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The UI GreenMetric Ranking System: Analyzing Impacts of Categories on Overall Results

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Abstract

The UI GreenMetric Ranking system is celebrating tenth year anniversary in 2020. The UI GreenMetric has six categories which are; “Setting & Infrastructure” (SI), “Energy & Climate” (EC), “Waste” (WS), “Water” (WR), “Transportation” (TR) and “Education” (ED). The SI category has 15% of the total point while EC category has 21%, WR category has 10%, WS, T and E categories have %18. However, there is still missing points about the exact impacts of categories on overall results. Thus, the aim of this study is to exam previous years ranking results to understand details of category impacts on the UI GreenMetric ranking. The ranking data for the study were taken from the UI GreenMetric’s official website. According to results; the EC category determines which university has the higher ranking if two university have the same total point. The WS, TR and ED categories are possible second effective categories however very rarely SI category has second place after EC. Ranking results were also examined for each continent and strong relationship between existence of developed countries and success of the UI GreenMetric performance of a continent was found. New certificates for categories such as “energy efficient campus of the year”, “zero waste producer of the year”, “water-saver of the year”, “green path of the year” and “green producer/consumer of the year” are recommended for embracing categories and increasing their recognition. Besides the updates and change in the category indicators fee-free applications to the UI GreenMetric ranking system should be continued and details of the scoring system should be clarified in the guidelines.

Key words

Green campus, UI GreenMetric, Higher Education Institutions (HEIs), Sustainability, Sustainable Development Goals (SDGs)

1. INTRODUCTION

The solution of global problems such as staying in planetary boundaries and detention of climate change, depends on the positive steps have taken on a smaller scale such as city, district and even in university campus [1],[2]. Sustainable Development Goals (SDGs) have been developed as a solution to these problems. The triple bottom of sustainability is mandatory in order to fully realization and application of SDGs. Education sector has strong relationship with SDGs. Universities has a direct effect on their stakeholders such as students, employees, alumni, parents and have indirect effects on society [2], since universities are excepted as high-esteem [3]. SDGs Australia report; supports this theory by stating that “knowledge of universities and their unique position

within society, have a critical role to play in the achievement of the SDGs” [4]. Also, universities are seen as living labs. SDGs and universities relationship has been discussed ambitiously in recent years [2]. Also, some studies showed that it is not possible to reach SDGs without education [4].

The relationship between Higher Education Institutions (HEI's) and the environment began with The Stockholm Declaration in 1972 [5]. The Talloires Declaration was signed in France in 1990 and it had become an important step for HEIs to focusing on environmental problems [5]. UNESCO stated that education is a necessity for sustainable development in 1994 [2]. While USA universities started to establish NGO's for sustainability projects Australian universities prepared strategic plans for reaching sustainability goals at the end of 90's [2]. The Rio + 20 Declaration in 2012 had five scopes for universities; "Teaching sustainable development concepts, encouraging research on sustainable development issues, greening of campuses, supporting sustainability efforts and fostering and engaging in international collaboration" [2]. After Rio Declaration, SDGs were established in 2015. The concept of green campus date back to the 70's, but it has started to gain importance since the 2000s. Related timeline was given in Figure 1.

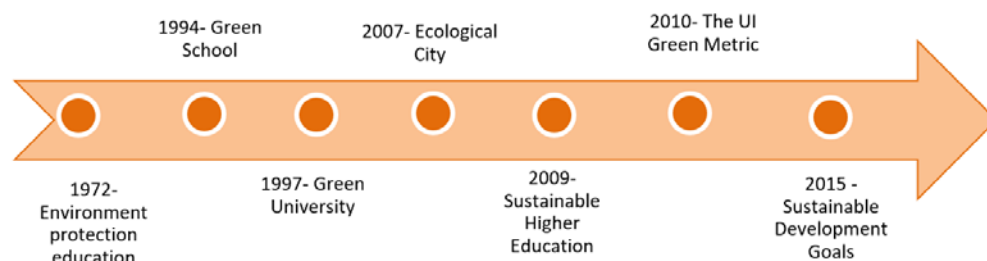


Figure 1. Timeline summary of Green Campus concept, adapted from Tan et. al [2].

“The majority of university campuses in Europe and North America have been involved in greening initiatives over the past two decades, particularly through the development of environmental policies, implementation of action plans, restructuring and signing of courses and research programs” as stated by Arroyo [6]. Today, climate change mitigation and campus sustainability have become a global concern for university leaders. Many world universities are taking steps to fight climate change by reducing their carbon footprint and managing sustainability activities [7], [8]. Also, previous studies claimed that per capita energy and water consumption in university campuses were higher than other residents [2]. These recent studies have enabled to accept campuses as mini cities [9] and the green campus concept is presented as a solution for existing problems.

There is no single target for green campus and campus sustainability concepts in the literature [10]. Every institution sets their own goals towards a sustainable campus. Previous studies have established holistic and comprehensive concept suggestions for embracing sustainability in HEIs [9],[11]. These recommendations have been adopted by many universities and scholars. The green campus projects and academic studies have increased rapidly since 2008. The number of publications containing the "green campus" keyword (Figure 2) in the last 35 years supports this theory. Also, green campus activities and other university projects are classified in different ranking systems in recent years.

University rankings have become popular and representative for university's reputation besides academic publications especially in the last twenty years [7], [12]. The rankings, cover a variety of topics such as research, academic reputation, education, number of female students and international students [7]. The importance of research and academic reputation is in the first place in most of the university rankings while they are followed by education. However, environmental problems have little or no attention [7]. The QS ranking system is one of the ranking systems in the world and it ranks 3000 universities each year according to; academic reputation, employee reputation, academic staff/student ratio, international student and citation per faculty [14]. However, new certificate and ranking systems that highlight sustainability and campus relationship have emerged in the early 2000s with the new wave of sustainability and green campus concept. One of the pioneer and famous system is The Sustainability Tracking, Assessment & Rating System (STARS) which was established in 2006 by the Association for the Advancement of Sustainability in Higher Education [15]. The STARS system consists energy, buildings, waste, water, food & dining, grounds, purchasing and transportation as main categories [14], [16]. STARS classifies universities with certificates instead of competing universities among each other [5]. The UI GreenMetric system was established in 2010 which had been inspired by STARS, Greenship, and Holcim sustainability assessment systems [17]. The UI GreenMetric has encountered increasing interest from all over the world since it does not have any precondition and fee for the applications [15].

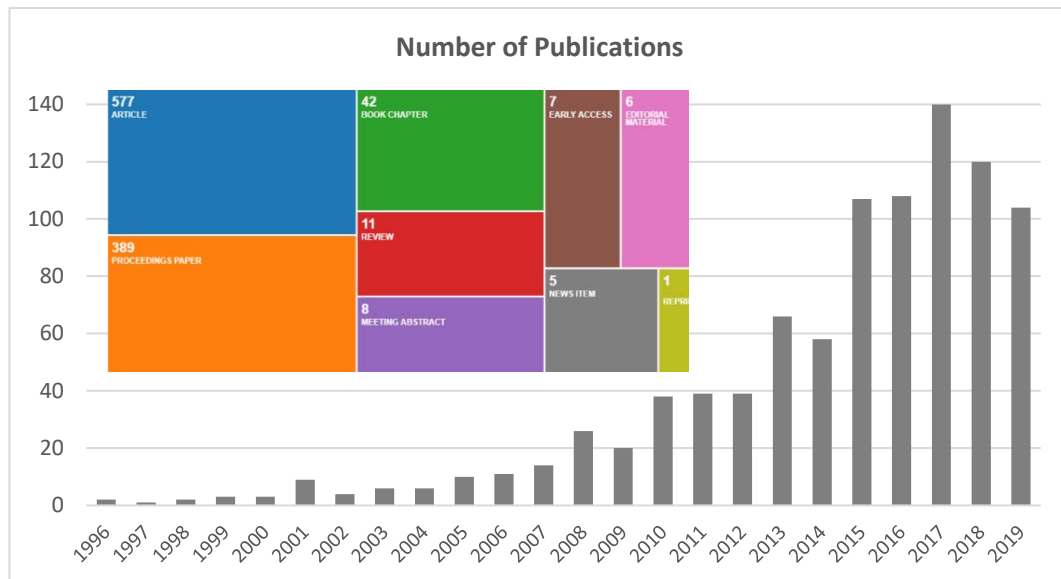


Figure 2. Number of “Green Campus” publications by years in Web of Science [13].

The UI GreenMetric has six categories which are; “Setting & Infrastructure” (SI), “Energy & Climate” (EC), “Waste” (WS), “Water” (WR) “Transportation” (TR) and “Education” (ED) in current scoring system. The UI-Green Metric has been regularly updated since the beginning but it made the biggest change in terms of categories in 2012. The 23 indicators under five categories were used in the 2010 while 34 indicators were used in 2011. Old scoring system was changed in 2012 and the **ED category** was added into scoring system. The names and percentages of the categories of The UI GreenMetric were shown in **Figure 3**. The **EC** category still has the highest impact. The **SI category** used to have the second place in terms of impact on overall results with 24%, now it has the fifth highest impact with 15% [18]. The **WS, TR** and **ED** categories have %18 while **WR** category has 10% of the UI GreenMetric total score. Although there was no change regarding percentage weight of categories after 2012, the indicators within the categories continued to change. The new indicators related to carbon footprint were added to the EC category in 2015. In addition, **WR and TR** categories were updated [18]. The new indicators were established and old indicators such as “planted vegetation, energy efficient appliances usage, smart building, elements of green building implementation, the greenhouse gas emission reduction program, all of waste and water criteria, the ratio of parking area to total campus area, transportation initiatives to decrease private vehicles on campus, the transportation program designed to limit or decrease the parking area on campus, shuttle services, Zero Emission Vehicles (ZEV) and pedestrian policy on campus, existence of published sustainability report” were updated to strengthen the relationship between SGDs and universities” as stated in the UI GreenMetric 2020 Guideline [18].

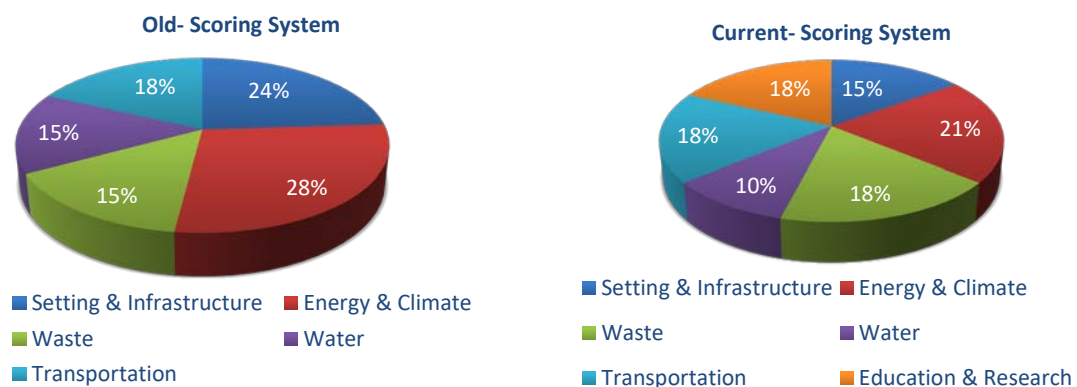


Figure 3. Old and current scores of categories in the UI GreenMetric [7], [18].

Universities submit their applications via a questionnaire in the UI GreenMetric’s official website. Submissions start in May and continue until end of October. Results are announced in December. While evidence uploading is mandatory for some questions, in others it up to university’s choice. However, there is no direct relationship between the number of evidence requested in a category and the total score of the category. For instance, while six evidences are requested in the SI and WS categories, four evidence are requested in the EC category which

has the highest effect with 21%. The UI GreenMetric have received applications from 35 different countries and 95 universities in 2010. These numbers have gradually increased and reached 780 universities from 85 countries by 2019. Despite the increasing interest in academic studies about the UI GreenMetric [1], [19-21], and continues updating of the ranking system, there are still unknowns such as evaluation of applications and exact effects of categories on overall results. Thus, the aim of this study is to examine previous years ranking results for understanding details of the UI GreenMetric's ranking system.

2. MATERIAL AND METHOD

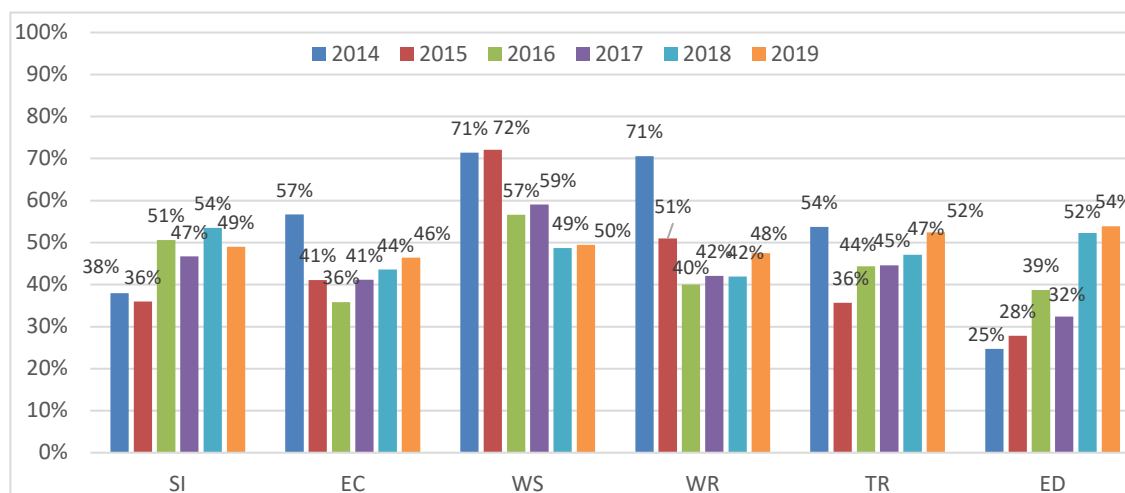
Literature research was done using Scopus, Web of Science (WoS) and Google Scholar search engines. The "Green Metric", "green campus", "sustainability and university" keywords were used to find previous publications. After initial search, snowball method was followed. Additional research was done in WoS by using the keyword "green campus" in order to specify number of academic studies. This study was conducted to clarify impacts of categories on overall results. The ranking data were taken from the Green Metric's official website and analysis were carried out by using data between 2014 and 2019.

3. RESULTS AND DISCUSSION

It is known that the UI GreenMetric ranking system has positive effects on sustainable universities and green campus concepts. The number of universities applying to the UI GreenMetric have increased and this shows increasing attention of green campus activities in universities. According to search results; 577 articles and 389 proceeding papers have been published until June 2020. A significant increase in the number of publications has been observed after 2012. The highest number of publications belongs to 2017 as it can be seen in Figure 2. According to the UI GreenMetric 2020 guideline 64 publications refer to the UI GreenMetric ranking system in their studies [18]. The UI GreenMetric ranking system was established in 2010 however discussions and studies about the system still continue. Previous studies were mostly focused on content of the UI GreenMetric ranking system and provided valuable suggestions [1], [19-21]. In this study, we tried to determine the category which has the highest impact on success (ranking) of universities by evaluating previous year's results. In order to understand that, universities which have the same overall score but also have different rankings were compared. A preliminary study was carried out by using different ranking ranges averages scores, in order to give suggestions to universities for improving their GreenMetric performance. In addition, category results were compared by continents to understand whether the location of the universities has an effect on the results.

3.1. World overall ranking performance by categories

The UI Green Metric official site has been sharing category results since 2014. Therefore, evaluations were made for the years 2014-2019. While the number universities applied to the UI GreenMetric was 361 in 2014, this number has increased and reached 780 in 2019. The new universities may affect the overall results in both ways, increase or decrease, however they still provide necessary information about general trend of the university performances. The ratio of the maximum score that can be obtained for each category and the average scores of all applied universities were given in Figure 4.



SI: Setting & Infrastructure, EC: Energy & Climate, WS: Waste, WR: Water, TR: Transportation, ED: Education

Figure 4. World overall ranking performance by categories (receiving score average/ maximum score of category (%))

The **SI** category performance has decreased in odd-numbered years while it has increased in even-numbered years. The general trend of the **SI** category results show that increase was more than the decrease. Although the **EC** category was experienced a sudden decline in 2015, it has an increasing trend in recent years. The **WS** category has always remained above 50% except in 2018. The **WR** category has experienced a sudden decline in 2015 and 2016, although there is an increase in the following years, it is still below 50%. The **TR** category has increased except for the year 2015. The **ED** category has showed an increase except for 2017 and became the category with the highest increasing trend.

Table 1. Average score of universities in different ranking ranges in 2019.

Ranking range	SI (1500)	EC (2100)	WS (1800)	WR (1000)	TR (1800)	ED (1800)	Total Score (10000)
1-49	1066	1579	1606	838	1459	1562	8110
50-99	916	1387	1475	788	1316	1467	7348
100-199	841	1235	1231	686	1194	1276	6461
200-299	811	1089	1109	572	1089	1108	5778
300-399	759	996	922	484	1015	1009	5185
400-499	738	888	797	438	900	888	4649
500-599	679	804	715	358	778	818	4151
600-699	590	707	457	278	678	667	3376
700-780	416	509	243	102	412	380	2063

SI: Setting & Infrastructure, EC: Energy & Climate, WS: Waste, WR: Water, TR: Transportation, ED: Education

In order to understand the category which deserves more attention and the priorities for universities to become greener and more successful in the UI GreenMetric ranking system in the coming years, the average scores of certain ranking ranges were calculated using 2019 data. It was seen from Table 1 that ranking ranges scores of each category stayed behind if they had lower ranking range in the overall results. For instance, 300-399 range universities had average overall results with 5185 and stayed behind the 200-299 range (5778 overall point) while all other categories also stayed behind. To find an answer to "What would universities do to be in the upper range?" question a heat table was created in Table 2 using Table 1. According to Table 2, there is a 10% difference between the average performance scores of universities between 1-49 (1579 point) and 50-99 (1387 point) for the **EC** category. As it can be understood from Table 2, a university that wants to be in the top 49 and whose ranking is currently between 50-99 should try to improve their institutions in the **EC**, **WS**, **ED**, **SI**, **WR** and **TR** categories, respectively. The heat table was prepared using average scores. Therefore, the university could be already successful in a certain category even though average score (heat table) suggests an improvement. Therefore, every university should develop their own plan by considering economic feasibility and social factors of their institutions.

Table 2. Heat table of range difference (%) - (What would universities do to be in the upper range?)

Difference between ranges (%)	SI	EC	WS	WR	TR	ED	Total Score
(1-49)-(50-99)	8	10	9	7	5	8	5
(50-99)-(100-199)	9	5	7	14	10	7	11
(100-199)-(200-299)	7	2	7	7	11	6	9
(200-299)-(300-399)	6	3	4	10	9	4	5
(300-399)-(400-499)	5	1	5	7	5	6	7
(400-499)-(500-599)	5	4	4	5	8	7	4
(500-599)-(600-699)	8	6	5	14	8	6	8
(600-699)-(700-780)	13	12	9	12	18	15	16

% difference with higher ranking changes	1-3	4-6	7-9	10-13	> 13

3.2. World ranking performance by continents

The UI GreenMetric has been sharing results on a continent basis since 2017. The highest participation was from Asia with 48% (373 universities) while lowest participations belongs to Africa (2% with 14 universities) and Oceania (0.5% with 4 universities) in 2019. The universities in Oceania continent had the highest average points, while African countries had the lowest average in overall results. The %50 (7 universities) of the African

universities had 3500 or less points. It is thought that universities from the higher GDP countries like in Oceania have effect on these results. When the categories were examined, the **SI** category had the highest average score in Oceania, while North America had the second place and they were followed by South America, Asia, Europe and Africa. The most of the European universities were established in the past and their campuses had relatively less green areas than most of the participant Asian universities [20]. Hence, European universities were behind the Asia universities in the **SI** category. The **EC** category had the highest average in Europe, while North America had second higher average and Africa had the lowest. The reason why Europe comes to the fore in the **EC** category is that there are many universities study and practice on renewable energy. In the **WS** category North America was the leader due to the influence of the USA universities, which have better waste management applications in the university campuses. North America was followed by Oceania, Europe, South America, Asia and Africa continents. In the **WR** category North America had the highest average and it was followed by Oceania, South America, Europe, Asia and Africa. Europe had the highest average in the **TR** category. This result was related to the general lifestyle as well as university initiatives. Public transport and bicycle usage are very common in European countries. Therefore, the number fossil fuel vehicles entering the campus is less and the number of zero emission vehicles is higher than other countries. In the **ED** category, the highest average was in the Oceania continent and it was followed by Europe, North America, South America, Asia and Africa. The main reason for this is the institutional sustainability studies which have been initiated in the late 90s, especially at Australian universities [2]. As the Ragazzi and Ghidini (2017) , were previously stated in their study; the development level of countries has effect on overall results [19]. This theory supported by the performance results of the continents. The UI GreenMetric performance is generally higher in the developed countries.

3.3. Categories impacts on overall results

Evaluation information for the universities with the same score is not given in the guideline. Therefore, the 2019 ranking results were examined to understand the categories which have higher impacts on overall results. According to the percentage weight of categories, the **EC** category is expected to be in the first place and it is followed by **WS**, **TR**, **ED**, **SI**, **WR** categories respectively. However, when the current ranking results are examined, it is seen that this is not the case. The **EC** category has the first place but impact of other categories is still not certain. In order to determine the second important category, universities with the same overall results and **EC** scores were compared. As it can be seen in Table 3 results have some uncertainties. In addition to the categories **alphabetical order** could be another parameter for ranking universities. Although the university that came first in alphabetical order was generally had higher ranking, exceptional cases were also observed.

Table 3. Selected ranking scores for comparing impacts of categories on overall results

Rank 2019	University	Country	SI	EC	WS	WR	TR	ED	Total Score	2 nd possible category
42	Universidad Autónoma De Occidente	Colombia	925	1475	1725	875	1200	1525	7725	WS ,ED, WR ,A
43	Western Michigan University	USA	1375	1475	1275	850	1375	1375	7725	
168	Pontificia Universidad Javeriana-Bogota	Colombia	625	1300	1125	450	1425	1350	6275	WS ,TR,ED,A
169	Universidad CES	Colombia	825	1300	1050	750	1200	1150	6275	
181	National Chin-Yi University of Technology	Chinese Taipei	625	1050	1200	600	1050	1650	6175	WS,ED
182	Maejo University	Thailand	1350	1050	825	600	1250	1100	6175	
195	Universidade de Vigo	Spain	850	1250	1275	625	1125	975	6100	WS,SI
196	Universidad De Antioquia	Colombia	550	1250	1125	750	1125	1300	6100	
198	University of Guilan	Iran	1125	1100	750	500	1125	1500	6100	TR,ED, SI,A
199	Univrsiy of Kufa	Iraq	950	1100	1125	825	925	1175	6100	
289	Universidad Autonoma Del Estado De Mexico	Mexico	700	675	1350	625	1025	1125	5500	WS ,ED, WR
290	Akdeniz University	Turkey	1050	675	1125	450	1225	975	5500	
315	University of Baghdad	Iraq	1100	725	600	500	1325	1100	5350	ED,SI, WR
316	Babes Bolyai University	Romania	825	725	750	300	1600	1150	5350	
318	Universidad Pontificia Comillas	Spain	275	1100	1125	650	950	1225	5325	ED, WR
319	Universita degli Studi di Padova	Italy	800	1100	1125	400	1025	875	5325	
319	Universita degli Studi di Padova	Italy	800	1100	1125	400	1025	875	5325	WS ,TR,A
320	University of Jordan	Jordan	900	1100	750	450	950	1175	5325	

Rank 2019	University	Country	SI	EC	WS	WR	TR	ED	Total Score	2 nd possible category
414	Universidad de Pamplona	Colombia	775	925	825	350	825	1150	4850	WS,TR,ED
415	Razi University Kermanshah	Iran	975	925	675	600	775	900	4850	
433	Institut Teknologi Sumatera	Indonesia	850	900	750	575	875	775	4725	TR, WR,A
434	Islamic Azad University	Iran	1200	900	900	200	725	800	4725	
437	Yeditepe University	Turkey	725	1050	900	350	825	850	4700	WS ,TR,ED, WR
438	Saurashtra University	India	975	1050	825	300	800	750	4700	
502	Institute of Business Management	Pakistan	375	1025	900	500	825	750	4375	TR,ED,SI, WR
503	Bow Valley College	Canada	325	1025	1200	375	775	675	4375	
515	Voronezh State Technical University	Russia	500	800	900	450	700	975	4325	WS, WR
516	University of Kragujevac	Serbia	550	800	600	425	900	1050	4325	
612	Yazd University	Iran	1125	500	675	350	875	300	3825	SI, WR
613	Gorno Altaisk State University	Russia	425	500	750	275	900	975	3825	
700	University of Mosul	Iraq	900	650	75	0	700	375	2700	TR
701	Ivan Franko National University of Lviv	Ukraine	900	650	150	0	475	525	2700	
714	University of Kirkuk	Iraq	400	425	225	0	700	800	2550	ED
715	Universidad Autonoma De La Ciudad De Mexico	Mexico	450	425	300	200	950	225	2550	

A: Alphabetical order, SI: Setting & Infrastructure, EC: Energy & Climate, WS: Waste, WR: Water, TR: Transportation, ED: Education

3.4. Suggestions for the UI-GreenMetric Ranking System

Developers of the UI GreenMetric system were stated that an equal system for all universities is not possible by saying *"The different missions and perspectives created by these dimensions mean that the goal of finding indicators that are equally fair to all, seems practically impossible"*. Also, they clarified that the UI GreenMetric is an entry level tool for sustainability activities for universities [7]. Despite that it is possible to make improvements in the system. Following assessments and suggestions were given for the improvement of the UI GreenMetric ranking system:

- All universities are entering the ranking list in the current UI GreenMetric system without any precondition. **"Baseline"** score was suggested in the previous academic study by **Ragazzi and Ghidini** [19]. According to previous study, universities should have minimum (baseline) score to have a place in the UI Green Metric ranking system like other sustainability ranking systems such as STARS. However, it is thought that all universities should be included in the ranking system in order to see the general trend in the world and also to make comparisons between countries and within countries.
- The ranking of universities could change due to change of other universities performances even though their overall performance is constant [19]. This situation was explained by **Ragazzi and Ghidini** as the **relativity of scores** problem [19]. Therefore, making a certain grouping or sustainability classes in the GreenMetric system will ensure that the sustainability performance of a university remains the same even if the overall place in the ranking changes.
- The UI GreenMetric has been a system that constantly renews itself over the years. **Sonetti et al. and Marrone et al.**, stated that this continues updating is the UI Green Metric's strength [1], [20]. While **Ragazzi and Ghidini** indicated that changing indicators in the categories every year prevents making long-term plans [19]. Major changes were done in the UI Green Metric in 2012 and 2018, and minor changes were made in other years. Future major changes should be announced at least one year in advance to universities necessary time for preparation of next year application.
- The comparison between the ranking results and the score expectations of the universities will increase harmony and the transparency of the system. **Sonetti et al.**, recommended a **"satisfaction survey"** to strengthen the feedback system [1]. This survey should be done after the announcement of the ranking and it will enable universities to see the differences between expectations versus real results. Also, it will strength the assessment system of the UI GreenMetric.
- It is known that local conditions of university such as; size and location of the campus, university budget and other factors like old and new buildings affect the success of the sustainability plans [22]. Hence not only overall results but also categories should be examined in detail. **New certificates for categories** such as "energy efficient campus of the year", "zero waste producer of the year", "water-saver of the year", "green path of the year" and "green producer/consumer of the year" are recommended. The awards of "categories" will help universities to highlight the subjects they are

successful in. Also, sharing the awarded projects on the UI GreenMetric website will be an incentive for new projects in other universities.

- The continent results in this study have shown that the development levels of the countries affect the UI GreenMetric results. Therefore, "**contribution to surrounding area sustainability**" indicator should be added in the **EC**, **WS** and **WR** categories for universities that positively affect basic life needs such as climate, waste and water management. The percentage weights of the categories may remain the same, but the addition of this indicator will encourage universities especially in developing countries.
- Details of the ranking system and **impacts of categories** on overall results should be clarified in the future in the UI GreenMetric's guidelines. Possible category descending order could be **EC**, **WS**, **ED**, **TR**, **SI** and **WR**.
- **The fee-free application** is one of the main reason why the UI GreenMetric is getting increasing attention from all over the world, hence fee-free applications should be continued despite the updates in the UI GreenMetric.
- In addition to the evaluation system, it would be a good option to award projects that directly address **global problems** such as "SDG-contributor" or "climate saver" in the annual GreenMetric workshops which are held every year.
- **Green purchasing** is another important factor for reaching institutional sustainability [23] and circular economy. Hence, purchasing indicator could also be added in the ranking system like in the STARS [24].
- Giving more importance to **social aspects** will help universities to embrace sustainability concept in the long term [1],[20]. Employee and student satisfaction indicators will cause increment in the social acceptance of the UI GreenMetric.

4. CONCLUSION

The UI GreenMetric has been getting great interest from all over the world since it was established. The UI Green Metric puts the green campus concept on the agenda of many universities, especially in developing countries. However, it is a fact that GreenMetric needs some updates and improvements. The exact effect of the UI GreenMetric categories should be clarified. It should be stated in the UI GreenMetric guideline that which parameters have priority while ranking universities. In order to understand the importance of categories and for creating successful projects, new awards for each category are recommended. The fee-free application to the UI Green Metric should continue in the future.

There is a significant increase in the number of published studies about green campus during last ten years. The possible effect of the UI GreenMetric on these studies should be analyzed in the future. Many universities carry out green campus projects under the management of "sustainability offices" in order to achieve more comprehensive results. The relationship between the UI GreenMetric ranking system performance of a university and the presence of sustainability office is also an important topic to be addressed. Although, ranking systems are important in terms of establishing standards and putting targets for universities they could cause a dilemma. After a certain point, universities may aim to be successful only in the ranking indicators. Hence, universities should put targets by considering their institutional weaknesses and they should aim more comprehensive targets such as SDGs.

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CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest.

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