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Article

# Sustainability performance and communication of the greenest Hungarian Universities

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**Abstract:** Universities play a crucial role in supporting sustainable development. In recent decades, indicator-based assessment tools have emerged to quantify universities' efforts towards sustainability. The most widely known is the UI GreenMetric World University Rankings (UI-GWUR): In our paper, we examine the sustainability performance of the three greenest Hungarian universities. The University of Pécs, the University of Szeged and the University of Sopron were among the top 200 higher education institutions (HEIs) in the UI-GWUR in 2023, which proves that they have successfully integrated sustainable development into the components of their system. The aim of the paper is to identify the sustainability measures implemented by the three-top Hungarian HEIs. Their experiences shed light on how it is possible to move forward in the UI GWUR for a Hungarian higher education institution. In order to evaluate the sustainability efforts of the universities, the UI GWUR database was first examined. The websites and sustainability reports of the three universities were also analyzed to gain insight into their activities. Identifying the sustainability actions of the three institutions will help other universities to successfully plan and implement their sustainability initiatives. In the last part of our paper, we evaluate how the three Hungarian universities communicate sustainability through their websites. The results show that advancement in the UI Green Metric World University Rankings primarily requires conscious planning, which means a deeper understanding of the ranking methodology on the one hand, and a clear strategy creation and implementation on the other hand.

**Keywords:** sustainable university; higher education; UI GreenMetric; Hungary

## 1. Introduction

Universities have a crucial role to promote sustainable development. Sustainability issues have been on the agenda of higher education institutions since the 1980s. The Stockholm Declaration of 1972 formally recognized at the international level that education has an important role to play in promoting environmental protection and conservation. Since then, several documents (declarations, charters and initiatives) have been issued with the aim of encouraging the process of integrating sustainable development into the different activities carried out by higher education institutions (Lozano, 2015). There are two main reasons why sustainability should be integrated into the work of academic institutions. First, universities can be considered as "small cities" due to their size, population, and the different complex activities that take place on campus, which have some direct and indirect impacts on the environment. The pollution and degradation caused by universities in the form of waste generation, transportation, water, material and energy consumption could be significantly reduced by a more appropriate approach to sustainability. On the other

hand, higher education institutions contribute significantly to the education of future generations (Alshuwaikhat and Abubakar, 2008). The early 2000s saw the emergence of new certification and ranking systems to assess the sustainability performance of universities. The indicator-based assessment tools help to quantify universities' sustainability efforts. They are essential to focus the attention of university leaders on the importance of sustainable development actions and thus support the institutionalization of sustainability (Galleli, 2022). The most widely recognized is the UI GreenMetric World University Rankings (UI-GWUR) developed by Universitas Indonesia in 2010, which evaluates the performance of universities based on six categories that provide an accurate overview of the current situation of the institutions.

In our study, we examine the sustainability performance of the three greenest Hungarian universities that are among the top 200 higher education institutions of the UI GWUR in 2023. These ranks prove that they have successfully integrated sustainable development into the components of their system. The aim of the paper is to identify the sustainability measures implemented by the three top-ranked Hungarian higher education institutions. Their experiences shed light on how it is possible to move forward in the UI GWUR for a higher education institution operating in Hungary, i.e. considering the domestic conditions. Identifying the sustainability actions of the three institutions will help other universities successfully plan and implement their sustainability initiatives. The first part of our paper presents the evolution of the concept of a sustainable university. After a brief introduction of the UI GWUR, the ranking positions and average scores of the participating Hungarian universities are presented. Then, the sustainability measures and scores of the top three universities are reviewed. In addition, the universities' websites are analyzed from the perspective of how sustainability actions and results are communicated. The paper concludes with some of the theoretical and practical implications and draws the conclusions from the research.

## 2. Theoretical background

According to Cortese (2003), the university system has four dimensions: education, research, university operations, and external community (relationships with local, regional, and global communities). A sustainable university should embrace the concept of sustainability across these four dimensions. Because students learn from everything around them, these activities are not separate but form a complex web of experiences and learning. Lozano et al. (2015) added three more dimensions (institutional framework, on-campus experiences, and assessment and reporting) to this system, suggesting that commitment to sustainable development (SD) and its impact in a higher education institution can be examined through these activities. The seven core elements proposed by the authors in their HEI system are as follows:

1) Institutional framework (the HEI commitment: policies, vision, mission, sustainable development office, and signed DCIs);
2) Campus operations (energy use and efficiency, greenhouse gases, waste, water and water management, food purchasing, transportation, accessibility, equality and diversity);
3) Education (courses and programs on SD, transdisciplinarity, curricular reviews

and “educate the educators” programs);

4) Research (research on SD, research centers, research funding, holistic thinking, SD research used in teaching, publications, patents, new knowledge and technologies, collaboration and transdisciplinarity);
5) Outreach and collaboration (SD student exchange programs, joint degrees with other universities, joint research, SD partnerships with businesses, NGOs and governments, SD events open to the community);
6) Sustainable development through on-campus experiences (SD working group, SD policies for students and staff, sustainable practices for students, SD visibility on campus, SD awareness on campus, student and staff engagement);
7) Assessment and reporting (SD assessment, SD communication, environmental reports, sustainability reports, national environmental or sustainability HEI rankings, and international environmental or sustainability HEI rankings) (Lozano et al., 2015).

Velazquez et al. (2006, p. 812) define the sustainable university as “a higher education institution, as a whole or as a part, that addresses, involves and promotes, at a regional or global level, the minimization of negative environmental, economic, societal and health effects generated in the use of its resources, in order to fulfill its functions of teaching, research, outreach and partnership, and stewardship, in a way that helps society make the transition to sustainable lifestyles”. The authors point out that there is a lack of clear guidance on what exactly a sustainable university should be and, after examining the best practices used in universities around the world, they propose a comprehensive sustainability management model developed specifically for universities. The model consists of four phases, organized from strategic to more operational areas (Amaral et al., 2015). In phase 1, the university should develop its own sustainability vision (what a sustainable university is about). In phase 2, the university includes sustainability in its mission statement as one of the core values of the university. The next management step recommends that the organizational structure of a sustainable university should reflect its commitment by incorporating its policies into its routine operations and by generating the resources necessary to successfully achieve its mission. The establishment of a sustainability committee facilitates the task of creating and establishing comprehensive campus-wide policies, goals, and objectives. This committee is the primary decision-making level. In phase 4, the authors list the four sustainability strategies (education, research, outreach and partnerships, and campus operations) that can be used to integrate sustainability into all aspects of the university (Velazquez et al., 2006).

Several universities have committed themselves towards sustainability by signing international agreements and conventions, but the majority of them are pursuing matters related to sustainable development on an ad hoc basis. The implementation of sustainable development at universities is therefore, not only a matter of policy. University strategies, declarations or action plans are useless, unless they can be backed up by concrete actions (Leal Filho, 2011).

In the past decades, diverse efforts were being made by universities to make sustainable development part of their institutional framework. Some universities, particularly in Europe, have become leaders in the field with very good practices. But unfortunately, many of those efforts address only one or two of the sustainability

domains at HEIs, which continue to foster compartmentalization, instead of a holistic and a systemic approach (Ramos et al., 2015). The results of the explanatory literature review of Lozano et al. 2015 revealed that the majority of HEIs are focused on education followed by campus operations, institutional framework, outreach, and assessment and reporting. Curriculum practices can vary from simple coverage of some environmental issues and material in existing courses to modules or new courses within a program, at both the undergraduate and postgraduate levels. The least applied area seems to be research (Lozano et al., 2015).

Leal Filho et al. (2017) identified 25 fundamental obstacles compromising the implementation of sustainable development in universities. The qualitative analysis shows that most of the obstacles are considered almost with similar magnitude. The lack of support from the management can be the major obstacle to the integration of sustainable development into HEIs. Technology is ranked the second greatest stumbling block to sustainable development. Universities are places to create and access scientific and technological knowledge; however, knowledge is seldom successfully applied to operating activities. This is followed by a lack of interest in or concern with sustainability issues as third most important obstacles. The lack of structures, such as environment committees, also contributes to the problem. The authors mention that the lack of building with sustainable performance can also hamper the sustainability efforts of the campuses. Despite the high front-up costs, HEIs have continually invested in green building in recent years but the university-wide commitment is indispensable in order to ensure that the activities of institutions not being limited to single projects. Government barriers also can be important. Government regulation of business activities plays an important role in environmental protection. Compliance with government regulations and laws are seemingly the key drivers of sustainable development (Leal Filho et al., 2017). Ávila et al. (2019) conducted a comparative analysis in universities on all continents to examine the innovation and sustainability barriers in HEIs. The authors confirm the findings of Leal Filho et al. (2017) regarding the major obstacles, but they point out that there may be differences in the importance of barriers between continents. Findings from interviews conducted by Dahle and Neumayer (2001) showed that for many institutions the most significant barrier was budget constraints. The lack of resources or funding available for sustainability projects also appeared in the research conducted by Brandli et al. (2015).

To the successful integration of the environmental sustainability in HEIs, it is vital for the university management to identify critical success factors (CSFs) that overcome the barriers and then to choose appropriate measures to deal with them. CSFs refer to the limited number of areas in which satisfactory results will ensure successful competitive performance of the organization Based on a comprehensive literature review, 23 success factors were identified out of which only 14 factors were considered as critical to be practiced by the university management to successfully implement sustainable campus operations initiatives. (Abdullah et al., 2017). The 14 CSFs were classified into two groups. The first group consists of 9 critical success factors related to the university's governance for implementing sustainable campus operations. In the second group 5 additional factors were listed regarding the accountability to improve the performance of sustainable campus operations initiatives

(see **Table 1**).

**Table 1.** Critical success factors (CSFs) in implementing sustainable campus operation (SCO) initiatives.

| Governance set-up to perform SCO initiatives | Accountability to improve performance of SCO initiatives |
|---|---|
| Developing policies and guidelines. | Integrating the Plan-Do-Check-Act (PDCA) cycle to coordinate improvement efforts. |
| Obtaining top management support. | Conducting an audit to measure performance. |
| Allocating sufficient resources. | Preparing and submitting a report on performance initiatives. |
| Identifying leaders or experts. | Cooperation and trust among the campus community in managing projects/activities. |
| Providing adequate training to leaders and staff. | Raising awareness among the campus community. |
| Setting the vision and goals of the SCO at university level. | |
| Creating incentives to motivate campus community involvement. | |
| Having knowledgeable and skilled staff in the field of sustainability. | |
| Smooth communication across departments. | |

Razman et al. (2018).

The success of a university in overcoming barriers and achieving sustainability is highly dependent on the commitment and involvement of all levels of the organization of the campus community, i.e. students, lecturers, staff, associations, administration and also representatives of the local residents (Alshuwaikhat and Abubakar, 2008). Reid and Schwab (2006) pointed out also the importance of implementing the strategy developed by the university with the support of the regional or local government. For the authors, it was clear that partnerships between universities are also excellent vehicles for generating long-term commitments and achieving complex policy goals.

## 3. Materials and methods

In our paper we investigate the green activities and performance of the top three green Hungarian universities, the University of Pécs, the University of Szeged and the University of Sopron, according to the UI GWUR in 2023. We chose these universities because they are listed in the top 200 that makes them stand out compared to the other Hungarian universities that are also listed in the ranking (see **Table 2**). In order to assess the sustainability performance of the universities, first the UI-GWUR database was examined.

The UI GreenMetric World University Rankings (UI-GWUR) was developed and managed by Universitas Indonesia to measure the sustainability efforts of universities around the world. By 2023, the number of participating universities has reached 1183 in 84 countries consequently the UI-GWUR has become the most widely used global sustainability ranking. UI GreenMetric assesses the sustainability performance of universities in six categories representing the main environmental aspects: Setting and Infrastructure, Energy and Climate change, Waste, Water, Transportation and Education and Research. The Energy and Climate change category has the highest weight (21%), while Water management has the lowest (10%). The

categories Waste, Transportation and Education and Research have 18%, while the category Setting and Infrastructure has 15% of the total UI GreenMetric score (UI GreenMetric Guidelines, 2023). The scoring system has been regularly updated over the years. By 2023, the number of indicators within the categories has increased to 51. Despite some shortcomings of the evaluation system (Ragazzi and Ghidini, 2017), the UI GWUR makes the performance of the participating universities easy to interpret and eliminate problems arising from incomplete data communication of the universities. In our paper, the most recent sustainability scores from the year 2023 were compared with the scores from the year 2017 in the case of the University of Pécs and the University of Szeged. In the case of the University of Sopron, the sustainability scores from 2023 were compared with those from the year 2020 which was ranked first in that year.

**Table 2.** Hungarian universities' positions in the UI Green Metric world university ranking in 2023.

| | Rank | University |
|---|---|---|
| 1. | 24. | University of Pécs |
| 2. | 77. | University of Szeged |
| 3. | 130. | University of Sopron |
| 4. | 340. | University of Debrecen |
| 5. | 348. | Semmelweis University |
| 6. | 368. | Eötvös Loránd University |
| 7. | 583. | University of Pannonia |
| 8. | 750. | Corvinus University of Budapest |
| 9. | 785. | Budapest Business University |
| 10. | 870. | Eszterházy Károly Catholic University |
| 11. | 1099. | University of Miskolc |
| 12. | 1161. | University of Nyíregyháza |

UI GreenMetric World University Rankings official website.

After presenting the sustainability results of the universities by categories, sustainability reports of the universities were analyzed to identify which measures helped the institutions to improve their sustainability indicators. The websites and in particular the green web pages of the three universities were also studied. Our aim was also to identify how the universities communicate their sustainability goals and achievements and who they address their sustainability communication at. The best practices and the communication of the leading Hungarian institutions in the field of sustainability can serve as an example for the universities of other countries with similar conditions.

## 4. Results and discussion

The UI GreenMetric ranking has received increasing attention from higher education institutions in Hungary. The number of universities participating in the ranking system has increased rapidly not only globally, but also domestically (see **Table 2**). In 2023, 1183 institutions in 84 countries measured their sustainability performance in the international ranking. As far as Hungary is concerned, 12 out of 63

Hungarian higher education institutions have already participated in the ranking (Imre and Makkos, 2024).

In 2023, the highest average scores of the 12 Hungarian universities surveyed were achieved in the Education and Research (ED), Transportation (TR), and Waste (WS) categories. The high scores achieved in the Transportation and Education and Research categories can be explained by the fact that they did not require universities to make costly investments (Imre and Makkos, 2024).

The three greenest Hungarian institutions, the University of Pécs, the University of Szeged and the University of Sopron have essentially caught up with the world leaders in terms of sustainability as they are listed in the top 200. In the next part of our paper, we present the sustainability performance of these universities by comparing the information provided by their sustainability reports and websites with their scores in the different categories of the UI GreenMetric Rankings.

## 4.1. University of Pécs (PTE)

In 2023, the University of Pécs was ranked first among Hungarian HEIs in the UI GreenMetric Rankings, occupying the 24th place. It has been on the list of green universities since 2016. The student population of the institution is almost 22,500 and the number of lecturers and researchers reaches 1800 (PTE, 2022). The strategy of the University of Pécs defines the directions to be followed by the institution in the period 2023–2030. Among the objectives, the highest priority is given to the group of "institution-specific strategic objectives", the most important of which is sustainability, which is listed as one of the main objectives of the University (PTE, 2023). PTE has achieved significant national and international successes in the field of environmental sustainability, thanks to the fact that it has been able to advance year after year in the ever-growing international ranking.

**Table 3.** The performance of the university of Pécs in the UI green metric rankings (2017, 2023).

| **Categories and the highest possible scores** | **2017** | **2023** | **Improvement (2020–2023)** | **The score achieved in 2023 as a percentage of the highest possible score** |
|---|---|---|---|---|
| | Score | | Percentage | |
| Settings and Infrastructure (1500) | 668 | 1200 | 79.6 | 80 |
| Energy and Climate Change (2100) | 1173 | 1675 | 42.8 | 79.7 |
| Waste (1800) | 1326 | 1800 | 35.7 | 100 |
| Water (1000) | 625 | 900 | 44 | 90 |
| Transportation (1800) | 713 | 1600 | 124.4 | 88.8 |
| Education and Research (1800) | 624 | 1775 | 18.4 | 98.6 |
| Total (10000) | 5129 | 8950 | 74.5 | 89.5 |

UI Green Metric World university rankings official website.

In 2023, PTE achieved the best result in the Waste management category, where it received the highest possible score (see **Table 3**). The fact that the University of Pécs stopped purchasing plastic bottled water and beverages in 2019, becoming a PET-free university, contributed significantly to this success. Instead, more than 500 free water filling stations have been installed (PTE, 2022). PTE strives to integrate sustainability as a basic principle into the entire procurement process. Approximately

25% of the waste generated at PTE is recycled, but the Botanical Garden achieves 100% recycling through composting (PTE, 2017).

The second highest score was achieved in the category of Education and Research, where PTE received 98.6% of the total available points in 2023. Between 2017 and 2023, the most significant score improvement was also achieved in this area, as the University of Pécs almost doubled its points (184%). In all faculties of PTE, we can find courses in which horizontal sustainability issues appear. Without claiming to be exhaustive, these include courses on intelligent environmental technologies, 3D technology, renewable energy, climate-conscious architecture, circular economy, and sustainable material and energy management. The formation of individual and community attitudes is also emphasized at PTE. The university has initiated a series of attitude-shaping actions in different areas such as energy use, transportation, waste management and water management. The actions (promotion of cycling, garbage collection campaign, used oil collection campaign, mobile phone collection campaign, packaging-free shopping) are partly university initiatives and partly linked to national and global actions. At PTE, there is an increasing emphasis on research related to sustainability. Some of the most important research topics are: root zone wastewater treatment system; extensive green roof; rainwater retention; investigation of energy and acoustic comfort aspects of buildings; secondary fuel production process from municipal solid waste; hydrogen technologies suitable for storage of weather-dependent renewable electricity; development of fuel cell equipment; and water policy and water diplomacy. Under the leadership of PTE and with the participation of ten partners, the National Laboratory of Renewable Energies (MENL) has been established to dynamize domestic research and development activities in the field of renewable energy (PTE, 2021).

The increase in scores in the Transportation category was also significant. Between 2017 and 2023, the university improved its scores by 124.4%, earning 88.8% of the total available points in the category (https://greenmetric.ui.ac.id). PTE is committed to promoting the use of zero or near-zero emission modes of transportation, such as walking, cycling, and public transportation (PTE, 2018). The number of bicycle racks on PTE campuses is increasing every year. In 2022, the University of Pécs won the “Bicycle Friendly Workplace” award of the Ministry of Construction and Transportation in the category of public institutions. The university also supports the use of public transport by its employees (PTE, 2022). In the case of the university’s car fleet, the proportion of fossil energy used and carbon dioxide emissions from transport have been reduced by increasing the number of electric cars. In 2019, there were 9 zero-emission electric cars in the fleet, which play an important role in the transportation of goods and people between the different locations of the university (PTE, 2019).

Through the application of technical solutions (installation of sensor faucets and eco-aerators) and attitudinal methods, PTE reduced the amount of water used for its activities between 2017 and 2023. In 2019, the number and quality of sanitary facilities were also evaluated in terms of water efficiency (PTE, 2019). As a result, the score in the Water management category increased by 44%, reaching 90% of the total points available in 2023 (https://greenmetric.ui.ac.id). The university is continuing its efforts to recycle swimming pool water and implement rainwater management (water

retention) in the Botanical Garden (PTE, 2020).

PTE scores in the Setting and Infrastructure category increased significantly (by 79.6%) over the studied period (https://greenmetric.ui.ac.id). Due to the characteristics of the area, the possibility of planting trees is limited. However, the University of Pécs has prioritized the greening of its campuses, increasing the proportion of wooded and vegetated areas. That is why the construction of the new study block of the Faculty of General Medicine in 2021 included not only the addition of a new 12,000-square-meter teaching and research area, but also the renovation of a 10,000-square-meter green area. As a result, the percentage of land covered by vegetation at PTE sites has increased to over 40%. In addition to the expansion of green areas, special emphasis is placed on regular park maintenance (PTE, 2022). In 2023, PTE achieved 80% of the total scores available in this category (https://greenmetric.ui.ac.id).

As for the Energy and Climate Change category, the first cornerstone of the university's decarbonization roadmap is the replacement of fossil energy sources with renewable ones. Since 2016, the share of renewable energy sources in the total energy used by PTE has been continuously increasing. In 2023, more than 60% of the total energy used by the university came from renewable energy sources. Among the renewable energy sources, biomass has the largest share, which is due to the transition to district heating based on biomass. Biomass is followed by geothermal and solar energy (PTE, 2021). Nearly 800 new solar panels have been installed in three locations, which can reduce the university's demand for fossil energy. The installation of a solar water heating system also serves this goal. The second point of the university's decarbonization roadmap is to increase energy efficiency and savings. As part of this, many university buildings have been renovated. 52% of the PTE buildings are considered SMART buildings. The University of Pécs was the first Hungarian university to join the Virtual Power Plant Program (VEP) in 2018. The "output" of the Virtual Power Plant consists of the energy savings of the companies, municipalities and schools that joined the program, which practically triggers the creation of a real power plant (PTE, 2020). These costly investments resulted in a moderate increase (42.8%) in the UI Green Metrics Rankings. However, in 2023 the University of Pécs obtained almost 80% of the available scores in the Energy and Climate Change category.

## 4.2. University of Szeged (SZTE)

The University of Szeged is the only Hungarian university that has participated in the ranking since its inception in 2010. Between 2010 and 2019 it was ranked first among Hungarian universities. In 2023 it was the second greenest domestic university, ranked 76th. SZTE has 12 faculties and about 25,000 students. The number of its academic research and teaching staff reaches 2300.

The first steps of the University of Szeged towards becoming a sustainable university were mainly individual initiatives: the management of the József Attila Study and Information Center of the SZTE (SZTE JATIK) organized an "Earth Day" event in 2008. In 2009, it successfully applied the guidelines of the Green Office competition and won the award for "The office that takes the most steps towards being green". Thanks to the recognition of the initiative, more and more university citizens

and organizations joined the call for greening the university. In 2010 and 2011, SZTE JATIK was awarded the title of "Bicycle-friendly Workplace" and launched the initiative "Green Commando" with the aim of transforming other units of the university according to the guidelines of the Green Office, taking into account environmentally friendly aspects. (Mónus, 2020; SZTE JATIK, 2024).

The sustainability project of the University of Szeged is based on two pillars. In addition to the programs aimed at raising the awareness of the citizens of the university and the city, the second pillar of the sustainability efforts was the continuous development of the infrastructure. The dissemination of effective technical solutions (application of motion sensor switches and LED bulbs, optimization of building management systems) contributes to the reduction of the university's environmental impact (Gyarmati, 2018). Numerous investments using renewable energy are also responsible for the position achieved by the university in the international sustainability rankings, especially in the period between 2012 and 2019.

The implementation of innovations and technologies for the reduction of carbon emissions is one of the main priorities of the University of Szeged. In 2023, the University received 66.6% of the maximum scores in the category of Energy and Climate change (see **Table 3**). SZTE is committed to using the opportunities offered by the use of renewable energy sources. These investments have contributed to reducing the energy consumption of the university buildings, despite the fact that their number is increasing. At the same time, CO2 emissions have been successfully reduced. The infrastructural developments of the past period, listed below, support this statement:

- The establishment of a geothermal cascade system provides heating and cooling of five university buildings.
- In 2012, more than 2700 pieces of solar panels were installed on the roofs of 27 university buildings. Three years after the completion of this project, another 2040 pieces of solar panels were placed on the roofs of 18 university buildings. In 2023, the amount of energy produced by the solar panels covered 2.96% of the university's annual consumption.
- In 2015, the József Attila Study and Information Center installed a wastewater heat recovery system. With the help of this system, the thermal energy extracted from the wastewater with a constant temperature is used for the heating and cooling of the building (Gyarmati, 2018).

In 2023, the University of Szeged achieved the best results in the Waste management category with 95.8% of the total available scores (see **Table 4**). Between 2017 and 2023 the score of this category increased only by 9.5%. The university operates sustainable, environmentally conscious waste management. There is selective waste collection in the university buildings. Organic waste stays on campus as the Botanical Garden recycles it as compost. Rainwater is also collected in the Botanical Garden to reduce irrigation costs. There is also a lot of research going on at the University of Szeged with a focus on waste reduction, such as methods to remove microplastics from water or a recycling machine that anyone can use at home to produce raw material for 3D printing from PET bottles (SZTE JATIK, 2024).

**Table 4.** The performance of the University of Szeged in the UI Green Metric Rankings (2017, 2023).

| Categories and the highest possible scores | 2017 | 2023 | Improvement (2017–2023) | The score achieved in 2023 as a percentage of the highest possible score. |
|---|---|---|---|---|
| | Score | | Percentage | |
| Settings and Infrastructure (1500) | 1076 | 1280 | 18.9 | 85.3 |
| Energy and Climate Change (2100) | 1070 | 1400 | 30.8 | 66.6 |
| Waste (1800) | 1575 | 1725 | 9.5 | 95.8 |
| Water (1000) | 775 | 850 | 9.6 | 85 |
| Transportation (1800) | 963 | 1550 | 60.9 | 86.1 |
| Education and Research (1800) | 314 | 1700 | 441.4 | 94.4 |
| Total (10000) | 5773 | 8505 | 47.3 | 85 |

UI GreenMetric World University Rankings official website.

The second-best result (94.4% of the total score) was achieved in the category of Education and Research. At the same time, this category showed the most significant improvement in scores (441.4%) between 2017 and 2023. The number of courses dealing with sustainability has increased, and among the research topics, sustainability issues appear more and more prominently. The shaping of students' attitudes has always been an important part of the greening activities of the University of Szeged. There is a Green Team at the university which supports the innovative initiatives in the field of sustainability. Therefore, several communication channels are used to make the students aware of the environmental aspects. For example, a series of programs called "Get green during the registration at the SZTE Study and Information Center" is organized for enrolling students. The Center's official Facebook page has more than 10,000 followers, and information boards have been put up to encourage the conscious use of resources. Raising awareness among employees is also important. A web-based internal forum was created in 2014 to inform employees about the university's sustainable efforts (Mónus, 2020; Gyarmati, 2018).

The score in the Transportation category shows a moderate improvement (60.9%) in the period studied. The University of Szeged supports the environmentally friendly mobility habits of its employees by creating bicycle storage facilities, providing bicycle services and promoting public transport. The university has 44 cars that are actively used to transport documents, people and supplies from one building to another. From 2020, five electric cars have replaced the university's most driven cars in urban areas, rapidly reducing direct carbon emissions in the city (SZTE, 2022).

In the category of Water management, SZTE strives to reduce its water consumption through the establishment of water-saving systems and the secondary use of rainwater. A grey water system is used in the central building of the university so that water can be reused after appropriate procedures (SZTE JATIK, 2024).

SZTE was ranked as the best Hungarian university in the Setting and Infrastructure category at the national level. The high score achieved is probably due to the fact that the university has a Botanical Garden and a Clinical Center at the same time. Therefore, the area of the campus is covered with planted vegetation and the facilities for the preservation of plants and the health infrastructure for the students and the staff of the university are unique.

### 4.3. University of Sopron (SE)

The University of Sopron is a private university maintained by a foundation in Sopron. It was founded on the basis of the University of Forestry and Wood Industry, which existed between 1962 and 1996. At present it has four faculties. With its 434 employees and almost 2500 students, it is considered to be a rather small university compared to the other two institutions presented above.

The University of Sopron's sustainability efforts were assessed for the first time in 2020, when it was ranked 590th. The university improved its position substantially in the following years. In 2023, despite the increasing number of participating universities, it was ranked 130th. The University of Sopron could show progress in all 6 main performance categories of the UI GreenMetric survey (UI GWUR).

The Environmental Management System (EMS), which examines the environmental impact of the institution's activities, was introduced at the University of Sopron in 2011. This internal evaluation system, which monitors the annual development of the organization's own environmental indicators, was replaced by an external one in 2020, when the University of Sopron joined the UI Green Metric World University Rankings (SOE, 2023).

**Table 5.** The performance of the University of Sopron in the UI Green Metric Rankings (2020, 2023).

| **Categories and the highest possible scores** | **2020** | **2023** | **Improvement (2020–2023)** | **The score achieved in 2023 as a percentage of the highest possible score** |
|---|---|---|---|---|
| | **Score** | | **Percentage** | |
| Settings and Infrastructure (1500) | 750 | 935 | 24.7 | 62.3 |
| Energy and Climate Change (2100) | 725 | 1565 | 115 | 74.5 |
| Waste (1800) | 825 | 1425 | 72.7 | 79.1 |
| Water (1000) | 350 | 900 | 157 | 90 |
| Transportation (1800) | 800 | 1700 | 112.5 | 94.4 |
| Education and Research (1800) | 1125 | 1675 | 48.8 | 93 |
| Total (10000) | 4575 | 8200 | 79.2 | 82 |

UI GreenMetric World University Rankings official website.

The University of Sopron achieved its best results in the categories of Transportation, Education and Research, and Water management, where it obtained 94.4%, 93%, and 90% of the total points available (see **Table 5**). These results were achieved by the institution after three evaluation cycles, and they are due to targeted developments and the effective implementation of the "Green University" philosophy in relation to sustainability.

The university's main campus and most of its educational buildings are located in the University Botanical Garden. The forested area, which also serves higher education purposes, is extremely large, and the size of open spaces projected to the number of university citizens is also unique. The ratio of the university's open spaces to the total area of the university is in the highest category in the world (SOE, 2023). In spite of the excellent characteristics, the score in the Settings and Infrastructure category was the lowest of all categories (62.3%) as a percentage of the total scores available. At the same time, this category showed the slightest improvement (24.7%)

between 2020 and 2023.

Since joining the Green Metric Rankings, the University of Sopron has significantly increased its scores in the Energy and Climate change category (115%). The fact that the central campus of the institution achieved carbon neutrality in 2021 certainly contributed to the improved position. The ecological footprint per student of the University of Sopron was found to be particularly favorable, as it's below the national sustainability threshold. Thanks to the conscious efforts of the past period, the annual carbon footprint of the university was also below the global sustainable value. The "Loyalty Forest" project of the university, in which a tree is planted for every newly enrolled student, has contributed significantly to these results. The University of Sopron uses four different renewable energy sources to cover its energy needs. The production of renewable energy from biomass and solar energy is significant. The institution also uses biodiesel and geothermal energy. The ratio between the production of renewable energy and the annual energy consumption is high at the university level (56.62% in 2023). The increasing share of energy saving devices has further improved these results (SOE, 2023).

The university's score in the Waste category increased by 72.7% between 2020 and 2023. The selective collection of waste includes paper, plastic, glass, green waste, metal, hazardous waste (special waste from laboratories, batteries, toners, paints, varnishes, etc.) and electronic waste. In the period under study, the University of Sopron developed its waste recycling activities by setting up additional selective collection containers. In 2023, more than 75% of the waste was recycled in cooperation with the municipal waste management partner. The value-added treatment of wastewater is also carried out in cooperation with the municipal wastewater treatment plant (by producing biogas, electricity and compost). The treatment of the university's organic waste is almost completely solved in the Botanical Garden by means of composting. The university also implements programs to reduce paper and plastic consumption, such as preferring double-sided printing, handling documents in electronic form, avoiding printing whenever possible, and using online systems. The free water collection points are available to all university citizens, which encourages the use of reusable bottles, glass cups or mugs (SOE, 2023). Based on the results of 2023, the University of Sopron achieved 79.1% of the total scores in the Waste category and strives to further increase the efficiency of selective waste collection in the coming years.

The Water management score of the University of Sopron increased by 157% between 2020 and 2023. There are several water-saving devices and the institution is constantly installing new ones (water-saving toilets, automatic faucets). The proportion of treated water is high compared to all water sources of the university (e.g. rainwater tank, groundwater, surface water, etc.). Development plans include the collection of rainwater run-off from buildings and paved surfaces in rainwater tanks for irrigation purposes (vegetation outside and inside the building), as well as for gray water use, which would greatly reduce the use of piped water (SOE, 2023).

The scores in the Transportation category increased by 112.5% between 2020 and 2023. At the University of Sopron, the number of all vehicles divided by the number of university citizens is low (0.11), which is very favorable from the environmental point of view. A permit is required to enter the university area, and the number of

permits is limited. The relatively short distance between the university campuses allows for walking, cycling, and the use of public transportation. The university supports (public) transportation by providing free bicycles to employees and subsidizing transit passes, which reduces the use of cars for commuting. Zero-emission vehicles are provided free of charge to employees by the university (SOE, 2023).

The improvement of the scores obtained in the Education and Research category was moderate (48.8%) in the period studied, due to the previous strong sustainability orientation of the education (more than 60% of the university courses are related to sustainability). The research activities are of a similar nature: the share of sustainability research resources of the university is about 90% compared to the total research resources, which also places the university in the highest rating category in the international context.

## 4.4. The communication of the universities' sustainability performance

The quality and completeness of website communication varies widely among the three universities studied. According to Lukács et al. (2024), communication about the sustainability efforts of universities can be essential because sustainability rankings can be a good opportunity for smaller universities to differentiate themselves from their competitors. Thus, a favorable position in sustainability rankings provides an alternative recognition and competitive advantage for universities.

In the UI GreenMetric Guideline for 2023, there is a category under Education and Research where universities must provide data on their sustainability websites. Questions include whether there is a dedicated sustainability website and whether it is available, accessible, and updated occasionally or regularly. According to the guideline, websites are essential "to educate students and staff" and provide information about the university's "latest involvement on green campus, environment and sustainability programs, sustainability plan, target, achievement" (Guideline 2023, 29). Although it is only a small subcategory worth 200 points, the communicating sustainability on a university website is an indicator of how important it is for the university to present itself as a green university.

The University of Pécs, the leading Hungarian university in the UI GreenMetric Rankings, has a sustainability website called Zöldegyetem/Green University both in Hungarian and in English (https://zoldegyetem.pte.hu/, https://zoldegyetem.pte.hu/en). It meets all the requirements as it is regularly updated. It appeals to students with its style and gives them plenty of ideas on how to be green every day. It lists current events related to sustainability and includes links to the university's green social media sites (see **Figure 1**).


**Figure 1.** All social media sites linked to the green university concept of the University of Pécs.

Its main focus is to activate and involve students in creating new solutions and participating in sustainability projects. To achieve this goal, the website is appealing with lots of visuals, photos and videos showing student activities. The SDG areas prioritized on the website are Education and Research with the latest sustainability reports and media footages, Transportation, Waste management, and Energy and Climate Change. This is all in line with the university's rankings in these areas, with the exception of Water management.

The University of Szeged does not have an easily accessible, single website dedicated exclusively to sustainability. It has some sub-pages where the concept of a green university appears, but they are not comprehensive at all and give some limited information only in Hungarian (https://u-szeged.hu/zoldegyetem; https://u-szeged.hu/kozponti-egysegek/zold-egyetem/zold-egyetem; https://u szeged.hu/tik/zoldintezmeny). The highest priority is given to communicating the ranking positions of the university and the various awards it has received, although not all of them are related to sustainability (see **Figure 2**). One of these pages emphasizes the importance of continuous infrastructure development for green purposes and the formation of green attitudes among university citizens. Here, too, the visitor can read about two projects from the years 2016 and 2019. Under the Green Report one can find achievements related to Energy and Climate Change, Waste and Transportation from the year 2022, but without any further information. These pages have not been updated recently and do not contain current, detailed information.


**Figure 2.** Various awards promoted on the Green Report page of the University of Szeged.

The University of Sopron has its own Green University website (https://greenuniversity.uni-sopron.hu/kezdolap), which is easily accessible from the home page. It is not aimed at students, but at partners and employees of the university. It gives equal emphasis to the university's achievements in all 6 UI Green Metric areas with summative assessments and explains how this ranking system works. The website is regularly updated with the latest news on sustainability programs. But if the visitor switches for English there is only a short, 8-page summary of the green activities and achievements of the university, and it is not easy to find (SOE, 2023)

This is the only university where the main feature of the home page is the natural environment (https://www.uni-sopron.hu/kezdolap). The university's motto, "Naturally with you," also draws attention to its asset, the unique environment in which it is located. This university boasts of its latest sustainability achievements on the home page (see **Figure 3**).


**Figure 3.** Sustainability-related achievements on the English homepage of the University of Sopron.

This comparison shows that the top-ranked Hungarian universities have different approaches to communicating their sustainability development goals and results. The number one university, the University of Pécs, excels in this type of communication and projects the image of a committed, active and responsible institution. It is also forward-looking, with the aim and practice of educating and involving the younger generations. The University of Sopron takes a different approach. Its communication is more formal, but it uses every opportunity to emphasize its natural endowments and builds its sustainability policy on them. The third Hungarian university studied in this paper, the University of Szeged, does not take the opportunity to promote itself as one of the top green universities in the country. It can be said that having a dedicated sustainability website can streamline and focus sustainability communication and may also have a backwash effect on sustainability activism. Mazo and Macpherson (2017) found, that universities still fail to communicate their sustainability actions effectively. They found, that after social media communication strategies (Facebook, Twitter, etc.) the second communication approach suggested for HEIs is websites that support their media campaigns. This type of one-way communication can be an important strategy to disseminate information as objectively as possible (Morsing and Schultz, 2006). While "sustainability messages must be clear, precise and coherent" they should be "tailored to the different contexts of recipients" (Djordjevic and Cotton, 2011, 392) to enhance understanding of the message and promote behavioral change. This aspect of sustainability communication still needs to be considered by the HEIs investigated.

## 5. Discussion

The University of Pécs, the University of Szeged and the University of Sopron have committed themselves to become more sustainable at different times, therefore they are at different stages on the road to sustainability. The University of Pécs achieved the best result among domestic universities in several categories of the UI GreenMetric World University Rankings (Energy and Climate Change, Waste, Education and Research) in 2023. The University of Szeged obtained the highest score in the Settings and Infrastructure category, while the University of Sopron's performance was the best in the Transportation category. In the category of Water management, the University of Pécs and the University of Sopron were the best at the national level. In order to better highlight the strengths and areas for improvement, **Table 6** provides a comparative analysis of the performance of the HEIs surveyed by category.

**Table 6.** Scores and percentages achieved by the three greenest Hungarian universities in the UI GreenMetric Ranking (2023).

| Categories and the highest possible scores | University of Pécs | University of szeged | University of Sopron |
|---|---|---|---|
| Scores (share of total scores) | | | |
| Settings and Infrastructure (1500) | 1200 (80) | 1280 (85.3) | 935 (62.3) |
| Energy and Climate Change (2100) | 1675 (79.7) | 1400 (66.6) | 1565 (74.5) |
| Waste (1800) | 1800 (100) | 1725 (95.8) | 1425 (79.1) |
| Water (1000) | 900 (90) | 850 (85) | 900 (90) |
| Transportation (1800) | 160 (88.8) | 1550 (86.1) | 1700 (94.4) |
| Education and Research (1800) | 1775 (98.6) | 1700 (94.4) | 1675 (93.0) |
| Total (10000) | 8950 (89.5) | 8505 (85) | 820 (82) |

UI GreenMetric World University Rankings official website.

Taking into account their current opportunities and the green developments of the previous periods, the three universities were able to advance in different categories in the UI Green Metric World University Rankings in the period between 2017 and 2023. After significant investments in the field of renewable energy in the previous period, the University of Szeged improved its sustainability performance mainly in the field of Education and Research in the period between 2017–2023. The University of Pécs also significantly increased its score in the Education and Research category, having already achieved the maximum possible points in the Water category by 2022. We can conclude that both universities have successfully integrated sustainability issues into their teaching and research activities. The University of Pécs and the University of Szeged put special emphasis on shaping the attitudes of students and employees and use several communication channels, because the reduction of the university's environmental impact depends primarily on the environmentally conscious behavior of the university's citizens. The University of Sopron significantly improved its score in the Transportation category during the studied period. Neither the improvements in the Education and Research category nor those in the Transportation category (e.g., the publication of policies to reduce the number of vehicles entering the campus, the number of initiatives to reduce car parking, and the number of shuttle services

available) require costly investments on the part of the universities, but they do allow them to more easily implement actions to become a green campus. The example of the greenest domestic universities shows to other Hungarian HEIs aiming to replicate the successful practices that in addition to large-scale infrastructure investments in renewable energy, mostly funded by the European Union, there are less expensive measures for more sustainable operations that help campuses move up in the UI GreenMetric World University Rankings.

It can be also said that cooperation with external partners is also crucial for the success of sustainability activities. Achieving results in the categories of Waste and Water management requires cooperation between the local government and the university. Cooperation is essential not only with external partners, but also among universities. By establishing a strong network among domestic universities, the learning process and the exchange of best practices can be accelerated, thus improving the sustainability performance of universities. Its exemplary role among the Hungarian higher education institutions obliged PTE to be the initiator of this process of networking with other domestic universities committed to sustainability. In September 2022, the Sustainability Platform of Hungarian Universities was established in Pécs. Fourteen domestic higher education institutions committed to the implementation of the UN Sustainable Development Goals joined the initiative in order to achieve useful results for society, higher education and also for the scientific public life. The aim of the association is to share good practices in the field of sustainability, to organize regular joint actions and to develop closer cooperation in the field of sustainable development. The members of the Platform are the University of Pécs, the University of Szeged, Semmelweis University, Pannon University, Óbuda University, the University of Miskolc, Budapest Corvinus University, Budapest Metropolitan University, Budapest Business University, Budapest University of Technology and Economics, Eszterházy Károly Catholic University, Hungarian University of Agriculture and Life Sciences, the University of Sopron and the University of Nyíregyháza. With the exception of the Hungarian University of Agriculture and Life Sciences, all participants of the Platform have already evaluated their greening efforts in the UI GreenMetric World University Rankings. In 2024, two further universities (Neumann János University and Széchenyi István University) have joined the Platform.

Beyond the exchange of experiences, progress in the UI GreenMetric World University Rankings requires conscious planning, which means a deeper understanding of the ranking methodology on the one hand, and a clear strategy formulation and implementation on the other. The successes of the domestic universities described in this paper can serve as an example for those universities that have not yet appeared on the sustainability lists, inspiring them to become more effective and internationally visible in the implementation of sustainability measures.

## 6. Conclusion

The aim of the paper was to examine the sustainability practices of the three greenest Hungarian universities, in light of their scores in the UI Green Metric World University Rankings between 2017 and 2023. Despite the increasing number of

participants, the top three Hungarian universities were able to continuously improve their position in the global list of sustainable campuses. The domestic universities that successfully integrate sustainable development can serve as an example for universities in the region that operate under similar financial, organizational, etc. conditions to implement their own sustainable initiatives. Their experiences can shed light on how to move forward in the UI GWUR. To evaluate the performance of the universities, we compared the sustainability activities of each area with the scores in the six categories of the ranking. Our research is primarily qualitative in nature, so we analyzed academic articles, sustainability reports, and university websites that report on their greening initiatives.

The results show that each university tried to advance in different categories of the ranking according to their previous developments. After the infrastructure investments of the previous period, the University of Pécs and the University of Szeged improved their results in the field of sustainability-related education and research. Both universities carry out excellent activities in shaping the attitudes of students. The University of Sopron significantly improved its score in the transportation category. These examples support the fact that not only EU-funded large-scale investments, but also less expensive measures can help universities to move up in the UI GreenMetric World University Rankings. The experience of Hungarian universities confirms that cooperation between universities and external partners (local governments, service providers) as well as among universities themselves is essential. They improve the effectiveness of sustainable actions and accelerate the learning process. The participation in the UI GreenMetric Rankings requires a conscious planning and a deep knowledge of the ranking methodology.

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## References

Abdullah, A.H., Razman, R., Muslim, R. (2017). A review on critical success factors of governance towards sustainable campus operations. IOP Conference series materials science and engineering 226 012057 https://doi.org/10.1088/1757-899X/226/1/012057

Alshuwaikhat, H. M., Abubakar, I. (2008). An integrated approach to achieving campus sustainability: assessment of the current campus environmental management practices. Journal of Cleaner Production, 16, 1777-1785. https://doi.org/10.1016/j.jclepro.2007.12.002

Amaral, L.P., Martins, N., Gouveia, J. B. (2015). Quest for a sustainable university: a review. International Journal of Sustainability in Higher Education, 16(2), 155-172. https://doi.org/10.1108/IJSHE-02-2013-0017

Ávila, L.V., Beuron, T.A., Brandli, L.L., et al. (2019). Barriers to innovation and sustainability in universities: an international comparison. International Journal of Sustainability in Higher Education, 20(5), 805-821. https://doi.org/10.1108/IJSHE-02-2019-0067

Brandli, L.L., Leal Filho, W., Frandoloso, M.A.L., et al. (2015). The environmental sustainablity of Brazilian universities. barriers and pre-conditions. In: Leal Filho, W., Azeiteiro, U.M., Caeiro, S., Alves, F. (editors). Integrating sustainability thinking in science and engineering curricula. Springer International Publishing, pp. 63-74.

Cortese, A. (2003). The critical role of higher education in creating sustainable future, Planning for Higher Education, 31(3), 15-22.

Dahle, M., Neumayer, E. (2001). Overcoming barriers to campus greening: a survey among hgher educational institutions in London, UK. International Journal of Sustainability in Higher Education, 2(2), 139-160.

Djordjevic, A., Cotton, D.R.E. (2011). Communicating the sustainability message in higher education institutions, International Journal of Sustainability in Higher Education, 12(4), 381-394. https://doi.org/10.1108/14676371111168296

Galleli, B., Brito Teles, N. E., Ramos dos Santos, J. A., et al. (2022). Sustainability university rankings: a comparative analysis of UI green metric and the times higher education world university rankings. International Journal of Sustainability in Higher Education, 2, 404-425. https://doi.org/10.1108/IJSHE-12-2020-0475

Guideline (2023). UI GreenMetric World University Rankings 2023: Innovations, impacts and future directions of sustainable universities. Available online: https://greenmetric.ui.ac.id/wp-content/uploads/2023/05/UI-GreenMetric-Guideline-2023-1.pdf (accessed on 10 August 2024).

Gyarmati, L. (2018). Expansion of renewable energy resources and energy-conscious behavior at the University of Szeged. E3S Web of conferences https://doi.org/10.1051/e3sconf/20184803006

Imre, G., Makkos, A. (2024). Sustainability performance of Hungarian universities based on their results in the UI GreenMetric Ranking. Presentation delivered at COS 2024 Conference on Sustainability, Széchenyi István University

Leal Filho, W. (2011). About the role of universities and their contribution to sustainable development. Higher Education Policy, 24, 427-438. https://doi.org/10.1057/hep.2011.16

Leal Filho, W., Yen-Chun, J: W., Brandli L. L., et al. (2017). Identifying and overcoming obstacles to the implementation of sustainable development at universities. Journal of Integrative Environmental Sciences, 14(1), 93-108. https://doi.org/10.1080/1943815X.2017.1362007

Lozano, R. (2006). Incorporation and institutionalization of SD into universities: breaking through barriers to change. Journal of Cleaner Production 14(9-11), 787-796.

Lozano, R., Ceulemans, K., Alonso-Almeida, M. et al. (2015). A review of commitment and implementation of sustainable development in higher education: results from a worldwide survey. Journal of Cleaner Production, 108, 1-18. https://doi.org/10.1016/j.jclepro.2014.09.048

Lukács, R., Papp-Váry, Á. (2024). Beyond green campuses: Sustainability rankings as strategic tools for university branding. Prosperitas, Budapest Business University, 1-14. https://doi.org/10.31570/prosp_2023_0104

Mazo, L., Macpherson, I. (2017). A strategic communication model for sustainable initiatives in higher education institutions. Athens Journal of Mass Media Communication, 3(4), 321-342. https://doi.org/10.30958/ajmmc/3.4.3

Mátyás, D., Gyarmati, L., Csóka, I. (2021). The University of Szeged and the impacts of the Covid-19 pandemic. In: Sari, R.F., Suwartha, N., Junaidi (editors). Managing sustainable universities during Covid-19 pandemic. UI GreenMetric, UNDIP Press, Semarang. pp. 35-41.

Mónus, F. (2020). Trends, possibilities and practice of sustainability education in secondary and higher education (Hungarian). Oktatáskutatók Könyvtára 9., Center for Higher Education Research & Development, Debrecen

Morsing, M., Schultz, M. (2006). Corporate social responsibility communication: stakeholder information, response and involvement strategies. Business Ethics: A European Review, 15(4), 323-338. https://doi.org/10.1111/j.1467-8608.2006.00460.x

PTE (2023). Stratégia 2023-2030. Available online: https://pte.hu/sites/pte.hu/files/share/PTE/PTEstrategia2023-2030.pdf (accessed on 2 July 2024)

PTE (2022). Zöld Egyetem Program Fenntarthatósági jelentés. Available online: https://zoldegyetem.pte.hu/sites/zoldegyetem.pte.hu/files/sajto/pte_fenntarthatosagi_jelentes_2022_hu.pdf (accessed on 11 June 2024)

PTE (2021). Zöld Egyetem Program Fenntarthatósági jelentés. Available online: https://zoldegyetem.pte.hu/sites/zoldegyetem.pte.hu/files/sajto/fenntarthatosagi_jelentes_2021_pecsi_tudomanyegyetem.pdf (accessed on 11 June 2024)

PTE (2019). Zöld Egyetem Program Fenntarthatósági jelentés. Available online: https://zoldegyetem.pte.hu/sites/zoldegyetem.pte.hu/files/sajto/fenntarthatosagi_jelentes_2019.pdf (accessed on 8 June 2024)

PTE (2018). Zöld Egyetem Program Fenntarthatósági jelentés. Available online: https://zoldegyetem.pte.hu/sites/zoldegyetem.pte.hu/files/sajto/zold_egyetem_fenntarthatosagi_jelentes_2018_20191025.pdf (accessed on 12 June 2024)

PTE (2017). Zöld Egyetem Program Fenntarthatósági jelentés. Available online: https://zoldegyetem.pte.hu/sites/zoldegyetem.pte.hu/files/sajto/6.12._sustainability_report_2017_university_of_pecs.pdf (accessed on 2 July 2024)

Ramos, T. B., Caeiro, S., van Hoof, B., et al. (2015). Experiences from the implementation of sustainable development in higher education institutions: environmental management for sustainable universities. Journal of Cleaner Production, 106, 3-10. https://doi.org/10.1016/j.jclepro.2015.05.110

Razman, R., Ramli, M.Z., Abdullah, A.H., et al. (2018). Critical success factors (CSFs) in implementing sustainable campus operation (SCO) initiatives at Malaysian public universities. AIP Conference Proceedings 2030, 020238 https://doi.org/ 10.1063/1.5066879

Ragazzi, M., Ghidini, F. (2017). Environmental sustainability of universities: critical analysis of a green ranking. Energy Procedia, 119, 111-120. https://doi.org/10.1016/j.egypro.2017.07.054

Reid, M., Schwab, W. (2006). Barriers to sustainable development Jordan's sustainable tourism strategy. Journal of Asian and African Studies, 41(5-6), 439-457. https://doi.org/10.1177/00219096060674

SOE (2023). Fenntarthatósági jelentés 2022. Available online: https://greenuniversity.uni-sopron.hu/images/SOE_Fenntarthat%C3%B3s%C3%A1gi_jelent%C3%A9s_2022.pdf (accessed on 15 July 2024)

SZTE (2022). Környezeti Fenntarthatóság. Available online: https://u-szeged.hu/pmi/kornyezeti-mn (accessed on 14 July 2024)

SZTE JATIK (2024) Available online: https://u-szeged.hu/tik/zoldintezmeny (accessed on 15 July 2024)UI GreenMetric World University Rankings (UI GWUR) official website. Available online: https://greenmetric.ui.ac.id

Velazquez, L., Munguia, N., Platt, A., Taddei, J. (2006). Sustainable university: what can be the matter? Journal of Cleaner Production, 14, 810-819.