publications related to sustainability constitute one crucial way in which universities can make substantial contributions to supporting sustainability issues. Universities often serve as hubs for scientific research and development, granting them access to in-depth knowledge across various aspects of sustainability [20]. Research and publications in the field of sustainability encompass diverse topics, ranging from climate change and renewable energy to environmental sustainability, food security, and social innovation [21]. These publications can furnish a robust scientific foundation for more effective policymaking and assist in addressing complex sustainability challenges. This paper discusses how UI GreenMetric and sustainability publications interact to strengthen universities' contributions to global sustainability.



Fig. 2. UI GreenMetric and SDGs [22]

2 Methods

In this study, data were collected from six universities: Wageningen University & Research (Netherlands), Universitas Indonesia (Indonesia), Universitas Diponegoro (Indonesia), University of Malaya (Malaysia), Universitas Airlangga (Indonesia), and Universitas Negeri Surabaya (Indonesia). The data encompassed several key variables, including university rankings in the 2022 UI GreenMetric, the average number of sustainability-related publications over the past three years (2020-2022) from UI GreenMetric data, and the total query data publications from Elsevier pertaining to sustainability over the same three-year period.

The study adopted a cross-sectional design, compiling information from these universities and sources to explore potential relationships between sustainability-related metrics and university rankings. To achieve this, data was collected from the specified sources (UI GreenMetric and Elsevier) for the selected universities and subsequently subjected to analysis. The analysis aimed to unveil any correlations or patterns between university rankings, sustainability-related publications, and query data publications.

3 Result and Discussion

In Table 1, a comprehensive comparison of six prominent universities is presented, highlighting their respective positions in the 2022 UI GreenMetric Ranking alongside key metrics related to sustainability publications. These universities include Wageningen University & Research in the Netherlands, Universitas Indonesia in Indonesia, Universitas Diponegoro in Indonesia, the University of Malaya in Malaysia, Universitas Airlangga in Indonesia, and Universitas Negeri Surabaya in Indonesia. The table encompasses critical data points such as their UI GreenMetric Ranks for 2022, the average number of sustainability-related publications spanning the last three years, and the total publication figures pertaining to sustainability from Elsevier over the same period. This comparative analysis offers valuable insights into the universities' commitment to sustainability and their contributions to the field through scholarly publications.

The subject areas for publications at each university, based on Scopus data, are shown in Figure 3. The figure illustrates that there is variation in the distribution of scholarly publications at each university. In general, it can be observed that all universities focus on broader fields of study, including science, technology, medicine, and social sciences. Wageningen University & Research has a strong emphasis on Agricultural and Biological Sciences (26.1%). University of Malaya, Universitas Indonesia, and Universitas Airlangga demonstrate their focus on Medicine, with respective subject area percentages of 26.1%, 25.4%, and 22.3%. Universitas Negeri Surabaya has a significant percentage in Physics and Astronomy (21.5%), while Universitas Diponegoro shows a strong commitment to Environmental Science (21.4%). Each university has a unique profile of subject areas, with some subjects being their primary focus, reflecting their specialization and commitment in particular fields of study.

The comparison between the number of publications from UI GreenMetric data and Elsevier is as shown in Figure 4, with universities arranged from left to right based on their rankings in 2022 UI GreenMetric. Wageningen University & Research from the Netherlands stands out as the top performer in the 2022 UI GreenMetric ranking, securing the first position. This suggests a strong commitment to sustainability practices

and policies, reflected in its top-tier ranking. Furthermore, the university's substantial average of 2395 sustainability-related publications over the last three years underscores its dedication to advancing knowledge in the field of sustainability. The university's high position in the UI GreenMetric ranking aligns with its prolific research output in this area.

In contrast, Indonesian universities, including Universitas Indonesia (UI), Universitas Diponegoro (UNDIP), Universitas Airlangga (UNAIR), and Universitas Negeri Surabaya (UNESA), exhibit lower rankings than Wageningen University & Research in the UI GreenMetric. While they face challenges in achieving higher positions in the sustainability ranking, their contributions to sustainability-related publications are noteworthy. For example, UI and UNDIP have impressive averages of 4725 and 4491 sustainability-related publications, respectively, over the last three years, indicating their active involvement in academic research on sustainability. These universities are leveraging their research capabilities to address sustainability issues despite their lower UI GreenMetric rankings. The University of Malaya from Malaysia, with a UI GreenMetric ranking of 50, occupies an intermediate position among the universities studied. Its average of 1284 sustainability-related publications demonstrates a significant commitment to research in sustainability. However, there is room for improvement in its UI GreenMetric ranking to align more closely with its research output.

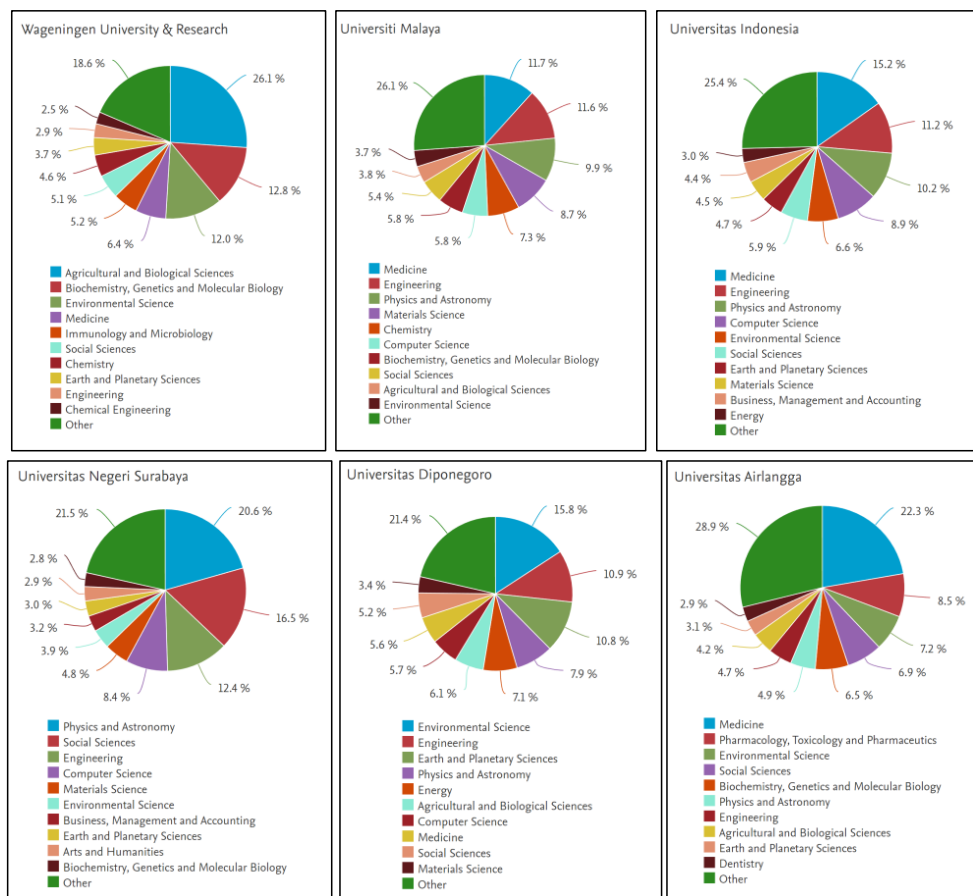


Fig. 3. University Subject Area Publications

Table 1. Comparison UI GreenMetric Rank and Universities Publications Related to Sustainability

No	University	Country	2022 UI Green Metric Rank	Average sustainability-related publications for last three years	Total publications data from Elsevier related to sustainability last 3 years
1	Wageningen University & Research	Netherlands	1	2395	3221
2	Universitas Indonesia	Indonesia	24	4725	1525
3	Universitas Diponegoro	Indonesia	29	1144	887
4	University of Malaya	Malaysia	50	4491	2000
5	Universitas Airlangga	Indonesia	83	1284	768
6	Universitas Negeri Surabaya	Indonesia	242	825	82

It's also worth noting that when considering the total publications data from Elsevier related to sustainability over the last three years, Wageningen University & Research, and the University of Malaya appear to have a more extensive presence in sustainability research globally, with 3221 and 2000 publications, respectively. In contrast, Universitas Negeri Surabaya (UNESA) lags significantly in this regard, with only 82 publications.

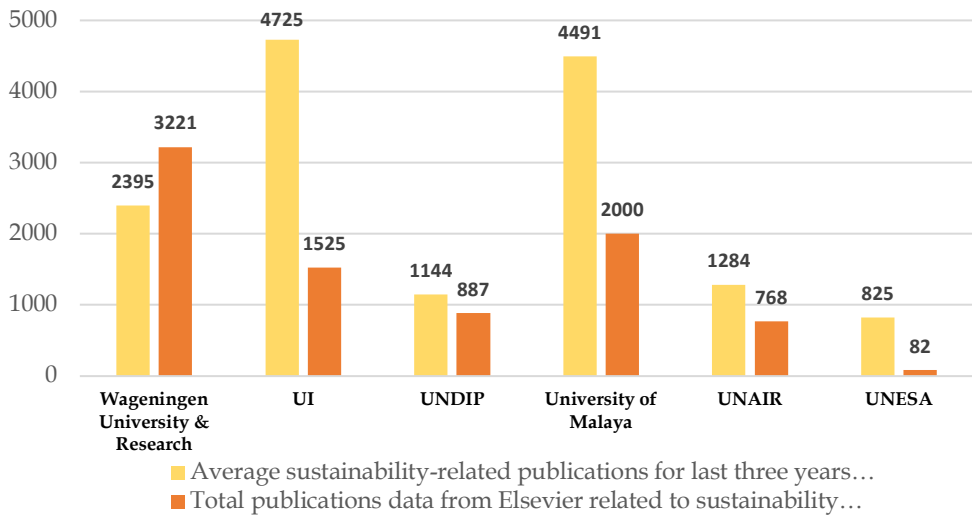


Fig. 4. Universities Publications Related to Sustainability

Universities with higher rankings have a greater number of publications related to sustainability. For instance, Wageningen University & Research had an average of 2395 sustainability-related publications in the last three years, while UNESA has only 82 publications. Therefore, there is a positive correlation between the ranking in UI GreenMetric, the number of sustainability-related publications from Elsevier, and the total sustainability-related publications in the last three years based on UI GreenMetric data. The more sustainability-related publications a university produces, the better its performance and ranking in UI GreenMetric tend to be. This indicates that universities with a stronger commitment to sustainability practices tend to have a greater impact in the field of sustainability research.

The university rankings in UI GreenMetric consistently reflect the level of focus and commitment of universities to sustainability. Universities with higher rankings in UI GreenMetric tend to have a stronger focus on sustainable initiatives and practices. This is reflected in the university's publications related to sustainability in the last three years. Universities with more publications related to sustainability tend to have a good ranking in UI GreenMetric. Universities with high rankings tend to produce more publications in the sustainability domain, indicating that they are actively involved in research and scientific publications that support sustainability practices. Therefore, there is a positive relationship between the ranking in UI GreenMetric, the number of sustainability-related publications based on Elsevier data, and the total sustainability-related publications in the last three years from UI GreenMetric data. This suggests that

universities with a stronger commitment to sustainability practices tend to have a greater impact in the field of sustainability research.

4 Conclusion

The global importance of sustainability and the pursuit of Sustainable Development Goals (SDGs) cannot be overstated, given the pressing challenges of climate change, biodiversity loss, and social inequality. Universities worldwide play a pivotal role in addressing these challenges by serving as hubs of innovation, knowledge, and advocacy. It generates essential scientific research, educates future leaders, and promotes sustainable practices. Initiatives like UI GreenMetric provide a platform for universities to assess their environmental impact, foster collaboration, and incentivize sustainability efforts. The strong correlation between UI GreenMetric rankings and sustainability-related publications underscores the influence of universities committed to sustainability. In a world where sustainability is paramount, universities are key agents of change and progress in the global pursuit of a fairer, more sustainable, and inclusive future.

References

1. F. Indana, R. W. Pahlevi, *Cogent Business & Management* **10**, 2 (2023)
2. C. Vasconcelos, N. Orion, *Sustainability* **13**, 3 (2021)
3. A. Hassoun, M. Prieto, M. Rodríguez, Y. Bouzembrak, H.J.P. Marvin, N. Pallarés, F. Barba, B. Punia, Sneh, V. Chaudhary, S. Ibrahim, G. Bono, *Food Research International* **162** (2022)
4. P. H. Raven, D. L. Wagner, *Proceedings of the National Academy of Sciences* **118**, 2 (2021)
5. Å. Persson, N. Weitz, M. Nilsson, *Comparative & International Environmental Law*. **25**, 1 (2016)
6. B. Reyers, E. R. Selig, *Nature Ecology & Evolution* **4**, 8 (2020)
7. 17 Goals of Sustainability Development Goals (2015). Available online at <https://sdgs.un.org/goals>
8. W. L. Filho, S. K. Tripathi, J. B. Guerra, R. Giné-Garriga, V. O Lovren, J. Willats, *International Journal of Sustainable Development & World Ecology* **26**, 2 (2019)
9. C. Cardoso, *Worldwide Hospitality and Tourism Themes* **12**, 6 (2020)
10. O. Larrinaga, N. Calvo, *Journal of Engineering and Technology Management* **35** (2015)
11. N. Alghamdi, A. den Heijer, H. de Jonge, *Int. J. Sustain. in HE6* **1**, 84 (2017)
12. L. Dryjanska, J. Kostalova, D. Vidović, *Higher Education Practices for Social Innovation and Sustainable Development* **6** (2022)
13. W. C., Clark, L. V. Kerkhoff, L. Lebel, G. C. Gallopin, *Proceedings of the National Academy of Sciences* **113**, 17 (2016)
14. R. Hansmann, H. A. Mieg, P. Frischknecht, *International Journal of Sustainable Development & World Ecology* **19**, 5 (2012)

15. M. Dzimińska, J. Fijałkowska, Ł. Sułkowski, *Sustainability* **12**, 11 (2020)
16. K. Kohl, C. Hopkins, M. Barth, G. Michelsen, J. Dlouhá, D. A. Razak, Z. Abidin Bin Sanusi, I. Toman, *International Journal of Sustainability in Higher Education* **23**, 2 (2022)
17. A. Amran, I. Jasin, M. Perkasa, et al., *Journal of Physics: Conference Series* **1521**, 4 (2020)
18. R. Scheyvens, G. Banks, E. Hughes, *Sustainable Development* **24**, 6 (2016)
19. J. Wang, M. Yang, P. Maresova, *Sustainability* **12**, 6 (2020)
20. B. C. Stahl, K. Chatfield, C. T. Holter, A. Brem, *Journal of Cleaner Production* **239** (2019)
21. M. G. Gómez Zermeño, L. Y. Alemán de la Garza, *International Journal of Sustainability in Higher Education* **22**, 2 (2021)
22. UI Green Metric World University Rankings; Methodology (2023). Available online at <https://greenmetric.ui.ac.id/publications/guidelines>