Evaluation of Environmental Sustainability Higher in Education Ranking Systems: Towards a Flat Intraranking System

Anwaar Buzaboon[1*], Waheeb Alnaser[2], Hanan Alboflasa[1], Safwan Shatnawia[1], Khawla Albinalia[1] And Thajba Aljowder[1]

[1] College of Applied Studies, University of Bahrain, Sakhair Campus, Zallaq, Bahrain

[2] College of Graduate Studies, Arabian Gulf University, Manama, Bahrain

*E-mail: anwaar.abdulla@gmail.com

Abstract

This paper reviews different ranking criteria for universities practicing environmental sustainability – named here as "Environmental Sustainability Higher Education ranking systems (ESHERSs)". The purpose is to evaluate the degree of such criteria in supporting the higher education institutions (HEIs) in achieving environmentally sustainable development goals (SDGs). In this paper, the potential metrics for ranking systems are identified to promote environmentally sustainable development practices within HEIs and support their home countries in achieving SDGs. Three ESHERSs - known in focusing on teaching & research, environment and social scope are evaluated and scored according to their compliance with the Berlin Principles (BPs), where the later are used to propose a new framework for an intra- ranking system that contribute to more effective practice in Environment and Education, i.e. developing University of Bahrain Environmental Sustainability Higher Education ranking system (UoBESHERS).

Keywords: University Ranking, Sustainable Development, Environment, Higher Education, SDGs.

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Introduction

Ranking systems are widespread in the field of higher education. In general, these systems adopt a one-size-fits-all approach and support the perspectives of some stakeholders better than others. New ranking systems are introduced by various bodies annually at either the national or global levels and joined by higher education institutions (HEIs). Some ranking systems, such as those developed by Quacquarelli Symonds (QS), Times Higher Education (THE), and Shanghai Jiao Tong University, focus on the quality of teaching and research, whereas other ranking schemes, like the University of Indonesia GreenMetric (UI GreenMetric) ranking, focus on environmental aspects of HEIs (Table 1). THE's University Impact Rankings 2019 also focuses on sustainable development and was built based on the United Nations' Sustainable Development Goals (UN SDGs), which cover the triple bottom-line (TBL) elements of economy, environment, and society as part of the 2030 Agenda for Sustainable Development.

Table 1. Categories of HEI ranking systems and examples

Group A Focus on Education, Research, Services	Group B Focus on Education, Research, Environment
Academic Ranking of World Universities (ARWU, Shanghai)	National Wildlife Federation's State of the Campus Environment
QS World University Ranking	Sustainability Assessment Questionnaire
Time Higher Education (*THE*)	Auditing Instrument for Sustainabilityin Higher Education (AISHE)
Rankings of Universities in the United Kingdom	Higher Education 21's Sustainability Indicators
National Institutional Ranking Framework	Environmental Workbook and Report
CWTS Latin Ranking	Greening Campuses
University Performance	Campus Ecology
Faculty Scholarly Productivity Index	Environmental Performance Survey
Swiss Quality Label for Further Education	Indicators Snapshot/Guide
Norrington Table	Grey Pinstripes with Green Ties
Tom Perkins Table	EMS Self-assessment
University Compress	UNI-Metrics
University Ranking by Academic Performance (URAP)	Global Report Initiative (GRI)
US News & World Report's Best Global Universities Rankings	Graphical Assessment of Sustainability in Universities (GASU)
Webometrics	GREENSHIP (developed by GBCI and NGO)
Wuhan University	STARS by AASHE (Association for the Advancement of Sustainability in Higher Education)
QS's Asian University Rankings	The College Sustainability Report Card (Green Report Card)
THE Asia University Rankings	UI GreenMetric
BCUR by Shanghai Jiao Tong University	People & Planet's University League
Wu Shulian, published in the name of the Chinese Academy of Management Science (payment)	International Sustainable Campus Network (ISCN)
University Ranking by Academic Performance (URAP)	Campus Score (Hajrasouliha, 2017)

Education is related to nearly all of the 17 UN SDGs. HEIs will play a vital role in achieving the SDGs by providing the next generation the skills and knowledge needed to understand and address sustainability challenges and opportunities and by performing research that advances the sustainable development agenda. HEIs can also serve as examples by using their expertise, capabilities, and leadership to influence stakeholders to adopt and model more sustainable practices. The SDGs are an essential vehicle for embedding sustainability into university business strategies, decision-making processes, and practices and for improving accountability to stakeholders (Mori Junior et al., 2019).

Disruptive technologies, financial challenges, new industry trends, and changes in socioeconomic ecosystems are placing additional pressure on universities to remain relevant and sustainable. To do so, universities need to be aware of the local, regional and global contexts in which they operate and influence. University ranking systems are used for marketing purposes, performance assessment, and as mechanisms of public

accountability (Nastase, 2015). However, ranking systems do not guarantee the quality nor the sustainability of universities because there is no consensus on what constitutes quality in higher education (Thakur, 2007).

University ranking systems use different scopes and metrics to place universities on a vertical scale from top to bottom. Rather than being used as tools for assessing sustainability, such systems place universities in competition to occupy the top rank.

HEI ranking systems (HERSs) can be classified into two categories: those that focus on research, education and services and those that focus on education, research, and environment. Table 1 provides examples of each category. Table 2 summarizes and compares the strengths and weaknesses (S&W) of five HERSs: UI GreenMetric, People & Planet's University League, International Sustainable Campus Network (ISCN), Campus Score, and THE's University Impact (Marrone et al., 2018a). Based on a review of the literature on different sustainability indexes (Marrone et al., 2018a), UI GreenMetric was identified as one of the most effective tools for evaluating sustainability. The importance of UI GreenMetric is further supported by the participation of many of the most important and prestigious universities worldwide. In recent years, the number of universities participating in UI GreenMetric has steadily grown, from 95 universities in 35 countries in 2010 to 360 universities in 65 countries in 2014, 516 universities in 65 countries in 2016, and 619 universities in 75 countries in 2017. This study considers the 9 sustainability assessment tools and the HERSs discussed by Marrone et al. (2018a) either for review or as a benchmark. Table 3 provides details on these Environmental Sustainability Higher Education Ranking Systems (ESHERSs), including country of origin, whether national or international, and the responsible entity.

Table 2. Strengths and weaknesses of selected ESHERSs

ESHERS	Strengths	Weaknesses
UI GreenMetric	• Continuously improved based on user feedback. • Significant diffusion. • Comprehensive. • Easy to consult. • Excellent assistance.	• The use of generic quantitative indicators does not support economic dimensions. • Lack of social aspect. • Lack of evaluation of urban morphology in terms of sustainability.
People & Planet's University League	• Emphasis on environmental policy. • Bottom-up approach (developed and monitored by students).	• UK-related. • Questionnaire changes every year, making comparison studies difficult.
International Sustainable Campus Network (ISCN)	• Joined by top-tier universities. • Provides a global forum to support university sustainability.	• The report does not assure the agreed SCN/GULF Sustainable Campus.
Campus Score	• Evaluation of urban morphology and green aspects. • Evaluation of the relationship between urban morphology and academic graduation time.	• USA-related. • Not specific for sustainability issues. • Difficult to find data.

Times Higher Education University Impact Rankings	• Based on evaluating HEIs' progress on UN SDGs.

Table 3. Sustainable Higher Education Ranking System Summary

Location	Name of ESHERS	Responsible entity
The UK/for UK universities only	People & Planet's University League	Compiled annually by People & Planet, the UK's largest student campaigning network
Brazil/for Global universities	International Sustainable Campus Network (ISCN)	ISCN
Indonesia/for Global universities	UI Green Metric	UI
US	Campus Score	California Polytechnic State University
Cambridge	Green Report Card (the College Sustainability Report Card)	Sustainable Endowments Institute
Indonesia	GREENSHIP	Developed by the Green Building Council of Indonesia (GBCI), an independent organization of professionals in design and construction, and NGO
Philadelphia	STARS	AASHE: the Association for the Advancement of Sustainability in Higher Education
Amsterdam	Global Reporting Initiative (GRI)	GRI, an independent international organization that has pioneered sustainability reporting
Nigeria	Sustainability Assessment questionnaire	ULSF: University Leaders for a Sustainable Future (University of Ibadan, Nigeria)
UK	University Impact Rankings	Times Higher Education

Ranking HEIs has become an unavoidable part of academic life for better or worse in response to consumer demand. The International Ranking Expert Group (IREG) was founded in response to criticism of existing ranking approaches in higher education. IREG is the result of a collaborative initiative involving the UNESCO European Centre for Higher Education (UNESCO-CEPES) and a wide variety of ranking experts from different international ranking organizations. IREG (IREC, 2006) developed a document outlining principles of quality and good practices for HERSs that later became known as the Berlin Principles (BPs). The BPs comprise 16 standards for ranking practices (Marope et al., 2013). Although hundreds of ranking systems exist, only a few have been audited and approved by IREG, such as the QS World University ranking, Center for Higher Education Ranking in Germany, and the Perspektywy University Ranking in Poland. Table 4 classifies the BPs in terms of the purposes and goals of ranking (Barron, 2017).

Table 4. Classification of the Berlin Principles

Category	No.	Principle Statement
Purposes and Goals of Rankings	1	Be one of several diverse approaches to the assessment of higher education inputs, processes, and outputs. Rankings can provide comparative information and improved understanding of higher education, but should not be the main method for assessing what higher education is and does. Rankings provide a market-based perspective that can complement the work of government, accrediting authorities, and independent review agencies.
	2	Be clear about their purpose and their target groups. Rankings have to be designed with due regard to their purpose. Indicators designed to meet a particular objective or toinform one target group may not be adequate for different purposes or target groups.
	3	Recognize the diversity of institutions and take the different missions and goals of institutions into account. Quality measures for research-oriented institutions, for example, are quite different from those that are appropriate for institutions that provide broad access to underserved communities. Institutions that are being ranked and the experts that inform the ranking process should be consulted often.
	4	Provide clarity about the range of information sources for rankings and the message each source generates. The relevance of ranking results depends on the audiences receiving the information and the sources of that information (such as databases, students, professors, employers). Good practice would be to combine the different perspectives provided by those sources in order to get a more complete view of each higher education institution included in the ranking.
	5	Specify the linguistic, cultural, economic, and historical contexts of the educational systems being ranked. International rankings in particular should be aware of possible biases and be precise about their objective. Not all nations or systems share the same values and beliefs about what constitutes “quality” in tertiary institutions, and ranking systems should not be devised to force such comparisons.
Design and Weighting of Indicators	6	Be transparent regarding the methodology used for creating the rankings. The choice of methods used to prepare rankings should be clear and unambiguous. This transparency should include the calculation of indicators as well as the origin of data.
	7	Choose indicators according to their relevance and validity. The choice of data should be grounded in recognition of the ability of each measure to represent quality and academicand institutional strengths, and not availability of data. Be clear about why measures were included and what they are meant to represent.
	8	Measure outcomes in preference to inputs whenever possible. Data on inputs are relevant as they reflect the general condition of a given establishment and are more frequently available. Measures of outcomes provide a more accurate assessment of the standing and/or quality of a given institution or program, and compilers of rankings should ensure that an appropriate balance is achieved.
	9	Make the weights assigned to different indicators (if used) prominent and limit changes to them. Changes in weights make it difficult for consumers to discern whether an institution’s or program’s status changed in the rankings due to an inherent difference or dueto a methodological change.

Collection and Processing of Data	10	Pay due attention to ethical standards and the good practice recommendations articulated in these Principles. To assure the credibility of each ranking, those responsible for collecting and using data and undertaking on-site visits should be as objective and impartial as possible.
	11	Use audited and verifiable data whenever possible. Such data have several advantages, including the fact that they have been accepted by institutions and that they are comparable and compatible across institutions.
	12	Include data that are collected with proper procedures for scientific data collection. Data collected from an unrepresentative or skewed subset of students, faculty, or other parties may not accurately represent an institution or program and should be excluded.
	13	Apply measures of quality assurance to ranking processes themselves. These processes should take note of the expertise that is being applied to evaluate institutions and use this knowledge to evaluate the ranking itself. Rankings should be learning systems continuously utilizing this expertise to develop methodology.
	14	Apply organizational measures that enhance the credibility of rankings. These measures could include advisory or even supervisory bodies, preferably with some internationalparticipation.
Presentation of Ranking Results	15	Provide consumers with a clear understanding of all of the factors used to develop a ranking and offer them a choice in how rankings are displayed. This way, the users of rankings would have a better understanding of the indicators that are used to rank institutions or programs. In addition, they should have some opportunity to make their own decisions about how these indicators should be weighted.
	16	Be compiled in a way that eliminates or reduces errors in original data and be organized and published in a way that errors and faults can be corrected. Institutions and the public should be informed about errors that have occurred.

In an attempt to quantify the BPs, Stolz et al. (2010) classified the BPs into three categories: methodology, transparency, and consumer friendliness. Each category is scored by an aggregate set of BPs, with one or two scales for each BP (A and/or B), resulting in 14 measurement scales. Table 5 describes the BP scales. Each scale has a score from 5 to 1, where 5 indicates excellent congruity of a certain ranking practice with a specific BP, 4 good; 3 fair; 2 poor, and 1 no congruity. For a particular ranking system, the methodology score is computed by taking the average of the scores for 2B, 3, 4A, 7A, 8, and 11, the transparency score is obtained by taking the average of 2A, 4B, 6A, 6B, 9A, and 12A, and the consumer friendliness score is determined by taking the average of 15A and 15B. However, Stoltz et al. excluded some BPs due to the lack of a specific direct scoring and scaling scheme, and some BPs span two categories (Stolz et al., 2010).

Table 5. Categorization of the Berlin Principles into Objective and Measurable Criteria

BP	Scale	Measurement scale
2	A	5- Information is given about all of the following: target group; intended impact on target group; scope of information provided to the target group; and the impact that the information provided to the target group might have beyond the direct ranking system-target group interaction. 4- Information is given about three of the above. 3- Information is given about two of the above. 2- Information is given about one of the above. 1- None of the above information is given.
	B	5- All of the following dispositions can be found: data directly collected from the target group (i.e. through surveying) is used when computing an overall ranking score; the distinct message that these target group data reveals is identifiable when an overall ranking result is presented; a score of at least 4 is achieved for Principle 3; and an overall score of at least 4 is achieved for Principle 15. 4- Three of the above dispositions can be found. 3- Two of the above dispositions can be found. 2- One of the above dispositions can be found. 1- None of the above dispositions can be found.
3		5- Separate rankings/scores are computed for each of the following factors: Type of higher education institution (i.e., research university; teaching college); program area (i.e. social sciences; engineering); level of the program (i.e. graduate; undergraduate; doctoral); organizational nature of the institution (public vs. private) 4- Separate rankings/scores are computed for three of the above. 3- Separate rankings/scores are computed for two of the above. 2- Separate rankings/scores are computed for one of the above. 1- Separate rankings/scores are computed for none of the above.
4	A	5- All four of the following sources of information are used in the data collection process: biblio-metrics, students, professors, employers 4- Three of the above sources of information are used in the data collection process. 3- Two of the above sources of information are used in the data collection process. 2- One of the above sources of information is used in the data collection process. 1- None of the above sources of information is used in the data collection process or unclear.
	B	5- The particular messages generated by all four different sources of information mentioned in 4A are made explicit in the ranking. 4- The particular messages generated by three of the different sources of information mentioned in 4A are made explicit in the ranking. 3- The particular messages generated by two of the different sources of information mentioned in 4A are made explicit in the ranking. 2- The particular messages generated by one of the different sources of information mentioned in 4A are made explicit in the ranking. 1- The messages are unclear.

6	A	5- The methodology given allows for recalculation of the overall score by the consumer. 4- All of the following methodological issues are explained: entity measured to assess the particular indicator; process of aggregating an indicator score; process of weighting indicator scores to calculate a ranking score 3- Two of the above methodological issues are explained. 2- One of the above methodological issues is explained. 1- None of the above methodological issues is explained.
	B	5- Information is given about the origin of data for all indicators used. 4- Information is given about the origin of data for at least 75% of the indicators used. 3- Information is given about the origin of data for at least 50% of the indicators used. 2- Information is given about the origin of data for at least 25% of the indicators used. 1- Information is given about the origin of data for less than 25% of the indicators used, or no assessment is possible because the issue is not addressed by the ranking's author(s),
7	A	5- There is at least one indicator for each of the following five dimensions: funding, human resources, academic outcomes, third mission and governance. 4- There is at least one indicator for four of the five dimensions. 3- There is at least one indicator for three of the five dimensions. 2- There is at least one indicator for two of the five dimensions. 1- There is at least one indicator for one of the five dimensions.
	B	5- All indicators are valid. 4- At least 75% of the indicators are valid. 3- At least 50% of the indicators are valid. 2- At least 25% of the indicators are valid. 1- Less than 25% of the indicators are valid, or no assessment is possible because the issue is not addressed by the ranking's author(s).
8		100% of the overall score is calculated based on output measures.–5 4- At least 75% of the overall score is calculated based on output measures. 3- At least 50% of the overall score is calculated based on output measures. 2- At least 25% of the overall score is calculated based on output measures. 1- Less than 25% of the overall score is calculated based on output measures, or no assessment is possible because the issue is not addressed by the ranking's author(s).
9	A	5- All weights assigned to the indicators used in the ranking are clearly stated. 4- Weights assigned are stated clearly for all sets of indicators used (i.e., category) but not for each indicator individually. 3- Weights assigned are stated clearly for at least 75% of sets of indicators (i.e., category) and/or individual indicators. 2- Weights assigned are stated clearly for at least 50% of sets of indicators (i.e., category) and/or individual indicators. 1- Weights assigned are stated clearly for less than 50% of sets of indicators (i.e., category) and/or individual indicators, or no assessment is possible because the issue is not addressed by the ranking's author(s).
	B	5- None of the indicators used has been changed relative to the ranking most recently published. 4- Less than 5% of the indicators used have been changed relative to the ranking most recently published. 3- Less than 10% of the indicators used have been changed relative to the ranking most recently published. 2- Less than 15% of the indicators used have been changed relative to the ranking most recently published. 1- More than 15% of the indicators used have been changed relative to the ranking most recently published.

11		100% of the overall score is calculated on the basis of data gathered by third-–5 party institutions (collected on all universities included in the ranking). 4- At least 75% of the overall score is calculated on the basis of data gathered by third-party institutions (collected on all universities included in the ranking). 3- At least 50% of the overall score is calculated on the basis of data gathered by third-party institutions (collected on all universities included in the ranking). 2- At least 25% of the overall score is calculated on the basis of data gathered by third-party institutions (collected on all universities included in the ranking). 1- Less than 25% of the overall score is calculated on the basis of data gathered by third-party institutions (collected on all universities included in the ranking), or no assessment is possible because the issue is not addressed by the ranking's author(s).
12	A	5- Data sampling procedures are described for all indicators included in the ranking. 4- Data sampling procedures are described for at least 75% of the indicators included in the ranking. 3- Data sampling procedures are described for at least 50% of the indicators included in the ranking. 2- Data sampling procedures are described for at least 25% of the indicators included in the ranking. 1- Data sampling procedures are described for less than 25% of the indicators included in the ranking, or no assessment is possible because the issue is not addressed by the ranking's author(s).
	B	5- The sampling procedure is sound for all indicators included in the ranking. 4- The sampling procedure is sound for at least 75% of the indicators included in the ranking. 3- The sampling procedure is sound for at least 50% of the indicators included in the ranking. 2- The sampling procedure is sound for at least 25% of the indicators included in the ranking. 1- The sampling procedure is sound for less than 25% of the indicators included in the ranking, or no assessment is possible because the issue is not addressed by the ranking's author(s).
15	A	5- Definitions are given for all indicators used in the ranking. 4- Definitions are given for at least 75% of the indicators used in the ranking. 3- Definitions are given for at least 50% of the indicators used in the ranking. 2- Definitions are given for at least 25% of the indicators used in the ranking. 1- Definitions are given for less than 25% of the indicators used in the ranking, or no assessment is possible because the issue is not addressed by the ranking's author(s).
	B	5- The consumer can alter both the weights assigned to the indicators and the selection of the indicators used to compute the ranking results for all three of the following levels: institutional, departmental, and program. 4- The consumer can alter both the weights assigned to the indicators and the selection of the indicators used to compute the ranking results for two of the three levels. 3- The consumer can alter both the weights assigned to the indicators and the selection of the indicators used to compute the ranking results for one of the three levels. 2- The consumer can alter either the weights assigned to the indicators, or the selection of the indicators used to compute the ranking results for at least one of the three levels. 1- The consumer has no choice in how the ranking is displayed.

To address the shortcomings of existing ranking systems, this study evaluates and reviews different ESHERSs in terms of methodology, consumer friendliness, transparency, and support of sustainable practices within universities to provide a foundation for a new ranking system. There are a limited number of environmental sustainability ranking

systems, and most rank any organization rather than specifically focusing on HEIs. Twenty-seven HERSs assess the sustainability of universities in general by evaluating their progress towards the 17 SDGs, and 10 of these systems focus on environmental sustainability. Among this group of 10 ESHERSs, 5 are national, two are still in the research stage and have not yet been implemented, and three are well-known and international. We first benchmark and assess the 10 ESHERSs using the BP scale in Table 5, and guidelines and metrics for ranking systems that support sustainability and spread sustainable culture and traditions among university stakeholders are identified.

Next, we evaluate the three international ESHERSs in more detail by requesting that HEI Quality Assurance Directors who are knowledgeable about ranking and assessing universities benchmark the ESHERSs. Based on the results, the strengths and weaknesses of the ESHERS with the highest score are pinpointed. By reinforcing these strengths while addressing weaknesses, a foundation is derived to develop a new ESHERS, denoted as the University of Bahrain (UoB) ESHERS or UoBESHERS, that adopts flat intraranking. Flat ranking is a ranking system that assesses the progress of universities without creating an ordered list. Instead, it assigns each university to a specific general category and suggests an improvement plan to move the university into a better class. For example, the flat ranking scheme QS Stars gives universities 1 to 5 stars depending on their progress instead of ordering them in a list. Flat ranking is particularly appropriate for intraranking, in which the progress of university colleges is specifically assessed instead of evaluating the university as a whole.

Overall, the objectives of this work are fivefold: 1. to assess the selected ESHERSs using the BPs, the only principles that evaluate HERSs in terms of methodology, consumer friendliness, and transparency; 2. to identify the weaknesses of the best-performing ESHERS; 3. to propose a general methodology for the future design of a new environmental sustainability ranking system; 4. to suggest several indicators for inclusion in the new proposed system; and 5. to identify tools for assessing ranking systems other than the BPs.

Method

In this paper, we review the general aspects of ESHERSs and choose three: UI GreenMetric by the University of Indonesia, STARS by AASHE (Association for the Advancement of Sustainability in Higher Education), and University Impact by THE. The criteria for the inclusion/exclusion of ESHERSs were the availability and accessibility of comprehensive data about each ranking system. We then evaluated these ESHERSs according to the BPs using the categories in Table 4 and the scale in Table 5. We recruited six HEI Quality Assurance Directors to evaluate these ranking systems as experts in ranking systems and HEI workflow. Each director assigned each principle of the selected ranking system a score from 1 to 5. Next, the authors benchmarked 10 ESHERSs. Statistical analysis was used to interpret the experts' findings.

Results

Table 6 presents the results of the scoring process. Separate sub-scores for methodology, consumer friendliness, and transparency and a final score were computed. Table 6 ranks the ESHERSs from highest to lowest scores: UI GreenMetric received the highest score, 3.8, followed by University Impact at 3.7 and STARS at 3.3.

Figure 1 shows the results of benchmarking the ESHERSs based on quantifying the BPs. UI GreenMetric received the highest score for methodology, with an average score of 3.8. THE's University Impact ranking scored highest on transparency and consumer friendliness, with scores of 3.8 and 3.7, respectively. Thus, it can be concluded that UI GreenMetric offers the best assessment of environmental sustainability in HEIs based on all of its targets and indicators. However, THE's University Impact and STARS are popular and offer professional methodologies, making them attractive to consider in our further research.

Table 6. HEI Quality Assurance Directors' Assessments of Ranking Systems Based on Methodology, Consumer Friendliness, and Transparency

Location	Name of ESHERS	Respon-sible entity	Methodology score (M)							Transparency score (T)							Consumer Friendliness score (C)			Final score	Mode	STD	Median
			2B	3	4A	7A	8	11	Avg	2A	4B	6A	6B	9A	12A	AVG	15A	15B	AVG	(MTC) Avg			
Indonesia	UI Green Metric	UI - University of Indonesia	4.3	3.2	4	3.3	4.7	3.2	3.8	4.2	2.8	4.7	4.5	4.5	4.3	4.2	4.5	2.7	3.6	3.8	4.5	0.7	3.8
UK	*Times Higher Education* University Impact Rankings	*Times Higher Education*	4.2	2.8	3.8	2.3	4.7	3.5	3.6	4	3.7	2.2	4	5	4	3.8	5	2.3	3.7	3.7	4	0.9	3.7
Philadelphia	STARS (The Sustainability Tracking, Assessment & RatingSystem)	A A S H E : Association for the Advancement of Sustainability in Higher Education	3.1	2.8	3.7	3.8	4.7	3	3.6	3.2	3.3	2	3.7	4.3	4.3	3.5	4.2	1.3	2.8	3.3	3.7	0.9	3.3

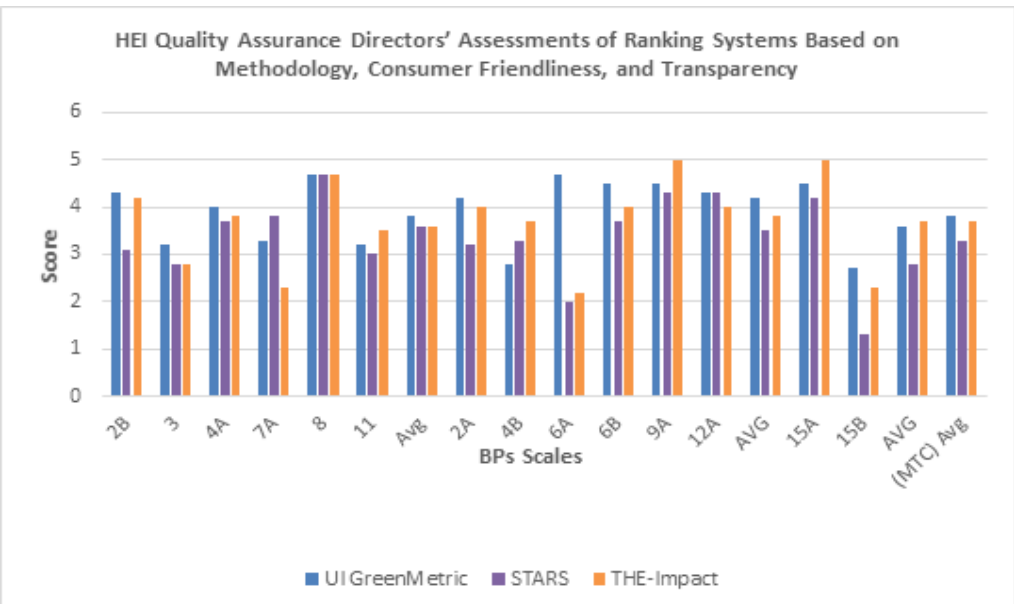

Figure 1. Benchmarking of ESHERSs based on Quantifying the BPs

Figure 2 shows the results of benchmarking 10 ESHERSs by the authors. The 10 ESHERSs can be classified into 3 groups in terms of the final score earned: high, average, and low. The ESHERSs with high scores are UI GreenMetric, People & Planets' University League, and Green Report Card. The ESHERSs with average scores are Sustainability Assessment Questionnaire, THE's University Impact, and STARS. Finally, the rankings with the lowest scores are GREENSHIP, Global Reporting Initiative, International Sustainable Campus Network, and Campus Score.

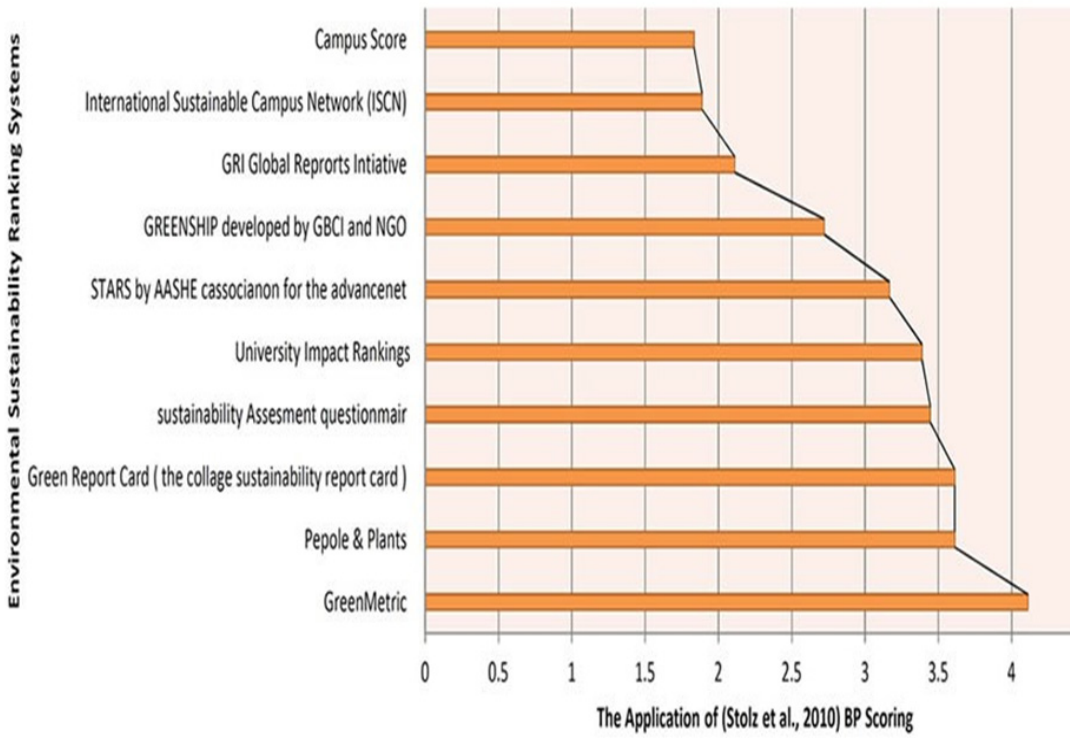

Figure 2. ESHEI Benchmarking based on Quantifying the BPs

Discussion

When the selected ESHERSs were scored according to the BPs (Table 3) and the rubrics (Table 4), UI GreenMetric received the top average score, followed by THE's University Impact and STARS. Despite receiving the highest score, UI GreenMetric has many weaknesses, as outlined in Table 2. Marrone et al. (2018b) analyzed the characteristics of UI GreenMetric and its capability to assess how campus urban morphology affects university sustainability issues. They noted the following limitations of UI GreenMetric:

1- The use of generic quantitative indicators does not adequately support social dimensions. To measure the quality of education, UI GreenMetric counts the ratio of students to instructors and the number of publications, which are very general metrics.
2- It does not include social aspect.
3- It lacks an evaluation of urban morphology in terms of sustainability.

The strengths of UI GreenMetric are as follows:

1- It is continuously improved through users' feedback.
2- It has significant diffusion.
3- It is comprehensive.
4- It is easy to consult.
5- It provides excellent assistance.

Developing a single sustainability ranking system that supports all regions is a challenging task. For example, Gulf Cooperation Council (GCC) countries and other Arab countries have unique climates, customs and traditions. To eliminate the limitations of current ESHERSs, a sophisticated ranking system that suits all countries and cultures is needed. Recent university ranking indexes, whether environmental sustainability-related (e.g., UI GreenMetric) or SDGs-related(e.g., THE's University Impact), also include environmental practices and indicators. Most ESHERSs measure not only UN SDG4 (Quality Education) but also all other SDGs. Examples of indicators of each Environmental SDG [ESDG] in UI GreenMetric and related ranking systems are as follows:

1- SDG4 (Quality Education: Education and Research). In UI GreenMetric's 2012 questionnaire, one new standard was added to the survey, teaching. This criterion is 18% of the total score and is based on the notion that the university has a vital role in introducing new groups to concerns about sustainability subjects. The indicators of teaching are the ratio of sustainability courses to total courses/subjects, the proportion of total research funding devoted to sustainability research, the number of scholarly publications on the environment and sustainability, the number of academic events related to the environment and sustainability, the number of student organizations related to the environment and sustainability, the existence of a university-run sustainability website, and the availability of sustainability reports.

2- SDG6 (Clean Water & Sanitation): The intent is for universities to provide good water use practices, increase conservation programs, and protect habitat. The criteria in UI GreenMetric include water conservation platforms and piped water use, and the indicators are water preservation program implementation, water recycling program implementation, the use of efficient water applications (water tap, toilet flush, etc.), and treated water consumed.

3- SDG7 (Reasonable and Clean Energy) and SDG11 (Sustainable Cities and Communities): Information on campus settings and infrastructure provide the knowledge required for the university's policies on a green environment. This indicator also illustrates whether the campus deserves to be called a Green Campus. The aim is to motivate the participating university to provide more space for greenery, to safeguard the environment, and to support emerging sources of sustainable energy. The indicators are the ratio of open space area to total area, the area on campus covered in forest, the area on campus covered in planted vegetation, the area on campus for water absorption, the entire open space area divided by the total campus population, and the university budget for sustainability efforts.

4- SDG9 (Industry, Innovation, and Infrastructure) and SDG11 (Sustainable Cities and Communities): The transportation system at a university plays an essential role in

carbon emissions and pollutant levels. Transportation policies that limit the number of motor vehicles on campus and promote the use of buses and bicycles on campus will encourage a healthier environment. Pedestrian policies can encourage students and staff to walk around campus and avoid using private vehicles. The use of environmentally friendly community transportation will reduce the carbon footprint of the campus. However, such policies ignore the unfavorable weather conditions in GCC countries, which in summer feature mean air temperatures of 45-48 °C and average relative humidities of 60-70%. On June 10, 2019, a record temperature of 50.4 °C was recorded in Kuwait City (Nagraj, 2019). These countries are highly vulnerable to climate change (Al-Olaimy,2021 and Almazroui,2020), and it is challenging to use bicycles or even solar power without air conditioning.

5- SDG13 (Climate Action) and SDG7 (Affordable and Clean Energy): The university's attention to subjects related to energy use and climate change has the highest weighting in UI GreenMetric. The survey for UI GreenMetric defines several indicators for this specific area of emphasis, e.g., energy-efficient appliance usage, renewable energy usage policy, total electricity use, energy conservation programs, green buildings, climate change adaptation and mitigation platforms, and greenhouse gas emission policies. With this indicator, universities are expected to increase their efforts toward energy efficiency in their buildings and conserving environmental and energy resources.

6- SDG15 (Life on Land), SDG14 (Life below Water), and in general, all SDGs and ESDGs support waste management. Waste treatment andrecycling activities are significant factors in creating a sustainable environment. The activities of university staff and students on campus can produce large amounts of waste. Therefore, the university should implement programs to address waste such as recycling programs, toxic waste recycling, organic waste usage, inorganic waste treatment, sewerage disposal, and reductions of paper and plastic use on campus.

We propose a flat intraranking system, UoBESHERS, that maps to the following SDGs: SDG3 (Good Health and Wellbeing), SDG4 (Quality Education), SDG7 (Affordable and Clean Energy), SDG8 (Decent Work and Economic Growth), SDG9 (Industry, Innovation, and Infrastructure), SDG12(Responsible Consumption and Production), SDG13 (Climate Action), and SDG17 (Partnerships for the Goals). Under this system, a score or category is assigned to each university based on predefined criteria or rubrics. Universities can use the ranking scheme as an assessment tool to compare their performance against the following criteria as part of an objective analysis of university performance:

1- Activity-based cost (ABC): ABC is an evaluation of the indirect cost of an HEI's environmental activities. It is calculated as the percentage of environmental services and products in the total institutional budget. This indicator can also be normalized based on the CO_2 footprint of each college.
2- Financial budget: This indicator requires the total budget per college.
3- Renewable energy as a percentage of total power: This indicator records the percentage of renewable energy in total energy consumption per college.
4- CO_2 footprint per college: For this indicator, the total CO_2 footprint per college is calculated.

5- Physical health: This indicator measures the number of activities and events dedicated to maintaining the physical health of both students and staff, the budget for health insurance, and the total days of sick leave.
6- Mental health: This indicator measures the number of social workers and other staff for supporting the well-being of students and staff as well as the number of events related to mental health and well-being.
7- Research commercialization: This indicator reflects the number of spin-offs, total research budget, and total research and consultation income.
8- Public-private partnership (PPP): This indicator measures the total income of PPP projects.
9- Open dataavailability: This indicator represents the number of open data repositories and their size in MB.
10- Responsible management of waste: This indicator measures the total amount of waste in tons and the total amount of recycled waste in tons.
11- Research: This indicator is equivalent to the number of publications (Scopus indexed).
12- Faculty self-development: This indicator reflects the total number of events and training workshops offered per college and the total number of staff participating in self-development activities.
13- Citations of faculty: This indicator is determined as the total number of citations in the last 5 years per college.

Conclusion

A flat intra- ranking system is proposed that maps to 8 SDGs through 13 new flat intra-ranking system requirements.

The current HEI ranking systems is divided into two categories:

1- Concentrating on research, education, and services.
2- Focusing on research, education, and the environment.

All ranking systems have strengths and weaknesses. Therefore, new ranking systems are needed that work towards eliminating the weaknesses of existing systems that ensure environmental sustainability by using specific indicators to evaluate the progress of colleges and facilitate strategic planning by the university.

This work attempts to overcome the limitations of the current ranking systems by reengineering from resources to outsourcing and a shift towards flat ranking systems, which focus attention on progress in a university's practices rather than the university's rank relative to other universities (vertical ranking). Our proposed flat intra-ranking system (UoBESHERS) eliminates the deficiencies of current ESHERSs and attempts to suits all countries and cultures. It is intended to assess the extent to which a college is environmentally sustainable according to specific indicators.

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تقييم نظم تصنيف البيئة المستدامة في التعليم العالي: بهدف الحصول على نظام تصنيف داخلي غير تسلسلي

أنوار بوزبون[1]*، وهيب الناصر[2]، حنان البوفلاسة[1]، صفوان شطناوي[1]، خولة البنعلي[1] وثاجبة الجوجر[1]

[1] كلية الدراسات التطبيقية، جامعة البحرين، حرم الصخير، الزلاق، البحرين

[2] كلية الدراسات العليا، جامعة الخليج العربي، المنامة، البحرين

*بريد الكتروني: anwaar.abdulla@gmail.com

المُستَخلَص

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يقدم هذا البحث مراجعة لعدة معايير تصنيف للجامعات التي تتبنى مفهوم البيئة المستدامة – وتم الإشارة إليها في البحث بأسم نظم تصنيف البيئة المستدامة في التعليم العالي (ESHERSs). بهدف تقييم مدى دعم هذه المعايير لمعاهد التعليم العالي (HEIs) لتحقيق أهداف التنمية المستدامة (DGs). وفي هذا البحث تم تحديد المعايير المحتملة لتعزيز ممارسات التنمية المستدامة في معاهد التعليم العالي، ودعم دولها للوصول لأهداف التنمية المستدامة، وتم ذلك من خلال تقييم ثلاث نظم تصنيف (ESHERSs) تعني بالتعليم والبحث العلمي إلى جانب عنايتها بالبيئة والمجتمع على اساس امتثالها بمبادئ بيرلين(BPs) الذي تم استخدامه لغرض اقتراح اطار عمل جديد للتصنيف الداخلي يسهم بشكل فعال في قطاع البيئة والتعليم، وبمعنى آخر تطوير «نظام جامعة البحرين لتصنيف البيئة المستدامة في التعليم العالي (UoBESHERS)».

الكلمات الدالة: تصنيف الجامعات، التنمية المستدامة، البيئة، التعليم العالي، أهداف التنمية المستدامة.