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UI GreenMetric Ranking Performance Analysis of Universities in Turkey: Suggestions Towards to Becoming Green Campuses

Kadriye Elif Maçın^{1*}

¹ Istanbul Technical University, Department of Environmental Engineering, 34469, Maslak/Istanbul, Turkey.

*Corresponding Author email: macin@itu.edu.tr

Abstract

There is growing attention to UI GreenMetric from all over the world since it was established in 2010. Turkey totally have 207 universities and 43 of them was applied to UI GreenMetric in 2019. The aim of this study is to analyse UI GreenMetric ranking performance of universities in Turkey and giving suggestions towards to becoming green campuses. The data used in the study were taken from the UI GreenMetric's official website. According to the results; the most successful category was transportation (TR) while the unsuccessful categories were "energy and climate (EC)" and "water (WR)" in Turkey. In addition, 72% of the applicant universities have not ranked in the first 300. The rankings of universities in Turkey have been decreased according to the general ranking results. The major problems are lack of sustainability offices and inability to provide institutional data for the application. Institutional data keeping, monitoring system and targeting global indicator such as Sustainable Development Goals were suggested in order to become green campuses.

Key words

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

1. INTRODUCTION

The importance of education, especially universities, to reach Sustainable Development Goals (SDGs) have been discussing since last four decades [1]. Universities are an impartial and reliable stakeholder in society. Hence, universities have the capacity and responsibility to guide SDGs at local, national and international level through dialogue and partnerships [1]. The relationship between the education sector and sustainability officially started with the Stockholm Declaration in 1972. Later, universities have made a commitment to address this issue more comprehensively with the Talloires Declaration. Universities stated that they would take measures to reduce the damage to the environment [2]. After the 1992 United Nations conference, the concepts of sustainable universities and green campus started to gain importance (Fig. 1). Although there is no single general definition exist, "green university" concept sometimes perceive as one-dimensional since current applications give more importance to environmental topics and neglecting economic and social aspects. However, the multidimensional nature of the "green campus" should be taken into consideration [3-5]. Hence, it would be more accurate to evaluate and associate the "green campus" concept with "sustainable university". A sustainable university is defined as a higher education institution that deals with minimizing the negative environmental, economic, social and health impacts at a regional or global level, caused by the use of its resources during fulfilling the functions of teaching, research, social assistance and partnership [6-7].

University campuses are complex systems in which education and research processes are carried out by consuming materials, energy and water [8]. In China, the education sector is responsible for 40% of the total electricity consumption in the public sector [3]. Therefore, studies have been gaining attention to reduce anthropogenic effects on campuses [9]. In addition to their academic achievements and reputations, universities are competing to reduce the human impact on environmental problems such as climate change.

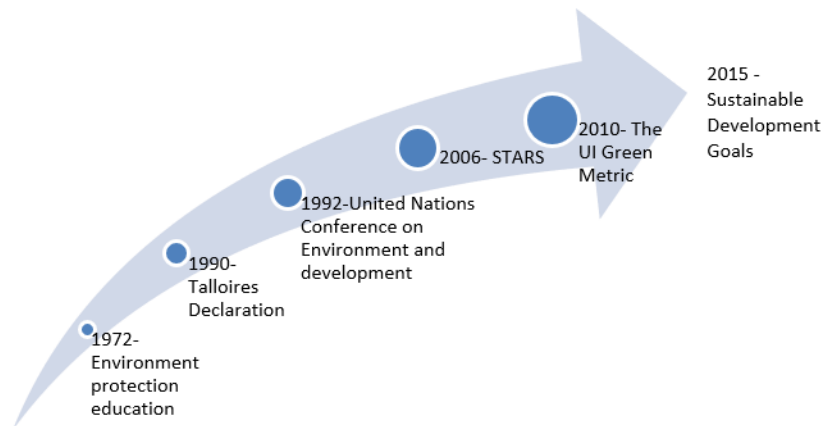


Figure 1. Important developments regarding the “green campus”, adapted from Tan et. al.

It is known that university rankings have become popular in recent years [10]. The ranking topics ranging from research, education and academic reputation to environmental performance [10]. In most university rankings, research and academic reputation rank first and followed by education while environmental issues have little or no attention [10-11]. The UI GreenMetric ranking is an important initiative that makes an international assessment of the sustainability of universities [10]. UI GreenMetric was created in 2010 by the University of Indonesia and it consists of six main categories which are Setting & Infrastructure (%15), Energy & Climate (%21), Waste (%18), Water (%10), Transportation (%18) and Education (%18) as shown in Table 1 [12]. UI GreenMetric has been a ranking system that constantly renews itself over the years and has received positive [7] and negative [13] comments with this feature.

Table 1. UI GreenMetric categories and scores

Categories	Total Score	Percentage (%)
Setting & Infrastructure (SI)	1500	15
Energy & Climate (EC)	2100	21
Waste (WS)	1800	18
Water (WR)	1000	10
Transportation (TR)	1800	18
Education (ED)	1800	18

The increase in the number of applications to UI GreenMetric has led to an increase in academic publications. (Ragazzi and Ghidini, 2017) made suggestions on how the ranking system could be improved [13]. (Marrone et al., 2018) stated changes are necessary, especially in the setting and infrastructure (SI) category [14]. (Muñoz-Suárez et al., 2020), analyzed academic ranking success and sustainability relations by comparing UI GreenMetric results with other academic ranking system results [15]. (Caeiro et al., 2020), evaluated the results of different ranking systems including UI-GreenMetric, in order to understand the effects of universities on sustainable development [16]. (Sonetti et al, 2016) compared the UI GreenMetric performances of two universities in Italy and Japan [7]. (Puertas and Marti, 2019) evaluated the UI GreenMetric results with cluster analysis and divided them into different sustainability classes [17]. In addition, UI GreenMetric performance analysis of universities from different countries such as Africa [4], Brazil [18], India [19], the Philippines [20], and Russia [9] were done.

UI GreenMetric is also popular in Turkey as well as all over the world since it has accepted applications without any preconditions and free of charge. Bilkent University has been the only university from Turkey to participate since the 2010. Zonguldak Bülent Ecevit University (ZBEÜ) applied for the first time in 2014 and started to take an active role in GreenMetric and became the representative of Turkey for UI GreenMetric. ZBEÜ ranked first in Turkey in 2014, 2015 and 2016. Istanbul Technical University (İTÜ), which applied for the first time in 2017,

ranked first in Turkey in 2017, 2018 and 2019. An international workshop was held at Istanbul University with the participation of the UI GreenMetric team in 2017 [21]. National workshop was organized by ZBEÜ in 2019 to discuss problems faced during and after application [22]. The increasing interest in UI GreenMetric by universities in Turkey has led to university-specific case studies [23-24] and the development of local sustainable university models [25]. Many publications have been made in Turkey from the perspective of ecological campuses [26] and green building certification systems [27-29]. General evaluation of UI GreenMetric for the year 2015 was made at national level [25]. The master thesis were done about green campus [30] and national green campus ranking system suggestion based on GreenMetric [31]. In addition, five state and five private universities from Turkey compared in terms of their sustainable-ecological parameters [32]. Besides, YÖK (higher education board of Turkey) has new initiatives about the Green Metric.

While there were 29 universities in Turkey in 1987, this number increased to 207 in 2019 [33-34]. Today, 7.9 million students, including graduates, study in higher education institutions in Turkey. The increasing number of students in the last 35 years is an important opportunity for the establishment of environmental management and sustainability systems in universities. Considering the approximately 10% of the country's population is educated in higher education institutions and 21% of universities in Turkey applied to UI GreenMetric in 2019 are clarified the importance of the subject. Despite the increasing interest in the UI GreenMetric system in Turkey, there is no study on national performance analysis has been found during literature research. A new study is needed when factors such as the increasing number of UI GreenMetric applications, YÖK's interest in this subject and universities' role on SDGs. The aim of this study is to examine the UI GreenMetric performances of universities in Turkey and to give suggestions to become green universities.

2. MATERIAL AND METHOD

2.1. Material

The data required to review and compare UI GreenMetric performances were taken from the UI GreenMetric website. Detailed information about the green campus projects of the universities applying UI Green Metric from Turkey were obtained from the official websites of the universities. In addition, the number of academic publications containing the term "green campus" was obtained from the Web of Science (WoS) [35].

2.2. Method

In the study, a literature search was conducted using Web of Science (WoS), Scopus, Google Scholar, Dergipark and YÖK Thesis Center search engines. The national and international studies were examined by using the keywords "green campus", "GreenMetric", "sustainable development" and "university". UI GreenMetric shares category and continent based results since 2014 and 2017 respectively. Therefore, the category reviews were made for the years 2014-2019 and analyzes of the continents were made for the years 2017-2019. The UI GreenMetric results between 2010 and 2019 were compared in order to understand how the performances of universities in Turkey have changed in the general ranking and in the country. Also, it has been tried to determine whether there is a relationship between the performance of the countries that are successful in UI GreenMetric and academic interest (number of publications) by examining the academic studies that include the word "green campus" in WoS. Suggestions were made to become a green campus by evaluating the interviews held at the ZBEÜ national workshop and using the literature resources.

3. RESULTS AND DISCUSSION

3.1. Academic publications and successful countries in the UI GreenMetric ranking

In order to understand whether the number of academic publications is an effective parameter on the country's UI GreenMetric performance, apart from the development level of the countries, the publications including the word "green campus" in WoS were examined. There is no direct relationship between publications and ranking, have been found however some positive effects were observed. For example, one of the most publishing countries in Europe is the United Kingdom and it has the most universities in the top 20. Similarly, in the Asian continent, the universities in the top 20 are generally from China, Malaysia, Indonesia and Taiwan, which have more publications compared to other Asian countries. A total of 983 papers (article, conference paper, book chapter, etc.) containing the term green campus was published between 1996-2020. The number of publications has started to increase rapidly and reached the highest point with 140 publications in 2017. The most publications were made in the USA and China with 249 and 163 publications respectively. Turkey is the 11th country with the highest number of publications with 29 publications containing the term "green campus" [35]. This is promising for future national success and performance. The effect of the UI GreenMetric ranking system,

on the number of publications with the terms "green campus" and "sustainable university" is a significant topic to be addressed in the future.

3.2. Overall ranking performance by categories

In order to examine the performances of universities in Turkey, the average of the scores between the years 2014-2019 were calculated. The same calculations were made for the overall results (Fig. 2). According to the average results of Turkey in 2019, the "transportation (TR)" category was the most successful category with an average score of 1027 (57% of the total score of the category). The average of the "Setting & Infrastructure(SI)" category is 824 (55%), while "Waste (WS)" category is 879 (48.8), "Education (ED)" category is 794 (44.1%), "Energy and Climate (EC)" category is 845 (40.3%) and "Water (WR)" category is 370 (37%).

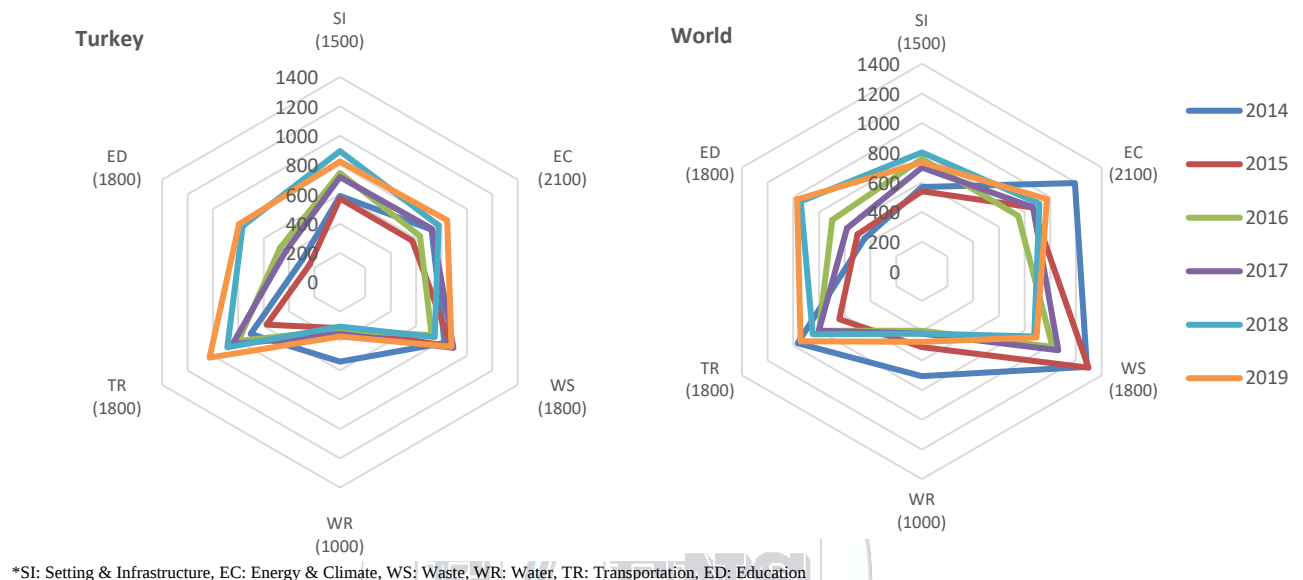


Figure 2. Change of category average scores in Turkey and world general ranking in 2014-2019

The highest increase is seen in the "Education (ED)" category (from 16.6% in 2014 to 44.1% in 2019), while a decrease in the "Water (WR)" category (from 54.1% in 2014 to 37.0% in 2019). In the "Waste (WS)" category, there was an increase in performance across the country between 2018 and 2019. This is due to the Zero Waste Regulation published in the country. In addition, performance changes can be observed due to changes in UI GreenMetric indicators as well as the activities of universities. According to the 2019 UI GreenMetric guide, although there is no change in the questions in the "Structure and Infrastructure (SI)" category, the options for the questions "1.9. Area covered with vegetation in the form of forest in the campus (%)" and "1.10. "Cultivated vegetation area (%)" within the campus" have been changed. This change, which required universities to have more green spaces in order to get the same score as the previous year, caused the performance of 842 points (56.1%) in 2018 to decrease to 824 points (55%) in 2019. This shows that universities should have a more comprehensive sustainability vision rather than just setting targets according to UI GreenMetric indicators. When the same results are examined for world universities, the most successful category was "Education (ED)" with 971 points (53.9%) and the most unsuccessful category was "Energy and Climate (EC)" with an average of 974 (46.4%). After success in 2014 and 2015, the waste (WS) category has declined rapidly in the last four years.

Table 2. UI GreenMetric average scores of universities in Turkey in 2019

Ranking	SI (1500)	EC (2100)	WS (1800)	WR (1000)	TR (1800)	ED (1800)	Total (10000)
1-99	1050	1150	1575	800	1425	1600	7600
100-199	983	1183	1075	625	1225	1275	6367
200-299	969	1031	1050	384	1281	984	5700
300-399	908	883	988	421	1096	913	5208
400-499	771	896	911	421	889	632	4521
500-599	759	741	834	225	931	650	4141
600-699	678	590	563	290	855	575	3550

The average score of Turkey 2019 is shown in Table 2. The university performance in the top 300 in the world rankings, performed close to each other except for the Water (WR) and Education (ED) categories. Although the universities ranked among the top 300 and 500 are more successful than the upper ranking range in the Water (WR) category, they lagged behind, especially due to their performance in the Setting and Infrastructure (SI), Transportation (TR) and Education (ED) categories. Universities ranked among the top 600 and 700 should draw attention to their low performance in Waste (WS) and Energy and Climate (EC) categories.

3.3. Comparison of university scores in Turkey with the average scores of the continents

A total of 780 universities applied to the UI GreenMetric ranking system in 2019. The number of universities applying from the Asian continent is 373 (48%), the European continent is 229 (29%), the South American continent is 95 (12%), the North American continent is 64 (8%), the African continent is 14 (2%), and the Oceania continent is 4 (1%). It is no coincidence that UI GreenMetric was founded by the Asian country (Indonesia) and received more applications from the Asian continent. It is also known that since the beginning of the 2000s, there has been an increasing interest in green campus studies, especially in China, Malaysia, Taiwan and Indonesia [36-37].

The requirement for specifying universities which continents they belong to can cause confusion in a country that has connections to more than one continent like Turkey. Although only 8 of the 43 universities applying from Turkey are geographically located in the Europe, 25 universities chose Europe as the continent in 2019. The remaining 18 universities chose the Asia. UI GreenMetric has been sharing the results by continents since 2017 (Fig. 3). According to this, although the average score of the universities in Turkey has increased over the years. It has lagged behind the world average and other continents except for Asia and Africa. (Muñoz-Suárez et al., 2020) stated that new universities (founded within the last 100 centuries) predominate among the top 500 universities in UI GreenMetric [15]. They explained as the Asian universities were dominant in the first 500 and these universities were generally established in the last century and the performance of Turkey is compatible with this theory.

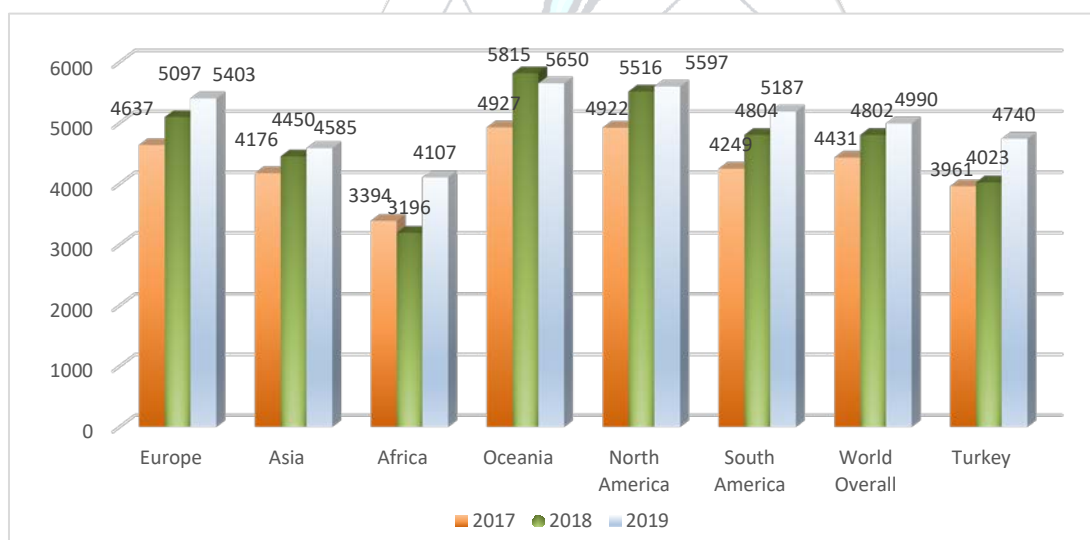


Figure 3. Average scores of continents and Turkey in UI GreenMetric

3.4. Change of UI GreenMetric performance of universities in Turkey over the years

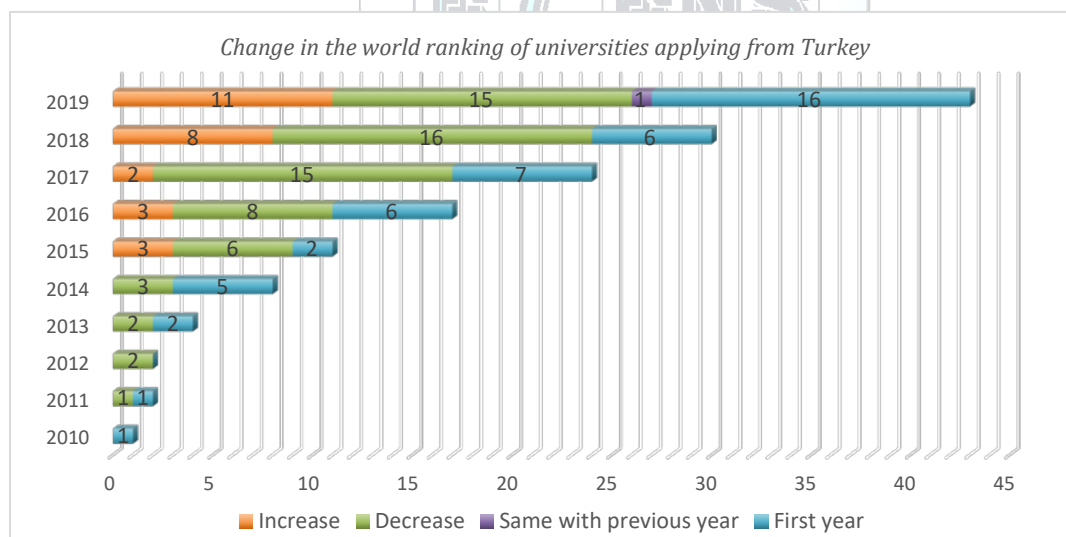
UI GreenMetric has received increasing attention from Turkey since its establishment. The number of applied universities has increased rapidly in the last three years and it was constant only in 2012.

Table 3. UI GreenMetric rankings of universities in Turkey

Ranking	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1-99	1	-	-	-	-	-	-	1	1	1
100-199	-	2	1	-	-	-	1	2	2	3
200-299	-	-	1	4	4	4	4	4	5	8
300-399	-	-	-	-	4	6	7	5	5	6
400-499	-	-	-	-	-	1	5	6	6	7
500-599	-	-	-	-	-	-	-	5	5	8
600-699	-	-	-	-	-	-	-	1	6	10
Number of universities (Turkey)	1	2	2	4	8	11	17	24	30	43
Number of universities (Total)	95	178	215	301	361	407	516	619	719	780

Universities that ranked in the top 100 in Turkey are Bilkent University, which applied in the year UI GreenMetric was first published, and ITU. As seen in Table 3, there are four universities in the top 200 and twelve universities in the top 300 in 2019. The remaining 31 universities (72%) are in the 300-700 range.

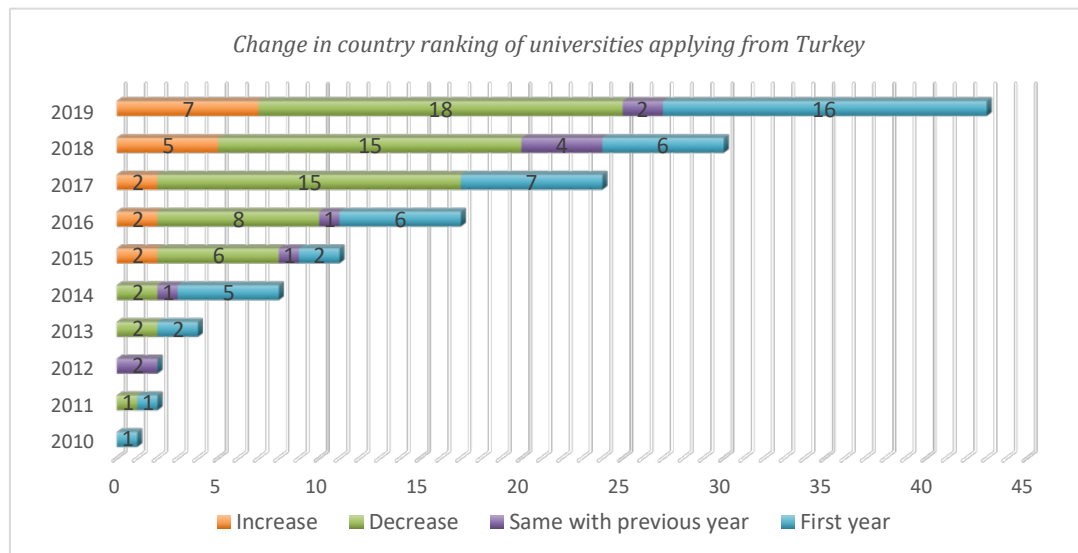
Results also shows university performances in Turkey vary widely. Results shown in Fig. 4 and Fig. 5 over the years in order to understand the overall performance change in the country according to these most of the universities have a decreasing trend in the general ranking. The number of universities with lower ranking ternd in the UI GreenMetric ranking in 2017, 2018 and 2019 was respectively 15, 16 and 15 while increasing rankings were respectively 2, 8 and 11. Although the average scores have increased over the years, their place in the ranking is decreasing (Fig. 4). This is due to the increase in average scores at other universities applying for the UI GreenMetric ranking. As (Ragazzi and Ghidini, 2017) and (Maçın et. al., 2020) mentioned, the absence of any sustainability classification in UI GreenMetric may cause the ranking change depending on the performance of other universities, although the university performance in terms of sustainability does not change [13]-[38].



*Inonu University did not apply in 2014. Therefore, the years 2013 and 2015 were compared.

Figure 4. Change in the world ranking of universities applying from Turkey between 2010-2019

Although the total scores of 14 universities in the national ranking and 13 universities in the general ranking increased, their rankings decreased in 2018. These numbers were changed to 9 (in national ranking of Turkey) and 7 (in the world) in 2019.



* Inonu University did not apply in 2014. Therefore, the years 2013 and 2015 were compared.

Figure 5. Change in country ranking of universities applying from Turkey between 2010-2019

4. PROBLEMS AND SUGGESTIONS TOWARDS TO BECOMING GREEN CAMPUSES

At the national workshop held by ZBEÜ, the problems faced by universities in Turkey during and after the UI GreenMetric application process were discussed. In this section, suggestions are made to be more successful in UI GreenMetric and how to serve the SDGs in order to become sustainable universities in the long term.

- Obtaining “institutional data” is one of the challenges faced by universities in Turkey. Considering the concept of a sustainable university in a broader perspective, “**sustainability offices**” are recommended [39]. Sustainability offices are necessary for universities to realize their sustainability visions, to acquire the habit of keeping data and to carry out multi-disciplinary studies. The office should regularly publish sustainability reports. One of the duties of the sustainability office is to keep this data on a regular basis. If it is not possible to establish an office in the short and medium term, a relevant unit of the university restaurant should be appointed. It will be useful for this unit to keep basic information regularly, such as electricity, water and natural gas consumption, the number and areas of buildings on the campus, the number of vehicles on the campus, the list of projects carried out and partnered with the university. Many universities in America and Europe are developing their projects under the management of “sustainability offices”, including universities in top 20 ranking of Green Metric. In addition, Asian universities have been interested in this subject and have achieved successful results [40].
- Organizing activities related to green areas in the campus with the participation of internal stakeholders were suggested for the **Setting and Infrastructure (SI)** category. (Caeiro et al., 2020) stated that stakeholder participation is important in adopting SDGs and becoming a green campus [16]. Increasing green areas with the help of non-profit organizations (NGOs) will also be beneficial in terms of creating social awareness.
- Performance of universities in Turkey follow closely the top 20 universities in the world ranking, especially in **Education (ED)**, **Setting and Infrastructure (SI)** categories. However, they are clearly behind in the **Energy and Climate (EC)** category. Renewable energy and smart building topics come to the fore and future projects and investments should focus on these projects. New projects should meet the energy needs of the campus from renewable energy sources by considering that the main purpose is to reduce energy consumption and carbon footprint. However, the effects of these projects will be understood in the medium and long term and they will be relatively costly.
- In the **Waste (WS)** and **Water (WR)** categories, cooperation between the local government and the university is necessary. As mentioned in (Amaral et. al., 2020), sustainability studies that use “top-down” and “bottom-up” approaches at the same time are more successful [41]. Studies are generally carried out with a “top down” approach in Turkey. One of the important example is Zero Waste project [42]. Waste category results were increased in 2019 because many universities have started composting applications [43-44] after the Zero Waste Regulation. It is possible to implement projects similar to zero waste, on issues such as water recycling and use of renewable energy but the support of the state and local governments is required. Furthermore, YÖK added UI GreenMetric as an indicator to the

“General Report of University Monitoring and Evaluation” [45]. This development is very important in terms of discussing how state and local governments can contribute to green campus practices. Waste and water consumption can be reduced by training and campaigns to be carried out within the university. For example, research conducted at Rhodes University has shown that knowing how much waste is produced in dining halls can reduce the amount of food waste [46]. It is possible to reduce the use of plastic bottles by placing water dispensers in different parts of the campus [47]. Grey water use may increase for universities in Turkey and rainwater harvesting is also feasible [31].

- In particular, it would be beneficial for universities ranked low in Table 3 to produce projects in categories such as **Transportation (TR)** and **Education (ED)** that do not require any cost on campus, but will enable them to take action more easily on the way to becoming a green campus. The publication of guidelines that will reduce the number of vehicles entering the campus and highlight the comfort of pedestrians will ensure more success in the **Transportation (TR)** category without any cost.
- **In the Education (ED)** category, projects should be developed on topics such as sustainability, green economy, and biotechnology, which gain attention today. Academic publications and university stakeholders should take a more active role. Thanks to internal surveys, trainings and the active role of student clubs, it will be possible for universities to engage in sustainability activities with all internal stakeholders. While discussing, during the Covid-19 process, the question of whether distance education (and/or blending education) will dominate the future without a campus education [48], embracing **sustainable university** concept is essential. Therefore, universities should include courses containing “SDGs” in their curriculum within the scope of being sustainable institutions. In addition, education should cover to other stakeholders of the campus other than students [2].

5. CONCLUSION

UI GreenMetric has been developed to better understanding of sustainability in education, to be more effective in reaching the SDG and to keep universities informed from each other. The number of newly applied universities to UI GreenMetric increases every year, but the rankings decreases. 72% of the universities applying from Turkey did not ranked in the top 300 and the most unsuccessful categories across the country were Water (WR) and Energy and Climate (EC) in 2019. The major problems are coming from lack of sustainability offices and inability to provide data for the application. However, GreenMetric indicators do not capture specific factors such as the level of development in the country or stakeholder participation. Universities in developing countries sometimes do not receive adequate support from local governments for basic needs such as waste management, water treatment and transportation. This causes a part of the budget for sustainability to be allocated to basic needs and prevents equal conditions between universities. This shows that it is necessary to focus on global and long-term goals, rather than just UI GreenMetric indicators. Furthermore, solutions climate change mitigation depend on the success of small-scale projects such as university campuses. Although it is not possible to reach the SDGs in the short term, it is understood from the number of universities applying to UI GreenMetric that universities in Turkey volunteer to support sustainable development. The universities in Turkey should make short, medium and long-term plans within the framework of the sustainable vision with the support of state and local governments.

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CONFLICT OF INTEREST STATEMENT

The author declares that there is no conflict of interest.

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