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A Systematic Review of Sustainable Higher Education Assessment Systems: Indicators, Models, and Future Directions

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Abstract: A Systematic Review of Sustainable Higher Education Assessment System: Indicators, Models, and Future Directions. **Objective**: Evaluation of the sustainability of higher education institutions (HEIs) has become a major focus in academia, especially as evaluation and ranking systems have evolved into increasingly complex ones. This study aims to provide a set of simple indicators for national policy makers to facilitate the measurement of progress towards sustainability in the higher education sector. **Methods**: Using a qualitative descriptive approach and a Systematic Literature Review (SLR) method, this study examines 16 types of higher education ranking systems and 16 previous research findings based on the UNEP sustainable higher education framework policy, in order to develop a set of indicators specific to the sustainable higher education sector. Articles were selected using the keywords "sustainable higher education" OR "Sustainable performance measurement" and "Performance indicator AND sustainable HEIs" through a systematic screening process that was in line with the inclusion criteria, including relevance to indicators for assessing sustainable higher education performance. **Findings**: The results of this study revealed areas that were not yet filled, especially in the criteria that combine all pillars holistically. Previous researchers assessed higher education using only part of the four pillars of sustainability identified by the UN, based on the reviewed literature, it was found that 37.5% of researchers used 3 pillars, 25% of researchers used 2 pillars and 37.5% of researchers used 1 pillar of sustainable higher education. This shows that there is an opportunity for further research that can integrate all aspects of higher education sustainability holistically. This multidimensional approach is important to provide a more complete and comprehensive picture of the performance and contribution of higher education in the context of sustainability. **Conclusion**: It is necessary to develop a comprehensive and integrative evaluation method, as well as identify performance indicators that measure the impact of interactions between pillars to provide a more comprehensive picture of higher education sustainability. Further research is also needed to bridge the gap in the literature and strengthen the multidimensional approach in assessing sustainable higher education performance.

Keywords: model, sustainability indicators, higher education, sustainability.

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INTRODUCTION

Higher education institutions (HEIs) have been identified as actors with considerable influence in shaping the mindset and values of the general public regarding sustainability issues through education, while also playing a significant role in the transition of society towards sustainable development patterns through research and

collaboration with community actors (Filho et al., 2020). The UN stipulates that a sustainable higher education institution must implement a sustainable higher education framework that includes 4 pillars of sustainability, namely teaching and research, Governance and administration, climate and environment and community engagement (United Nations Environment Programme, 2021). A comparative analysis of various performance indicators of sustainable higher education institutions was conducted (Findler et al., 2019) by reviewing the existing literature and found that holistic assessment of higher education institution performance according to UNEP or UN indicators is still very limited. Developments that focus on the quality performance of higher education institutions (HEIs) have recently been made to attract their stakeholders worldwide (Laziæ et al., 2021)(Ramzi et al., 2022). To improve stakeholder satisfaction, every university must maintain excellence in teaching and learning (Ramzi et al., 2022). The excellence of the university can be seen from the university ranking (Vernon et al., 2018).

Several institutions and university rankings have developed various indicators to assess university performance, most of which still focus on academic and research aspects only (Seyfried & Ansmann, 2018). Assessments that combine environmental, social, and governance (ESG) dimensions as a whole have not been widely implemented (Ceulemans et al., 2015). Meanwhile, assessments of external campus performance, such as CSR, have not been carried out comprehensively. The results of previous research by (Saputra & Charles, 2023) showed that there is a positive and strong influence of CSR on the reputation and brand loyalty of universities in attracting prospective new students in both public and private universities. Research conducted by (Rasoolimanesh et al., 2021), confirms the strong influence of CSR implementation on university reputation in the context of higher education. . (Ali et al., 2021) found that the integration of social responsibility initiatives into university policies and management, as well as stakeholder engagement, is essential to generate meaningful social impacts that are different from corporate social responsibility. Accreditation is not just a formal assessment, but also an important tool to improve the service and quality of educational institutions holistically. So that accreditation becomes an important pillar in achieving improved service quality in educational institutions (Indri Febrianti, 2023). Research conducted (Hashemi Petrudi et al., 2022) on performance measurement in higher education using 7 performance assessment criteria, where all criteria are indicators of internal campus performance based on activities carried out by lecturers, students, employees and campus management. Meanwhile, the assessment based on external factors was carried out by (Horan & O'regan, 2021) by creating a sustainability indicator framework to facilitate the measurement of progress towards sustainability in Higher Education and allow for meaningful international rankings, which include 12 KPIs, including education, governance, greenhouse gas emissions, on-site energy, research, solid waste, travel, and water, which are assessed based on data availability, in line with the research conducted by (Pizzutilo & Venezia, 2021) also drafted and proposed 12 comprehensive criteria for modeling social responsibility, integration of responsibility/sustainability in modern higher education. Based on the research above, it can be seen that there has been no discussion on the assessment of higher education performance that is carried out simultaneously for internal and external factors.

This study aims to conduct a systematic review of sustainable university ranking mechanisms and to trace key milestones, trends

and changes over time, thus highlighting the evolution of these techniques. In addition, this study aims to assess the contribution of peer-reviewed sustainable university performance journals to the understanding of sustainable university ranking techniques and emphasize their role in shaping relevant discourse and disseminating knowledge. In addition, this study aims to identify and present indicators of sustainable university assessment indicators. The focus is on showing performance improvement, improving the quality of universities and university graduates.

Finally, this study seeks to contribute to the field of sustainable university performance by proposing a sustainable university performance model that considers the diversity of methodologies in the higher education literature. Overall, this study aims to provide a holistic understanding of the historical context, current contributions, practical applications and indicators of sustainable university assessment indicators. This study is expected to motivate researchers involved in higher education research projects and explore the criteria of sustainable university assessment techniques. To answer its objectives, this study answers the following research questions:

1. How is the history of the evolution of the sustainable higher education ranking model in the world?
2. How do university performance journals reviewed by university researchers contribute to the understanding of sustainable higher education?
3. What indicators describe the assessment of sustainable higher education?

METHOD

This study uses a qualitative descriptive approach with the Systematic Literature Review (SLR) method which aims to identify and analyze research trends on indicators of sustainable higher education assessment in reputable journals or publications sourced from Web of Science, Scopus, ScienceDirect and Google Scholar published from 2018-2023. The chosen research design provides a systematic framework for selecting, filtering, and analyzing relevant literature in depth.

The literature search strategy uses the keywords "sustainable higher education" OR "Sustainable performance measurement" and "Performance indicator AND sustainable HEIs" through a systematic filtering process that is in line with the inclusion and exclusion criteria, including relevance to the indicators for assessing sustainable higher education performance. The Prisma method is used to explain the stages in the literature search. Figure 1 shows the stages of the literature search as follows:

Identification

By using the keywords above, articles were obtained that discuss the performance of sustainable higher education with a total of 865 articles, including books, conference proceedings, journals. The university ranking system obtained 16 university ranking systems obtained from the web.

Screening

Initial screening was carried out by removing all sources from book chapters, proceedings and taking all articles published between 2018-2023 that discussed the performance of sustainable higher education, so that a total of 141 publications and 16 sustainable higher education ranking systems were obtained.

Figure 1 is a PRISMA flowchart of the systematic literature review process to identify, screen, and select articles on sustainable higher education performance assessment models in journals (2018-2023).

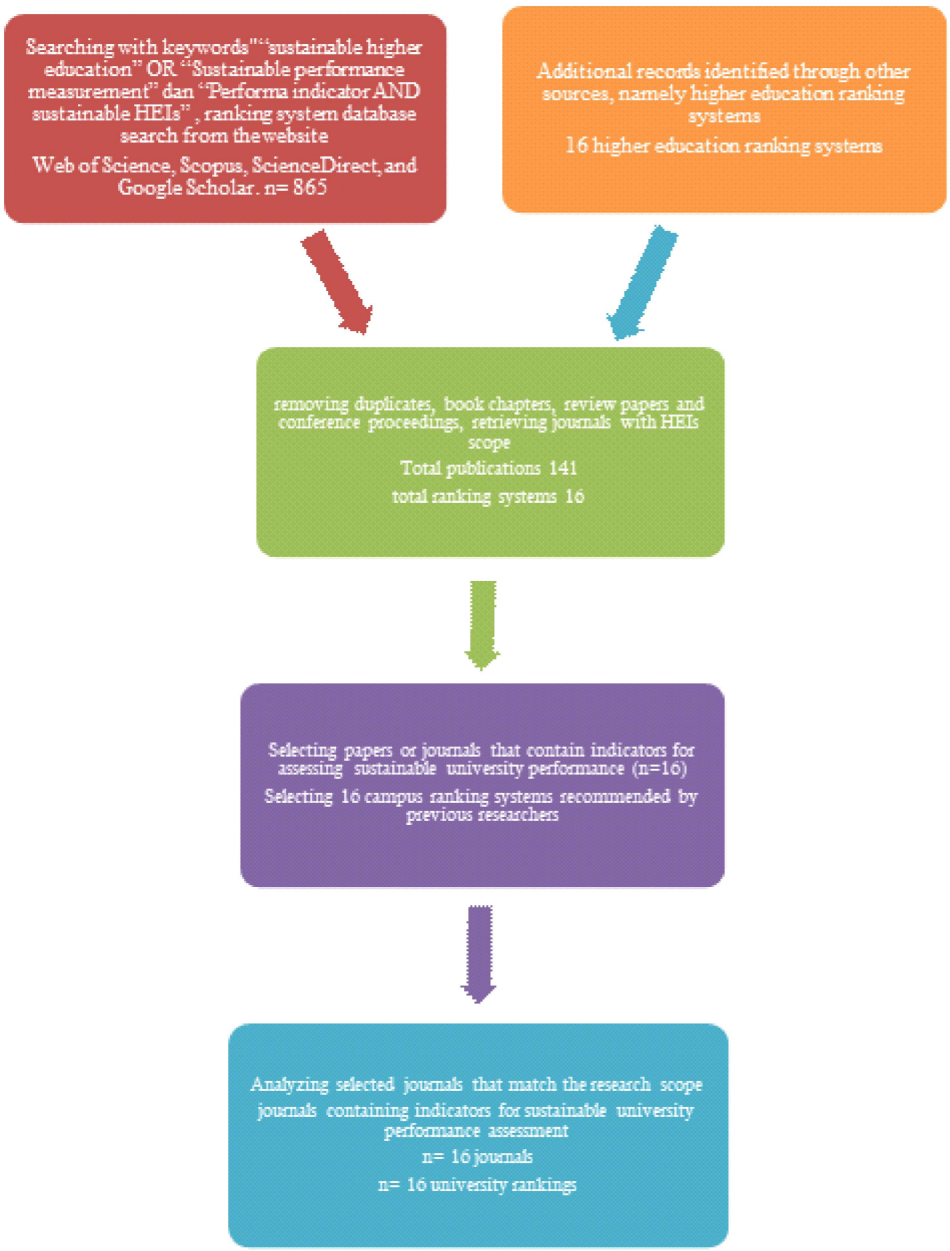

Figure 1: PRISMA flow diagram systematic literature review process for identifying, screening, and selecting articles on sustainable higher education performance assessment (2018-2023)

Included

In the Included stage of the PRISMA method, only studies relevant to sustainability in higher education are included in the analysis. The selected studies focus on academic performance, policy and governance, environmental sustainability, and social inclusion

Analysis

Selecting and analyzing journals related to higher education performance assessment using one or more pillars of higher education assessment to assess higher education performance or the application of indicators for sustainable higher education assessment. The assessment of the

relevance of journals is based on content analysis and eliminating journals that do not discuss sustainable higher education performance, totaling 16 journals. The objectives of the ranking system and the ranking methodology are drawn from statements published through each ranking system website or publicly available methodology documentation. Terms such as the objectives of the ranking system are used to identify the stated objectives of the ranking system. All indicators in the ranking system will be compared with the indicators stated in the sustainable higher education framework according to UNEP Policy.

■ RESULT AND DISCUSSION

Classification of Sustainable Higher Education Modeling

The framework of sustainable higher education in accordance with (United Nations Environment Programme, 2021) contains 4 pillars, where each pillar has different criteria. The four pillars and their criteria can be seen in diagram 2.

Based on the image above, it can be seen that each pillar has certain criteria, where the first pillar is teaching and research which has 3 criteria, the second pillar Governance and administration consists of 3 pillars, the third pillar Climate and environment has 7 criteria and the fourth pillar surrounding community which consists of 6 criteria. Research on the university ranking system was conducted by (Vernon et al., 2018) using 13 qualified ranking systems that have been evaluated for research performance assessment.

This study resulted in 76% of the total rankings being associated with research indicators and 24 being associated with academics and teaching. From the research, it can be seen that

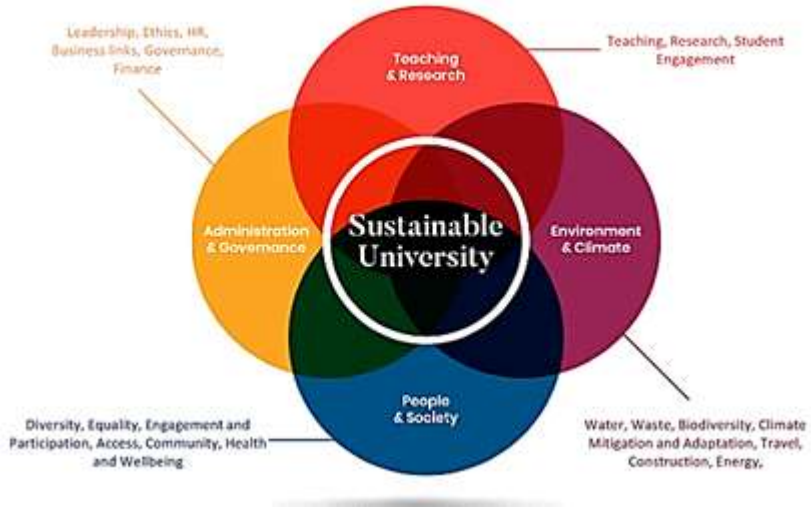

Figure 2. Four pillars of sustainable higher education

there is no ranking system that contains the 4 pillars of the sustainable higher education framework as a whole. The ranking system is important to evaluate its usefulness to improve institutional quality based on data transparency and data analysis, consistency of indicators used in ranking over time, and availability of institutional-level data from the ranking system available to others to replicate the ranking calculation. According to Anwar in (Agasisti et al., 2021) there are 4 acceptable ranking systems, namely THE, ARWU, QS and Webometric. Based on the existing ranking system, there has been no assessment of campus quality by looking

at all pillars and criteria that are in accordance with the policy. The following metrics will show the 4 pillars and criteria that exist in each ranking.

Based on Table 1. It can be seen the pillars and criteria for university assessment criteria used by each existing ranking system, it can be seen that each ranking system uses different pillars and criteria. The ranking system that uses four pillars in assessing university performance is the STAR ranking system. STAR only uses 47% of the total criteria based on policy. If depicted with a Venn diagram, the position of each ranking system based on the 4 pillars of university assessment based on policy will be seen.

Most of the current university ranking systems still have limitations in integrating the four pillars of sustainability, namely Teaching & Research, Administration & Governance, Environment & Climate, and Social Inclusion (Surrounding Community). In the Teaching & Research pillar, several systems such as UI GreenMetric, STAR, and Webometrics do not consider teaching, research, and student engagement aspects in depth. UI GreenMetric focuses more on environmental sustainability without measuring academic quality directly, while Webometrics assesses openness and digital impact without considering teaching and research methods comprehensively.

In the Administration & Governance pillar, almost all traditional academic ranking systems such as ARWU, QS, THE, CWUR, Leiden, RUR, Clarivate Analytics, UMR, USN&W, URAP, and Webometrics do not assess leadership, governance, ethics, and university financial management aspects explicitly. UI GreenMetric also does not cover governance aspects, because it focuses more on environmental sustainability, while Scimago assesses social impact more without specific indicators related to leadership and ethics.

In the Environment & Climate pillar, most academic systems such as ARWU, QS, THE, CWUR, Leiden, RUR, Clarivate Analytics, UMR, USN&W, URAP, Webometrics, and Carnegie do not have clear environmental sustainability indicators, so they cannot measure university performance in water, waste management, biodiversity, energy, and climate change mitigation. Scimago, although assessing social impact, also does not include environmental aspects in its assessment criteria. Meanwhile, UI GreenMetric is the only system that explicitly assesses various environmental aspects, but has the weakness of not paying enough attention to academic and governance dimensions. Finally, in the Social Inclusion pillar, most traditional ranking systems, including ARWU, QS, THE, CWUR, Leiden, RUR, Clarivate Analytics, USN&W, URAP, Webometrics, and Carnegie, do not include indicators related to social engagement, access to education, equality, and the well-being of students and the surrounding community. UI GreenMetric also lacks comprehensive social indicators, while Scimago includes social impact in its assessment, but still lacks aspects of equity and access to education. Overall, the current university ranking system focuses more on research and academics to the exclusion of governance, environmental sustainability, and social engagement. A more balanced ranking model is needed to ensure that university performance is assessed holistically by considering all aspects of sustainability.

This Venn diagram illustrates the position of various sustainable higher education ranking systems based on four main pillars: Teaching and Research, Administration and Governance, Environment and Climate, and Surrounding Community. Ranking systems such as QS, THE, Scimago, DIKTI, CWUR, RUR, Leiden, USN&WR (U.S. News & World Report), ARWU (Academic Ranking of World Universities), UMR, Corneige specifically focus on the Teaching and Research pillar, administration and governance and the

Table 1. Metrics of higher education ranking system criteria based on the 4 pillars of higher education sustainability

Pillars and Criteria for Sustainable Higher Education	Higher Education Ranking System															
	ARWU	QSWorld	THE/Times	UI Green	STAR	Scimago	DIKTI	CWUR	Leiden Ra	RUR	Clarivate Analytics /CA	UMR	USN&W	URAP	Webometric	Carnegie
I. Teaching & Research																
1. Teaching	√		√	√	√		√	√	√	√		√	√			√
2. Research	√	√	√	√	√	√	√	√		√	√	√	√	√	√	√
3. Student and Engagement		√	√		√					√		√	√			√
II. Adm & Govermance																
1.Leadership		√			√	√	√			√						
2. Ethics					√	√										
3. Human Resources	√	√	√		√	√	√	√		√		√	√			√
4. Business links									√							
5. Governance	√												√			
6. Finance													√			
III. Environment & Climate																
1. Water				√	√											
2. Waste				√	√											
3. Biodiversity				√												
4. Climate Mitigation and adaptation				√	√											
5.Travel				√												
6. Construction				√												
7. Energy				√												
IV. Masyarakat sekitar																
1. Equality		√			√				√				√			
2. Diversity		√			√					√						
3. Engagement and participation	√		√		√	√	√	√	√	√		√	√	√	√	
4. Access		√	√		√			√	√	√	√			√	√	
5.Community		√	√		√		√	√	√	√						√
6.Health and Wellbeing			√		√		√	√		√	√	√	√	√	√	

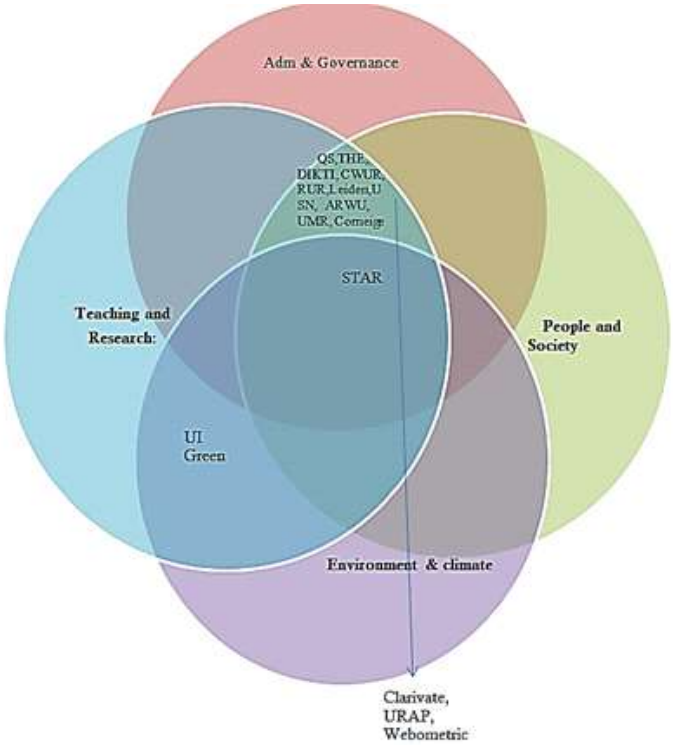

Figure 3. Diagram of the sustainable higher education ranking system based on the 4 pillars of the sustainable higher education framework

surrounding community pillar. While the Clarivate, URAP and Webometric ranking systems assess university performance based on administration and governance output and the environment and climate pillar. UI GreenMetric specifically highlights the Environment and Climate pillar, assessing university efforts in environmental management, energy efficiency, and sustainability initiatives. STAR occupies a central position in this diagram, indicating that this system assesses university performance comprehensively covering all main pillars, although in terms of indicators, not all sustainable university performance indicators are used in university rankings. This diagram reveals that although many ranking systems focus on one or two pillars, very few evaluate university performance holistically in accordance with the indicators expected by UNEP or UN policies.

Triple Bottom Line (TBL) integrates three main aspects of sustainability: economic (profit), social (people), and environmental (planet). The Venn diagram shows how different university ranking systems assess sustainability with different approaches:

Economic (Profit) Representation of Administration & Governance (including systems such as QS, THE, CWUR, and others) that evaluates the effectiveness of university resource and financial management. Social (People) Demonstrated by People and Society, covering aspects of educational access, equity, and campus community participation. Environmental (Planet) The main focus of Environment & Climate, which is strongly emphasized by UI GreenMetric and partly by Clarivate, URAP, and Webometric. From the Venn diagram, it can be seen that no single ranking system fully covers all three aspects of TBL in a balanced manner. STAR comes close to integrating TBL because it covers all four pillars (teaching & research, governance, environment, and community), but still does not use all sustainability indicators recommended by UNEP or UN.

The results of this study can be the basis for improving university ranking policies, both at the national and international levels. At the national level, universities can adopt a more holistic ranking system by including sustainability indicators that reflect economic, social and environmental integration. Meanwhile, for international, ranking institutions such as QS, THE, and UI GreenMetric can consider refining indicators to be more inclusive of social and economic aspects, not just academic and environmental. Creation of global standards: UNEP or UNESCO can encourage a more balanced ranking system so that universities around the world contribute more to global sustainability.

Sustainability assessment in universities requires a series of indicators that reflect performance in various aspects, including education, research, community engagement, and campus operations. However, the main challenge is to determine the most relevant and effectively measurable indicators (Ceulemans et al., 2015). The unique contributions of this study compared to previous studies include; Identifying that current ranking systems are more biased towards one aspect of TBL, rather than all three simultaneously, Visualizing the relationships between ranking systems using Venn diagrams, which previous studies have not done, and Providing concrete recommendations for university assessment policies to be more comprehensive in reflecting sustainability.

The next stage is to create metrics for the 4 pillars of sustainable higher education as seen from the perspective of sustainable higher education assessment indicators carried out by researchers.

Sustainable university performance assessment has been conducted by many researchers, but only conducted assessments using some of the pillars of the sustainable university framework. Sustainable university performance assessments by various researchers show diverse focuses based on the four main

Table 2. Research metrics of higher education assessment system based on 4 pillars of higher education sustainability

Pillars and Criteria for Sustainable Higher Education	Author																
	Bashir *et al.*, 2023	Hashemi Petrudi, Ghomi and Mazaheri asad, 2022a	Lazić, Đorđević and Gazizulina, 2021	Agasisti *et al.*, 2021	Sciarelli, Gheith and Tani, 2020	Faishol and Subriadi, 2021	Dawodu *et al.*, 2022	Adenle *et al.*, 2020	Schlickmann and Bortoluzzi, 2023	Maulachela, Qudsi and Tajuddin, 2021	Atici *et al.*, 2021	Wang *et al.*, 2022	Jiang and Kurnitski, 2023	Ali and Anufriev, 2020	Horan and O'regan, 2021	Da Silva and De AzevedoAlmeida, 2019	(Dawodu et al., 2024)
I. Teaching & Research																	
1. Teaching		√	√	√	√	√	√		√	√		√	√	√	√	√	√
2. Research		√	√	√	√	√	√		√	√	√	√		√	√	√	√
3. Student and Engagement		√	√	√	√	√	√		√	√					√	√	√
II. Adm & Governance																	
1.Leadership		√		√	√		√			√		√			√		
2. Ethics		√					√		√						√		
3. Human Resources		√	√	√	√		√		√	√		√			√	√	
4. Business links			√														
5. Govemance			√		√		√		√				√		√	√	√
6. Finance			√										√			√	√
III. Environment & Climate																	
1. Water	√						√	√	√				√	√	√	√	√
2. Waste	√						√	√	√				√	√	√	√	√
3. Biodiversity	√							√	√						√		√
4. Climate Mitigation and adaptation	√							√	√				√	√		√	√
5.Travel	√		√				√	√	√				√	√	√	√	√
6. Construction	√						√	√	√				√	√	√	√	√
7. Energy	√							√	√				√	√	√	√	√
IV. Masyarakat sekitar																	
1. Equality																	√
2. Diversity			√														√
3. Engagement and participation	√		√	√			√		√			√				√	√
4. Access			√						√			√					√
5.Community			√							√						√	√
6.Health and Wellbeing			√								√					√	√

pillars. Some groups of researchers use the same pillars to evaluate university performance, reflecting different interests in studying academic sustainability.

In the Teaching and Research pillar, a group of researchers including Hashemi Petrudi et al. (2022), Maulachela et al. (2021), Faishol & Subriadi (2021), and Agasisti et al. (2021) assessed teaching quality, research intensity, and the impact of academic publications. This group focuses on the academic contribution of universities through scientific publications, research quality, and teaching relevance, which are key indicators in determining the position and academic quality of a university at the global level. In the Administration and Governance pillar, there is research from AlJardali (2021), Sciarelli et al. (2020), and Hashemi Petrudi et al. (2022) which focuses on aspects of university governance, policy, and management. Their research focuses on operational efficiency, management transparency, and policy structures that support sustainability in higher education. This pillar is considered important because effective management can encourage higher education to be more oriented towards sustainability and long-term impact. The group of researchers exploring the Environment and Climate pillar includes Atici et al. (2021), Horan & O'regan (2021), Dawodu et al. (2022), and Jiang & Kurnitski (2023). They evaluate green initiatives, resource use, energy management, and environmental impact reduction. This group focuses on the responsibility of higher education institutions to reduce their ecological footprint and play an active role in environmental conservation through sustainable practices. For the People and Society pillar, there are contributions from Laziæ et al. (2021), Agasisti et al. (2021), and Wang et al. (2022) who assess the social contribution of higher education institutions to the community and wider society. Their research highlights the involvement of higher education institutions in community service activities, community development programs, and social initiatives aimed at improving community welfare.

Based on the analysis of research in various sustainability pillars, there are several major gaps in the current university ranking system: Lack of Integration between Social and Environmental Pillars. The Environment & Climate pillar has received significant attention in research, but social aspects such as community well-being, environmental justice, and community

engagement have not been fully integrated. Many ranking systems separate environmental sustainability from its social impact, even though universities have a role in sustainability education, environmental advocacy, and creating inclusive policies that are oriented towards community well-being. Excessive Focus on Academic Aspects without Considering Impact on Communities. The Teaching & Research pillar is widely measured based on the number of publications, citation impact, and research intensity, but does not sufficiently assess the extent to which these academic outputs actually provide benefits to the surrounding community.

The current ranking model trends to ignore how universities contribute directly to social development, access t education for marginalized groups, and economic empowerment of local communities. To improve the gaps in the current ranking system, further research is recommended to develop a new assessment model that is more holistic and covers all pillars of sustainability.

Researchers such as Hashemi Petrudi et al. (2022) and Maulachela et al. (2021) used a multidimensional approach that combined several pillars in their analysis. They assessed higher education performance by looking at the relationship between academic, governance, environmental, and social contribution aspects, providing a more comprehensive picture of sustainability achievement in higher education institutions. In addition, there are researchers who combine two pillars, such as E. B. Ali & Anufriev (2020) who explore the relationship between teaching and the environment. They highlight how teaching quality can correlate with green initiatives in universities, demonstrating the link between educational aspects and ecological responsibility. Overall, each group of researchers contributes to broadening the understanding of higher education sustainability performance, but there is still a gap in research that covers all four pillars holistically. Further research that combines all pillars of sustainability is needed to provide a more comprehensive and balanced assessment of how higher education can contribute to global sustainability.

However, this table also reveals areas that are not yet filled, especially in the criteria that combine all pillars holistically. This suggests opportunities for further research that can integrate all aspects of higher education sustainability comprehensively. Thus, this table provides a clear picture of the use of evaluation criteria by various researchers and shows areas that still require further research. This multidimensional approach is important to provide a more complete and comprehensive picture of the performance and contribution of higher education institutions in the context of sustainability.

The diagram above shows the position of researchers based on the pillars of higher education used, where there are still positions that have not been filled, namely a combination of 2 pillars covering the environment and society, the pillar of the environment, administration, governance, a combination of 3 pillars covering administration, governance, environment, society and the pillar of teaching and research, society and environment. Finally, the meeting point of all pillars includes Teaching and Research, Administration and Governance, Environment and Climate and the Surrounding Community, there are still few researchers who use the indicators of the four pillars simultaneously and the incomplete use of all indicators in accordance with the policies set by UNEP. So this study will try to fill this space by using all indicators set by the policy and also taking indicators from previous researchers.

When viewed from the number of authors who use the 4 pillars of sustainable higher education assessment, it can be seen from the following diagram.

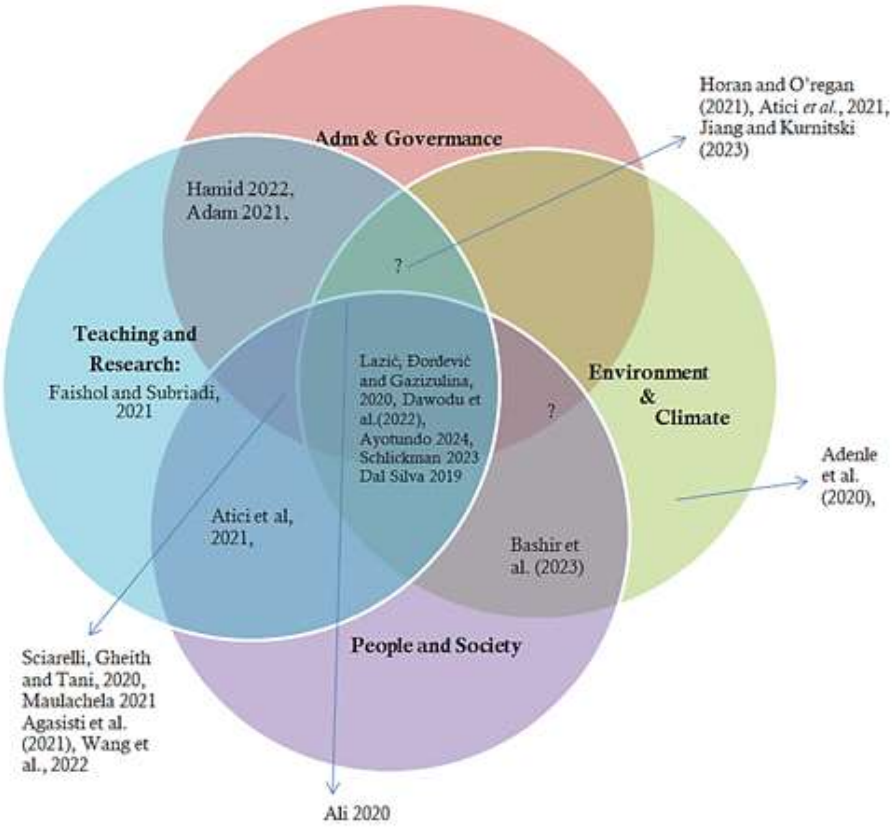

Figure 4. Diagram of the sustainable higher education ranking system based on the 4 pillars of the sustainable higher education framework

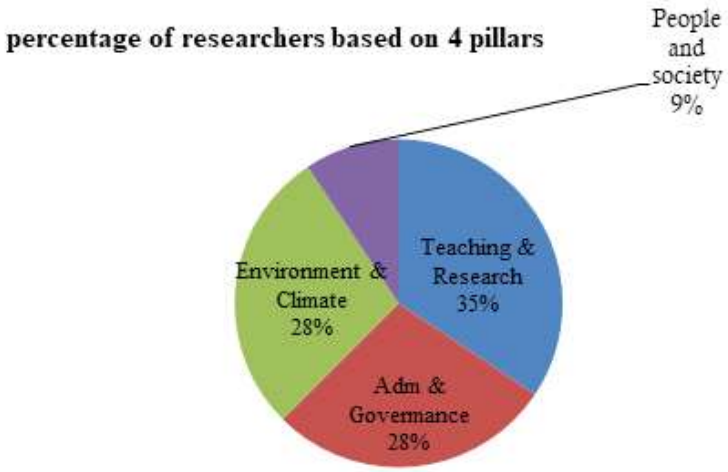

Figure 5. Percentage of researchers based on pillars used

This diagram shows that the pillars most widely used by authors are the teaching and research pillars. While the following diagram shows the results of a literature review showing that previous researchers conducted university assessments using only a portion of the four pillars of sustainability identified by the UN, based on the reviewed literature, it was found that 37.5% of researchers used 3 pillars, 25% of researchers used 2 pillars and 37.5% of researchers used 1 pillar of sustainable higher education.

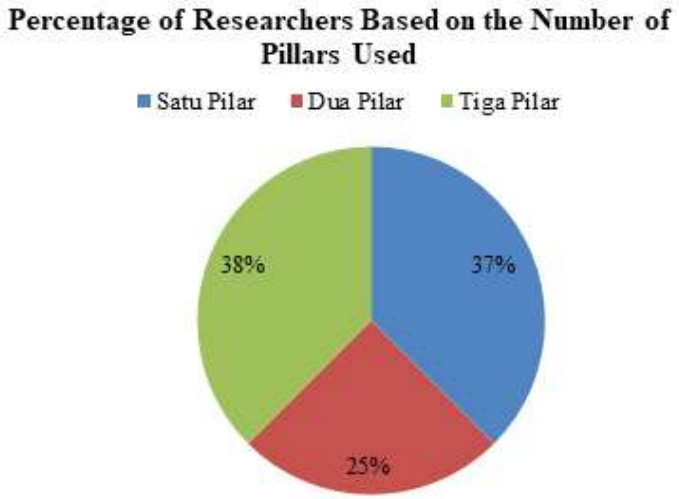

Figure 6. Percentage of researchers based on the number of pillars used sustainable higher education

Further research is needed to develop an evaluation method that integrates the four main pillars (Teaching and Research, Administration and Governance, Environment and Climate, and People and Society) as a whole. This could include developing a framework that assesses the contribution of universities in all of these aspects simultaneously, thus providing a more comprehensive picture of institutional sustainability. Identification and development of performance indicators that can measure the impact of interactions between pillars. For example, how environmental initiatives affect the quality of teaching and research or how good governance can improve the social contribution of universities. These indicators should cover aspects that have not been measured in previous research.

Table 3. Research metrics and higher education assessment ranking based on 4 pillar higher education sustainability

Pillars and Criteria for Sustainable Higher Education	Higher Education Ranking	Author
I. Teaching & Research		
1. Teaching	ARWU,THE, UI Green, STAR, DIKTI, CWUR, Leiden, RUR, UMR, USN&W, Cornegie	Hashemi Petrudi, Ghomi and Mazaheriasad, 2022a, Lazić, Đorđević and Gazizulina, 2021, Agasisti et al., 2021, Sciarelli, Gheith and Tani, 2020, Faishol and Subriadi, 2021, Dawodu et al., 2022, Schlickmann and Bortoluzzi, 2023, Maulachela, Qudsi and Tajuddin, 2021, Wang et al., 2022, Jiang and Kumiński, 2023, Ali and Anufriev, 2020, Horan and O'regan, 2021, Da Silva and De AzevedoAlmeida, 2019, Ayodunto 2024
2. Research	ARWU,QS, THE, UI Green, STAR, Scimago, DIKTI, CWUR, RUR, Clarivate Analityc/CA, UMR, USN&W,URAP,Webometric, Cornegie	Hashemi Petrudi, Ghomi and Mazaheriasad, 2022a, Lazić, Đorđević and Gazizulina, 2021, Agasisti et al., 2021, Sciarelli, Gheith and Tani, 2020, Faishol and Subriadi, 2021, Dawodu et al., 2022, Schlickmann and Bortoluzzi, 2023, Maulachela, Qudsi and Tajuddin, 2021, Atici et al., 2021, Wang et al., 2022,Ali and Anufriev, 2020, Horan and O'regan, 2021, Da Silva and De AzevedoAlmeida, 2019, Ayodunto 2024
3. Student and Engagement	QS, THE, STAR, RUR,UMR, USN$W, Cornegie	Hashemi Petrudi, Ghomi and Mazaheriasad, 2022a, Lazić, Đorđević and Gazizulina, 2021, Agasisti et al., 2021, Sciarelli, Gheith and Tani, 2020, Faishol and Subriadi, 2021, Dawodu et al., 2022, Schlickmann and Bortoluzzi, 2023, Maulachela, Qudsi and Tajuddin, 2021, Horan and O'regan, 2021, Da Silva and De AzevedoAlmeida, 2019, Ayodunto 2024
II. Adm & Governance		
1.Leadership	QS, STAR, Scimago, DIKTI, RUR	Hashemi Petrudi, Ghomi and Mazaheriasad, 2022a, Agasisti et al., 2021, Sciarelli, Gheith and Tani, 2020, Dawodu et al., 2022, Maulachela, Qudsi and Tajuddin, 2021, 2021, Wang et al., 2022, Horan and O'regan, 2021
2. Ethics	STAR, Scimago	Hashemi Petrudi, Ghomi and Mazaheriasad, 2022a, Dawodu et al., 2022, Schlickmann and Bortoluzzi, 2023, Horan and O'regan, 2021

3. Human Resources	ARWU,QS, THE, STAR, Scimago, DIKTI, CWUR, RUR, UMR, USN&W, USN&W, Corregie	Hashemi Petrudi, Ghomi and Mazaheriasad, 2022a, Lazić, Đorđević and Gazizulina, 2021, Agasisti et al., 2021, Sciarelli, Gheith and Tani, 2020, Dawodu et al., 2022, Schlickmann and Bortoluzzi, 2023, Maulachela, Qudsi and Tajuddin, 2021, Wang et al., 2022, oran and O'regan, 2021, Da Silva and De AzevedoAlmeida, 2019
4. Business links	Leiden	Lazić, Đorđević and Gazizulina, 2021
5. Governance	ARWU, USN&W	Lazić, Đorđević and Gazizulina, 2021, Sciarelli, Gheith and Tani, 2020, Dawodu et al., 2022, Schlickmann and Bortoluzzi, 2023, Jiang and Kurnitski, 2023, Horan and O'regan, 2021, Da Silva and De AzevedoAlmeida, 2019, Ayodunto 2024
6. Finance	USN&W	Lazić, Đorđević and Gazizulina, 2021, Agasisti et al., 2021, Sciarelli, Gheith and Tani, 2020, Faithel and Subriadi, 2021, Dawodu et al., 2022, Adenle et al., 2020, Schlickmann and Bortoluzzi, 2023, Jiang and Kurnitski, 2023, Ali and Anufriev, 2020, Da Silva and De AzevedoAlmeida, 2019, Ayodunto 2024
III. Environment & Climate		
1. Water	UI Green, STAR	Bashir *et al.*, 2023, Dawodu et al., 2022, Adenle et al., 2020, Schlickmann and Bortoluzzi, 2023, Jiang and Kurnitski, 2023, Ali and Anufriev, 2020, Horan and O'regan, 2021, Da Silva and De AzevedoAlmeida, 2019, Ayodunto 2024
2. Waste	UI Green, STAR	Bashir *et al.*, 2023, Dawodu et al., 2022, Adenle et al., 2020, Schlickmann and Bortoluzzi, 2023, Jiang and Kurnitski, 2023, Ali and Anufriev, 2020, Horan and O'regan, 2021, Da Silva and De AzevedoAlmeida, 2019, Ayodunto 2025
3. Biodiversity	UI Green	Bashir *et al.*, 2023, Adenle et al., 2020, Schlickmann and Bortoluzzi, 2023, Ali and Anufriev, 2020, Horan and O'regan, 2021, Ayodunto 2024
4. Climate Mitigation and adaptati	UI Green, STAR	Bashir *et al.*, 2023, Adenle et al., 2020, Schlickmann and Bortoluzzi, 2023, Jiang and Kurnitski, 2023, Ali and Anufriev, 2020, Da Silva and De AzevedoAlmeida, 2019, Ayodunto 2024
5.Travel	UI Green	Bashir *et al.*, 2023, Lazić, Đorđević and Gazizulina, 2021, Dawodu et al., 2022, Adenle et al., 2020, Schlickmann and Bortoluzzi, 2023, Jiang and Kurnitski, 2023, Ali and Anufriev, 2020, Horan and O'regan, 2021, Da Silva and De AzevedoAlmeida, 2019, Ayodunto 2024
6. Construction	UI Green	Bashir *et al.*, 2023, Dawodu et al., 2022, Adenle et al., 2020, Schlickmann and Bortoluzzi, 2023, Jiang and Kurnitski, 2023, Ali and Anufriev, 2020, Horan and O'regan, 2021, Da Silva and De AzevedoAlmeida, 2019, Ayodunto 2024
7. Energy	UI Green	Bashir *et al.*, 2023, Adenle et al., 2020, Schlickmann and Bortoluzzi, 2023, Jiang and Kurnitski, 2023, Ali and Anufriev, 2020, Horan and O'regan, 2021, Da Silva and De AzevedoAlmeida, 2019, Ayodunto 2024
IV. Masyarakat sekitar		
1. Equality	QS, STAR, Leiden, USN&W	Dawodu et al., 2024
2. Diversity	QS, STAR, RUR	Lazić et al. (2021), Ayotunde (2024)
3. Engagment and participation	ARWU, THE, STAR, Scimago, DIKTI, CWUR, UMR, USN&W, URAP, Webometric, Leiden, RUR	Bashir *et al.*, 2023, Lazić, Đorđević and Gazizulina, 2021, Agasisti et al., 2021, Dawodu et al., 2022, Schlickmann and Bortoluzzi, 2023, Wang, et, al,2022, Da Silva and De AzevedoAlmeida, 2019, Ayodunto 2024
4. Access	QS, THE, STAR, CWUR, Leidwn, en, RUR, Clarivate, Webometric, URAP	Lazić, Đorđević and Gazizulina, 2021, Schlickmann and Bortoluzzi, 2023, Wang et al., 2022, Ayodunto 2024
5.Community	QS, THE, STAR, Dikti, CWUR, Leiden, RUR	Lazić, Đorđević and Gazizulina, 2021, Maulachela, Qudsi and Tajuddin, 2021, Atici et al., 2021, Da Silva and De AzevedoAlmeida, 2019, Ayodunto 2024
6.Health and Wellbeing	THE, STAR, Dikti, CWUR, RUR, Clarivate, UMR, USN&W, URAP, Webometric	Lazić, Đorđević and Gazizulina, 2021, Atici et al., 2021, Da Silva and De AzevedoAlmeida, 2019, Ayodunto 2024

This study highlights the importance of the role of higher education institutions in promoting sustainability through education, research, and collaboration with the community. Although various ranking systems have been developed, the majority still focus on academic and research aspects without holistically integrating environmental, social, and governance (ESG) dimensions. The results of the literature review show that previous researchers assessed higher education institutions using only part of the four pillars of sustainability identified by the UN, based on the reviewed literature, it was found that 37.5% of researchers used 3 pillars, 25% of researchers used 2 pillars and 37.5% of researchers used 1 pillar of sustainable higher education. Therefore, it is necessary to develop a comprehensive and integrative evaluation method, as well as identify performance indicators that measure the impact of interactions between

pillars to provide a more comprehensive picture of the sustainability of higher education institutions. Further research is also needed to bridge the gap in the literature and strengthen the multidimensional approach in assessing the performance of sustainable higher education institutions.

CONCLUSION

This study highlights the importance of the role of higher education institutions in promoting sustainability through education, research, and collaboration with the community. Although various ranking systems have been developed, the majority still focus on academic and research aspects without holistically integrating environmental, social, and governance (ESG) dimensions. The results of the literature review show that previous researchers assessed higher education institutions using only part of the four pillars of sustainability identified by the UN, based on the reviewed literature, it was found that 37.5% of researchers used 3 pillars, 25% of researchers used 2 pillars and 37.5% of researchers used 1 pillar of sustainable higher education. Therefore, it is necessary to develop a comprehensive and integrative evaluation method, as well as identify performance indicators that measure the impact of interactions between pillars to provide a more comprehensive picture of the sustainability of higher education institutions. Further research is also needed to bridge the gap in the literature and strengthen the multidimensional approach in assessing the performance of sustainable higher education institutions.

REFERENCES

Agasisti, T., Yang, G. liang, Song, Y. yao, & Tran, C. T. T. D. (2021). Evaluating the higher education productivity of Chinese and European "elite" universities using a meta-frontier approach. In *Scientometrics* (Vol. 126, Issue 7). Springer International Publishing. https://doi.org/10.1007/s11192-021-03978-z

Ali, M., Mustapha, I., Osman, S., & Hassan, U. (2021). University social responsibility: A review of conceptual evolution and its thematic analysis. *Journal of Cleaner Production*, *286*, 124931. https://doi.org/https://doi.org/10.1016/j.jclepro.2020.124931

Ceulemans, K., Molderez, I., & Van Liedekerke, L. (2015). Sustainability reporting in higher education: A comprehensive review of the recent literature and paths for further research. *Journal of Cleaner Production*, *106*, 127–143. https://doi.org/10.1016/j.jclepro.2014.09.052

Filho, W. L., Eustachio, J. H. P. P., Caldana, A. C. F., Will, M., Salvia, A. L., Rampasso, I. S., Anholon, R., Platje, J., & Kovaleva, M. (2020). Sustainability leadership in higher education institutions: An overview of challenges. *Sustainability (Switzerland)*, *12*(9). https://doi.org/10.3390/su12093761

Findler, F., Schönherr, N., Lozano, R., Reider, D., & Martinuzzi, A. (2019). The impacts of higher education institutions on sustainable development: A review and conceptualization. *International Journal of Sustainability in Higher Education*, *20*(1), 23–38. https://doi.org/10.1108/IJSHE-07-2017-0114

Hashemi Petrudi, S. H., Ghomi, H., & Mazaheriasad, M. (2022). An Integrated Fuzzy Delphi and Best Worst Method (BWM) for performance measurement in higher education. *Decision Analytics Journal*, *4*(August). https://doi.org/10.1016/j.dajour.2022.100121

Horan, W., & O'regan, B. (2021). Developing a practical framework of sustainability indicators relevant to all higher education institutions to enable meaningful international rankings. *Sustainability*

(Switzerland), *13*(2), 1–15. https://doi.org/10.3390/su13020629

Indri Febrianti, M. S. (2023). *Peran akreditasi dalam meningkatkan mutu layanan di lembaga pendidikan. JUMPIS/ : Jurnal Manajemen Pendidikan Islam*, *1*(1), 11–23. http://e-journal.iainfmpapua.ac.id/index.php/jumpis

Laziæ, Z., Đorđeviæ, A., & Gazizulina, A. (2021). Improvement of quality of higher education institutions as a basis for improvement of quality of life. In *Sustainability (Switzerland)* (Vol. 13, Issue 8). https://doi.org/10.3390/su13084149

Pizzutilo, F., & Venezia, E. (2021). On the maturity of social responsibility and sustainability integration in higher education institutions: Descriptive criteria and conceptual framework. *International Journal of Management Education*, *19*(3), 100515. https://doi.org/10.1016/j.ijme.2021.100515

Ramzi, O. I., Subbarayalu, A. V., Al-Kahtani, N. K., Al Kuwaiti, A., Alanzi, T. M., Alaskar, A., Prabaharan, S., Raman, V., Suleiman M Gibreel, M., & Alameri, N. S. (2022). Factors influencing service quality performance of a Saudi higher education institution: Public health program students' perspectives. *Informatics in Medicine Unlocked*, *28*(January), 100841. https://doi.org/10.1016/j.imu.2021.100841

Rasoolimanesh, S. M., Tan, P. L., Nejati, M., & Shafaei, A. (2021). Corporate social responsibility and brand loyalty in private higher education: mediation assessment of brand reputation and trust. *Journal of Marketing for Higher Education*, *September*. https://doi.org/10.1080/08841241.2021.1973645

Saputra, S., & Charles, H. (2023). Corporate social responsibility, brand loyalty di universitas negeri dan swasta di Kota Batam. *E-Jurnal Akuntansi*, *33*(11), 2857–2871. https://doi.org/10.24843/eja.2023.v33.i11.p03

Seyfried, M., & Ansmann, M. (2018). Unfreezing higher education institutions? Understanding the introduction of quality management in teaching and learning in Germany. *Higher Education*, *75*(6), 1061–1076. https://doi.org/10.1007/s10734-017-0185-2

United Nations Environment Programme. (2021). The UNEP sustainable university framework. https://www.eauc.org.uk/global_alliance

Vernon, M. M., Andrew Balas, E., & Momani, S. (2018). Are university rankings useful to improve research? A systematic review. *PLoS ONE*, *13*(3), 1–15. https://doi.org/10.1371/journal.pone.0193762