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An Exploratory Study Examining the Key Aspects and Actions for Universities to Achieve High Sustainability Rankings

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Abstract: Understanding the concept of sustainability and its implementation in specific actions is necessary for today's societies, and part of this responsibility falls on Higher Education Institutions. How these institutions have tried to address this issue has been diverse. To standardize, homogenize, and validate these sustainable practices, a few years ago, the University of Indonesia Green Metric positioned itself as the internationally accepted ranking; however, other rankings have begun to emerge, such as the Times Higher Education Impact Ranking, which also addresses the search for compliance of the SDGs. For a novel or incipient university to establish the politics and actions to fulfill sustainability and SDGs or stay on track may represent a disorienting and challenging task, particularly when these rankings have different origins or criteria. So, this research aimed to review the top ten universities and their actions in the University of Indonesia Green Metric and Times Higher Education Impact Ranking, along with the organizational initiatives in education, to clarify the key measures and actions adopted by universities toward sustainability and their participation in the rankings, to pursue the SDGs related to social and environmental impacts in universities. Additionally, as a case study, we analyzed in detail the actions performed by the Tecnologico de Monterrey (located at the 274th and 100–200th places of the University of Indonesia Green Metric and the Times Higher Education Impact Ranking, respectively) and compared them with those of Top Ten Higher Education Institutions in both rankings. As a result, a summary guide of the actions is suggested to guide higher education institutions in adopting the required level of sustainability development indicated in the rankings.

Keywords: sustainability; sustainable development goals (SDGs); university rankings; higher education; environmental education; educational innovation

Citation: Mejía-Manzano, L.A.; Vázquez-Villegas, P.; Smith, A.; Soeiro, A.; Kálmán, A.; Atabarut, T.; Otaduy-Rivera, N.; Membrillo-Hernández, J.; Caratozzolo, P. An Exploratory Study Examining the Key Aspects and Actions for Universities to Achieve High Sustainability Rankings. *Sustainability* **2023**, *15*, 4165. https://doi.org/10.3390/su15054165

Academic Editors: Giuseppe Ioppolo, Giulio Mario Cappelletti, Carlo Russo and Luca Grilli

Received: 15 December 2022
Revised: 1 February 2023
Accepted: 23 February 2023
Published: 25 February 2023

1. Introduction

Although its original use was in forestry, the term sustainability quickly spread into the academic lexicon. It was defined in 1987 as "*development activity that meets the needs of the present without compromising the ability of future generations to meet their own needs*" in the Brundtland Report of the World Commission on Environment and Development [1,2]. Initially restricted to purely environmental aspects, this concept was strengthened with other elements to become an integrated approach with three dimensions: ecological, economic, and social [3]. In 2015, the United Nations General Assembly, at its 70th session, established 17 Sustainable Development Goals (SDGs) [4–6].

On the other hand, to assess the impact, quality, and reputation of Higher Education Institutions (HEIs) in the Global University Rankings (GURs), the Quacquarelli Symonds (QS) World University Ranking® is probably the most accepted methodology [7]. This metric considers only six indicators: academic reputation, employer reputation, faculty citations, faculty–student ratio, international-student ratio, and international-faculty ratio. By 2023, the *QS Ranking* will assess the contribution of academic institutions to sustainable development through two new categories: social and environmental impacts. Some SDGs will guide efforts in two new categories that will be included in the 2023 Ranking Metric to measure the contribution of academic institutions to sustainable development. Considering the definitions of the SDGs and in terms of Social and Environmental Impacts, the category will be defined as shown in Table 1.

Table 1. SDGs included in the *2023 QS Ranking Metric*. (Source: own elaboration).

Social Impacts			
SDG5	Gender Equality	SDG10	Reduced Inequalities
Environmental Impacts			
SDG7	Affordable and Clean Energy	SDG13	Climate Action
SDG11	Sustainable Cities	SDG14	Life Below Water
SDG12	Responsible Consumption and Production	SDG15	Life on Land

Another GUR is the *Times Higher Education World University Rankings* (THE-WUR), which focus on research activity, measuring teaching, research, citations, industry revenue, and international outlook as indicators [8]. It should be noted that none of these indicators are related to sustainability, even though many educational institutions have begun to incorporate some "sustainability level" measures for years, mainly due to a growing concern about the environmental crisis and the consequences of climate change [9]. From the point of view of future students and considering that they usually make decisions based on the GRUs, it is striking that the GRUs still do not incorporate any sustainability considerations into their indicators [10].

From 2010–2018, the National Union of Students of the United Kingdom (NUS-UK) survey was carried out among students worldwide. They were asked about their expec-

tations regarding sustainable development in their universities: 70% of this population indicated that they would like to see sustainability promoted through all their courses, and only 17% stated that their universities had good actions to limit their negative impact on the environment and society [11]. This survey showed university students' interest and global commitment to sustainability issues and the undeniable impact that universities have as social agents of change, and their ability to influence environmental policies and strategies [9].

Until now, the most ambitious project to measure the direct impact generated by sustainability strategies in universities has been the *UI GreenMetric*, created in 2010 by the University of Indonesia (UI). This sustainability ranking has been consolidating and spreading worldwide for a decade. In 2019, Puertas and Martí proposed the Data Envelopment Analysis (DEA)-Green Metric, a complement to the *UI GreenMetric*, to analyze the contribution of each university, categorizing universities into four groups depending on their level of sustainability: high, medium–high, medium–low, and low [12]. In 2020, Peirchinunno and Cazzolle re-evaluated and validated the *UI GreenMetric* with university campuses, defining it as an attractive and officially valid global sustainability ranking [13]. The *UI GreenMetric* allows for the identification of the areas of focus and opportunity of the efforts of each university and can also be used regionally to analyze sustainability in neighboring countries or globally to compare strategies of universities on different continents. The weight of the criteria in *UI GreenMetric* [14] is shown in Figure 1.

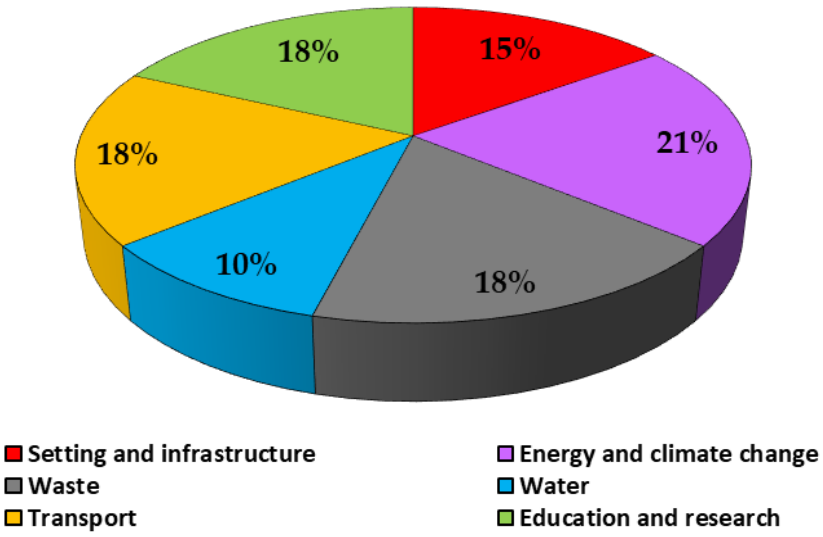

Figure 1. Weight of criteria in *UI GreenMetric*. (Source: own elaboration).

A recently developed but less known scale is the Times Higher Education (*THE Impact Ranking)*, founded in 2019, that assesses universities under the UN SDGs with calibrated indicators that provide comparisons across four areas: research, administration, outreach, and teaching [8]. A university's final score is calculated by combining its score on SDG17 (weight 22%) with its three highest scores of the remaining 16 SDGs (weight 26%). Under this aspect, the universities are qualified by different SDGs according to their approach [15].

At the European level, universities and other educational and training institutions work toward campus sustainability and a sustainable skills framework. Regarding the sustainability of the campus, the initiatives have been based on using internal policies such as *New European Bauhaus* [16] or *Level(s)* [17]. The first aims to educate and train architects and engineers with examples and prize competition. The second is aimed at successful buildings in terms of sustainable performance to act as data providers. Other initiatives related with the sustainable mobility policies and university governance strategies are the studies by Cappelletti et al. [18] and Sisto et al. [19]. In the 2020 study, Cappelletti et al. explain the details of the application of Machine Learning techniques to analyze aspects

of sustainable mobility on the campus of the University of Foggia, Italy. In the 2022 study, Sisto et al. present a retrospective focus on the contribution of universities to the challenge of sustainability and a discussion of the most effective actions to improve sustainability within the strategic plan of the 2030 Agenda.

Regarding the sustainable competency framework, the leading development has been the *GreenComp* framework of graduate sustainability competencies [20]. This framework targets the organizational and individual levels of knowledge, skills, and attitudes necessary for sustainable performance. Several European schools and projects have adopted *GreenComp* as the primary guide for updating the curriculum. A recent example is the CALOHEE project [21], which has included *GreenComp* requirements in proposed quality frameworks in various areas of higher education, such as computer science, nursing, civil engineering, history, physics, and teacher education.

Since 2017, few studies have been reported on the general work of HEIs evaluating cases in sustainability. In 2018, Albareda-Tiana et al. evaluated education for sustainable development through the SDGs in teaching practices at the International University of Catalonia (IUC), Spain, with a mixed methodology (qualitative and quantitative) in data collection using university curricula and interviews with staff [22]. These authors revealed the future challenges and opportunities in the training of IUC graduates. However, they did not offer specific information on the actions or activities carried out for that university; they also only considered the contributions in the teaching aspect. In 2019, Mawonde and Togo presented as a case study the incorporation of the SDGs in the operation of the Johannesburg campus at the University of South Africa [23]. They found that the practices with the SDGs in teaching, research, and the community are aligned with the campus management, with student participation being the only limitation because this is a distance education institution, so the highlight of this study was that online education also plays an active role in the implementation of sustainability.

In addition to the studies related to university sustainable development initiatives, it is essential to highlight the numerous publications related to initiatives, projects, and activities aimed at strengthening the 17 SDGs by international associations for professional development. In particular, the contributions of recent years by the *International Association for Continuing Engineering Education* (IACEE, https://www.iacee.org/ (accessed on 1 February 2023)) and the *European Society for Engineering Education* (SEFI, https://www.sefi.be (accessed on 1 February 2023)) can be mentioned. These organizations have exerted a profound influence on global initiatives for sustainability since the active members of their Council and Executive Boards are researchers at prestigious universities.

This study aims to discuss the actions of the top ten universities (in the *UI GreenMetric* and the *THE Impact Ranking*) regarding sustainability. It also analyses the organizational initiatives in education that have arisen internationally. The study also includes the case of the Tecnológico de Monterrey, in Mexico, because of its privileged position in both rankings and its sustainability plan with measured results to participate in sustainability and SDG implementation through five dimensions (culture, mitigation, adaptation, education, research, and outreach). The Results and Discussion section also includes an analysis of the purposes and actions of the Tecnológico de Monterrey to discover and understand how these have contributed to the Tecnologico's positioning. Additionally, some examples will be presented on the role played by international associations to promote sustainability initiatives with member universities. Finally, a discussion guide and recommendations for universities on the path to sustainability will be developed.

2. Materials and Methods

This exploratory study uses a phenomenological methodology to determine the instances, examples, and scenarios that would allow for examining the phenomenon of the positioning of universities in the ecosystem of innovation and sustainability [24]. For this, the case parameters were defined, and the limits of what is included and what is excluded were established, considering the approaches used to collect and analyze the data.

Regarding the approaches explored in the literature review, the alternative index built from the variables used in the *UI GreenMetric*, developed through data envelopment analysis (DEA) [12], stands out. This methodology was the one that allowed for classifying all the universities according to their contribution to sustainability, to identify the possible critical factors for the sustainability of HEIs, and to guide their institutional policies toward the elements that require immediate attention. The purpose of the research was to provide descriptive information, suggest theoretical relevance, and allow a deeper understanding of the phenomenon of sustainability rankings for HEIs. In addition, we analyzed the actions and programs that the Tecnologico de Monterrey has carried out in its development in the sustainability rankings. For this, the "2025 Sustainability and Climate Change Plan" [25] document and the results one year after implementation were consulted.

3. Results and Discussion

3.1. Sustainability and Universities

According to the 2021 *UI GreenMetric* ranking, the top ten universities in sustainability are the Wageningen University & Research (WUR), University of Nottingham (UN), University of Groningen (UG), Nottingham Trent University (NTU), University of California, Davis (UCD), Umwelt-Campus Birkenfeld (Trier University of Applied Sciences) (U-CB (TUAS)), Leiden University (LU), University College Cork (UCC), University of Connecticut (UC), and University of São Paulo (USP) [26]. From this list, three institutions belong to the Netherlands, two to the United Kingdom, and two to the USA. In Figure 2, the universities in the first positions stand out for their scores in the energy criteria and climate change, comprehensive waste management, and education and research in sustainability.

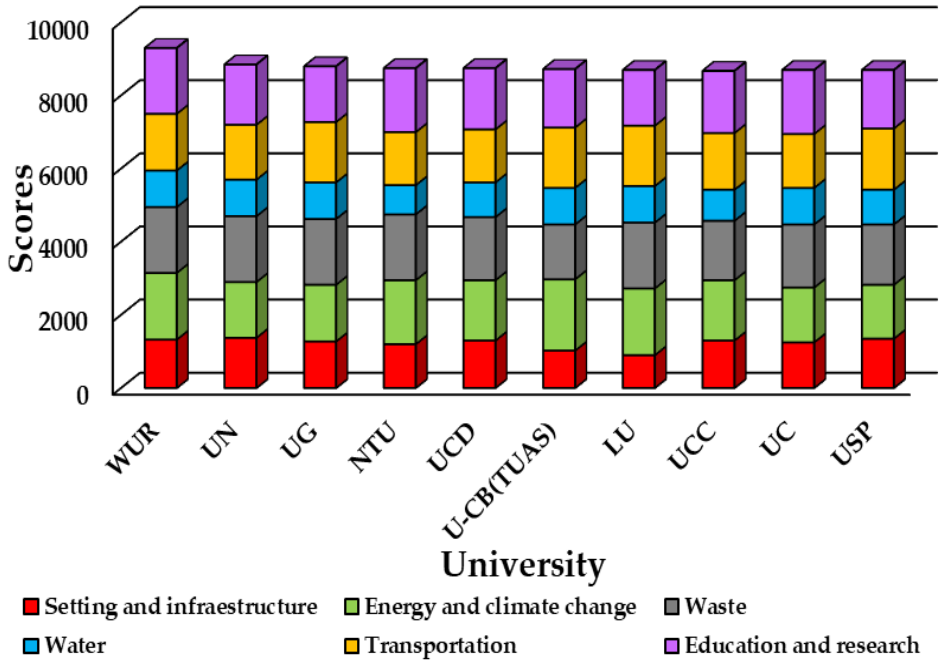

Figure 2. Scores of top ten universities in *UI GreenMetric* for sustainability. The bars' colors indicate the extent of the score of the corresponding element. The Wageningen University & Research (WUR), University of Nottingham (UN), University of Groningen (UG), Nottingham Trent University (NTU), University of California, Davis (UCD), Umwelt-Campus Birkenfeld (Trier University of Applied Sciences) (U-CB (TUAS)), Leiden University (LU), University College Cork (UCC), University of Connecticut (UC), and University of São Paulo (USP). (Source: own elaboration).

The 2020 data of the *UI GreenMetric* allow us to observe that the universities in the first positions present high values in the categories of integrated waste management, water and education, and research in sustainability; the institutions located at medium–high levels

are strong in waste, education, and research; and the universities with low scores have a particular deficiency in water treatment [26].

Once, the *UI GreenMetric* online site (https://greenmetric.ui.ac.id/ (accessed on 1 February 2023)) was consulted for the top ten sustainable universities, and the associated scores and positions were organized to be displayed graphically. Subsequently, specific actions/activities were searched on the web pages of these institutions in terms of sustainability, and a comparative table was prepared, inquiring about the activities implemented in terms of sustainability by the top universities of the *UI GreenMetric*. Various actions were found in their sustainability reports as shown in Table 2. Reducing carbon emissions, recharging points for electric cars and e-bikes, waste separation, sustainable buildings, sustainable restoration, mowing for biodiversity, renewable energy generation, green startups, natural gardens, and a green and healthy campus are sustainable actions carried out by the universities.

Table 2. Sustainability actions reported by top ten universities of the *UI GreenMetric.* (Source: own elaboration).

University	Actions and Activities	References
Wageningen University & Research	Decreasing carbon emissions, charging points for electric cars and e-bikes, waste separation (>15 waste flows), sustainable buildings, sustainable catering, mowing for biodiversity, generating renewable energy, green startups, natural gardens, and a green and healthy campus.	[27]
University of Nottingham	Between 2010 and 2020, the university succeeded in reducing its carbon emissions by nearly 40%. The university sets out the pathway to achieve net zero carbon emissions by 2040 or earlier. They have the Green Rewards initiative, an interactive program for all staff and students at the university. It rewards the everyday behaviors and actions that improve sustainability and well-being in monthly prizes.	[28]
University of Groningen	In its roadmap to sustainability, the university's goal is to reach a 30% CO_2 reduction in 2026 (compared to 2019) and be CO_2 neutral in 2035. They expect more involvement in sustainability from students, staff, and external parties while applying a sustainable human resources policy for a dynamic and vital organization encouraging sustainable behavior among staff and students integrally.	[29]
Nottingham Trent University	The university is focusing not only on energy use (which is responsible for 14% of NTU's emissions outputs) but also on supply chain, travel, and working-from-home outputs, among others. They have set interim milestones of a 24% reduction in carbon emissions by 2025 and a 50% reduction by 2030. They have established a net zero carbon governance structure that implements projects to deliver the necessary carbon reductions in particular areas.	[30]
University of California, Davis	UC Davis offers a wide range of sustainability coursework, with over 60 percent of academic departments offering sustainability-related courses. Thirty-five percent of employees who conduct research are engaged in sustainability-related research. Through its Climate Action Plan, the campus has reduced greenhouse gas emissions below the year 2000 levels and is working to reach carbon neutrality by 2025.	[31]
Umwelt-Campus Birkenfeld Trier University	The university has a photovoltaic installation on the rooftops that generates approx. 520 MWh annually, which covers approx. 52% of the total amount of energy required if it were fed directly into the campus grid. Additionally worthy of note is the fact that approx. 372 tons of CO_2 emissions are annually saved due to the PV installation. The university also cools with CO_2-neutral heat.	[32]
Leiden University	In its vision toward 2030, this university outlines four actions: sustainability in teaching, sustainability in research, sustainable campus, and awareness and involvement. The students are trained to become academic professionals with the knowledge and skills needed to contribute to the transition to sustainability. Research is used to gain more insight into global sustainability issues and to develop knowledge for correct and proportional solutions. A green, circular campus with a significant energy reduction by 2050 as its goal is specified in the Energy Transition Roadmap for University Buildings.	[33]

Table 2. *Cont.*

University	Actions and Activities	References
University College Cork	In 2019, UCC Green Campus established the Living Laboratory Seed Fund to research and address real-life problems using the UCC campus as a testbed. From here, they have reached a 56% decline in waste between 2019 and 2020. The amount of general waste, mixed dry recyclables, and food waste declined in 2020.	[34]
University of Connecticut	Total campus greenhouse gas emissions declined despite increasing the campus building square footage and student enrollment. It reached 19.5% annual greenhouse gas emissions reduction, compared to a 2007 baseline, and 3860 tons of greenhouse gas emissions reduced from campus-wide LED projects since 2015. Additionally, 355,530 ft^2 of land is disconnected from storm drainage, protecting surface water quality and natural hydrology through low-impact development.	[35]
Universidade de São Paulo	The university created the Environmental Management Superintendence (EMS) in 2012 to plan, implement, maintain, and promote environmental sustainability on the campuses. It seeks to incorporate the environmental dimension of sustainability into all university policies, plans, and activities, whether in teaching, research, extension, or management.	[36]

Considering the *THE Impact Ranking*, the top ten universities are [37]: Western Sidney University (WSU), Arizona State University (ASU), Western University (WU), King Abdul Aziz University (KAU), University Sains Malaysia (USM), University of Auckland (UA), Queen's University (QU), Newcastle University (NU), University of Manchester (UM), and Hokkaido University (HU). The top SDGs developed were SDG17 (association of goals), followed by SDG9 (industry, innovation, and infrastructure) and SDG11 (sustainable cities and communities).

Thus, as observed, to maintain or improve their current positions, the universities must seriously adopt sustainability as their purpose. The concept of sustainability requires universities to simultaneously address all dimensions, including sustainability principles in their curricula, not with isolated efforts but as a joint strategy of several departments—managerial, administrative, and academic—of the institution. Therefore, it is essential to investigate and analyze which are the leading universities in the *UI GreenMetric*, what strategies have been implemented to reach these positions, and how they have interacted with government and societal actors. Although it was believed that the existence of robust and sustainable development policies in HEIs was a precondition for successful sustainability, this was proven wrong according to the results of research published in 2018 that involved 35 universities from seven countries (Brazil, Germany, Greece, Portugal, South Africa, United Kingdom, and the USA) [38].

3.2. Case Study of Tecnologico de Monterrey, in Mexico

According to the *UI GreenMetric* in 2021, the Tecnologico de Monterrey (TEC MTY), in Mexico, was ranked in the 274th position with a total score of 6825 points, with the highest score in education and research on sustainability (1575 points) and the lowest in water management (750 points). At the regional level, TEC MTY occupies the 29th place in Latin America. Meanwhile, it ranks 11th in Mexico [14]. When historical data (scores and rankings) are analyzed, TEC MTY has been in different places since its inclusion in 2016 in the *UI Green Metric* (Figure 3). In the beginning, TEC MTY reached the 184th position when only 515 universities participated in the ranking. This evolved with the incorporation of more universities, rendering a lower ranking, achieving 584th place. Still, in 2020, the institution improved its position despite adding new universities to the study (956) in 2021 [26].

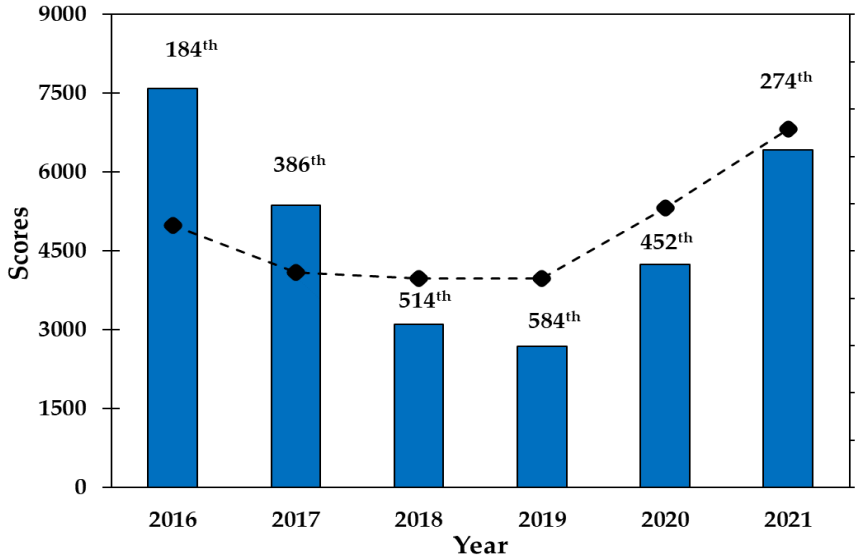

Figure 3. Historical ranking and scores of TEC MTY in *UI GreenMetric* for sustainability evaluation. (Source: own elaboration).

Considering the *THE Impact Ranking 2022*, the TEC MTY is between the 100 and 200th place with the participation of 1410 universities; this position has been preserved for the last three years (Figure 4). The universities have gradually been incorporated into this ranking; for the first time, 467 universities participated, and the TEC MTY ranked 90th. In the following years, there were up to 1117 in 2021 [37], and TEC MTY kept a similar place. The SDGs that have been best evaluated for TEC MTY are SDG5 (gender equality), SDG6 (clean water and sanitation), SDG11 (sustainable cities and communities), and SDG12 (responsible production and consumption).

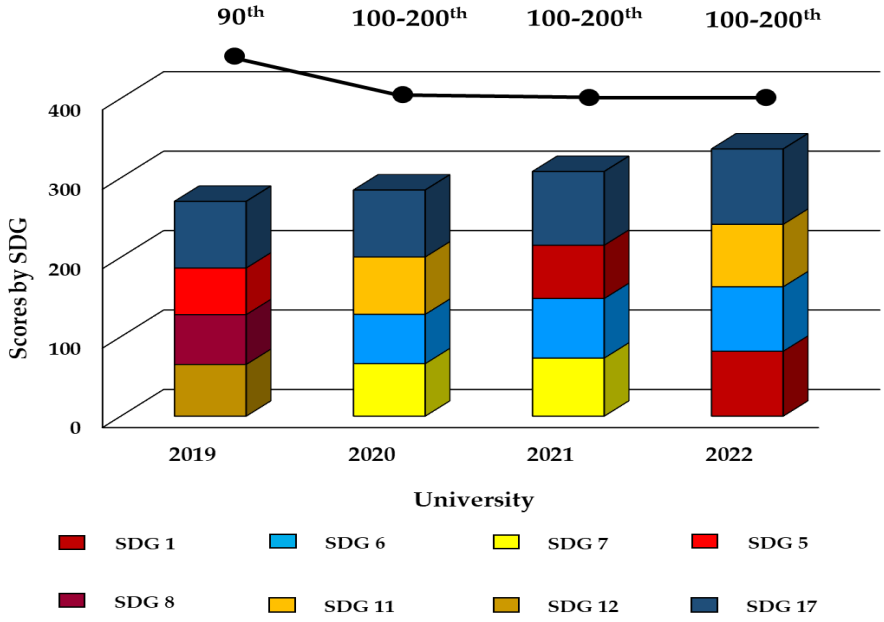

Figure 4. Historical ranking and scores by SDGs of TEC MTY in *THE Impact Ranking*. (Source: Own elaboration).

An investigation was carried out to know the particular actions of TEC MTY in terms of sustainability, finding that TEC MTY has a Sustainability Plan with clear objectives and actions to be carried out, which is public to the entire TEC MTY school community [25].

In April 2021, the TEC MTY presented its "2025 Sustainability and Climate Change Plan" to help reduce the impact of climate change and strengthen the internal culture of sustainability [25,39]. A year later, the Vice Presidency of Inclusion, Social Impact, and Sustainability generated a report with progress. Its impact will not be observed in the *UI GreenMetric* until the publication of the 2022 ranking. However, it can be inferred that some of the actions carried out so far can be closely related to the scores achieved in this metric in 2021 and the *THE Impact Ranking* in 2022. The plan comprises six dimensions: culture, mitigation, adaptation, education, research, and dissemination. The 28% reduction in greenhouse gas emissions compared to 2019 and reaching 100% renewable energy consumption in the institution's hospitals were the most relevant innovations in sustainability. The objectives and progress by 2022 are briefly mentioned in Table 3.

Table 3. Objectives, actions, and advances reported as part of the 2025 Sustainability and Climate Change Plan from TEC MTY. (Source: own elaboration).

Dimension	Objectives	Actions and Advances Reported in 2022
Culture	Implement an institution-wide culture of sustainability in each operating, leadership, and educational process.	Creation of a guide for sustainable events (recommendation for institutional events). The generation of 115.84 kg of CO_2 was avoided.
Mitigation	Reduce the institution's environmental impact by lessening our carbon footprint and driving circular water and integrated waste management.	Implementation of the first sustainability auto-evaluation per campus in energy, fuels, water, waste generation, and vehicles. A 63% of energies from clean sources was reached (increment of 9% annually).
Adaptation	Reduce the vulnerability to the present and future impacts of climate change and grow our capacity for resilience and adaptation to conditions generated by the environmental crisis.	Inventory of trees for promoting actions for their future care and maintenance.
Education	Prepare the Tecnologico de Monterrey students and faculty on climate change topics through education for sustainable development in curricular and co-curricular activities.	Implementation and mapping of SDGs in curricula.
Research	Drive interdisciplinary research to provide systemic solutions that will fully address the complexity of climate change and support sustainable development.	Mapping of research projects about climate change and sustainability for the future design of Research Interdisciplinary Funding.
Outreach	Be active in local, national, and global partnerships for sustainability and climate change, ensuring our academic, scientific, and technological capacities are available to society and fomenting the acceleration of processes toward sustainability.	Presentation of the Sustainability and Climate Change 2025 plan at the United Nations Climate Change Conference (COP26) in Glasgow in October 2021. Consolidation of the Lifelong Learning Green Academy, which is project oriented to form leaders from the private sector in sustainability and climate change.

Some goals and actions under the TEC MTY Sustainability plan [25] are summarized in Table 4. Additionally, as part of the commitments signed by the TEC MTY in 2019 under *the Global Climate Charter for Universities and Colleges on education* and in the education dimension, the institution has established a general goal "*to train students and teachers on climate change issues through education in sustainable development in the curricular and co-curricular activities of the institution, with the purpose that everyone has knowledge about climate change and sustainable development*". TEC MTY has undertaken a comprehensive academic vision of implementing actions to comply with the SDGs inside and outside the institution.

Table 4. Goals and actions in culture, mitigation, and adaptation of TEC MTY for achieving sustainability. (Source: own elaboration).

Aspect	Culture	Mitigation	Adaptation
Goals	Respect and nature care. Saving and moderation in all our daily actions. Empowerment and co-responsibility toward sustainability. The vision of global change, recognizing the vulnerability of human beings, and promoting better planning. The alignment of policies and procedures toward sustainability.	Provide 80% of the energy consumed from renewable sources. Reduce by 20% energy consumption per m^2. Reduce up to 50% of campus greenhouse gas emissions. Savings of 20% in water consumption. Design a comprehensive waste management strategy and implement it.	Generate vulnerability diagnoses of climate change on 100% of the Tec's facilities. Preparation of adaptation plans for each campus with three approaches: disaster risk reduction, an adaptation based on ecosystems (reforestation), and community-based adaptation (boost adaptability in vulnerable communities). Design a strategy for implementing and following the adaptation measures for the facilities with the highest risks.
Actions	Ensure awareness of environmental sustainability of all the community. Create communication and awareness campaigns in the community. Offer activities and programs to experience sustainability in the different internal areas. Establish drinking fountains with thermos fillers. Measure the behavior change index (consumption of office materials, waste generation, and food waste in cafeterias).	Supply of solar and wind energy through contracts and self-generation infrastructure. Reduce energy consumption. Replacement of lights and air conditioning equipment, centralization of services, installation of sensors, and measurement/control systems. Reduce institutional air travel. Reduce fuel consumption. Circular management of water (treatment, use, and reuse systems). Reduce water consumption (installing low flow, saving equipment, and using gray water).	Diagnose risks in the campuses and their ecosystems, analyzing the current economic impacts of climate change and future scenarios. Design and installation of monitoring and evaluation systems based on relevant indicators for adaptation to climate change. Design of master plans considering the factors studied and modeled for adaptation to climate change. Strengthening adaptation capacities through workshops for Operations, Physical Plant, Infrastructure, Security, Energy and Environment, Master Plans, and Urban planning.

Inner vision:

- Creation of Study Programs that include subjects with solid conceptual content on sustainability (for example, Biomimicry and Sustainable Development, Biology and Sustainability, Climate Change and Energy Use, Circular Economy, Bio Business, etc.).
- Creation of professional careers with a sustainable orientation (Sustainable Development Engineering).
- Evaluation of Sustainable competencies.

Vision outside the academic institution: Inner vision:

- Creation of the Vice Presidency of Inclusion and Sustainability that represents the University Institution in international events and forums.
- Creation of the Directorate for Sustainable Development Goals initiatives, which implements programs and establishes relations with governmental and non-governmental organizations to correctly fulfill the SDGs outside of the school.

Events such as the COVID-19 pandemic modify the schedule for meeting goals. In this regard, 19% of the courses have already included SDG topics [40]. Additionally, the TEC MTY has established an Institute for the Future of Education with a research group in charge of studying the teaching–learning process, considering sustainability as a transversal competence that can be evaluated for compliance [41]. In the research dimension, an analysis in the SCOPUS database of the sustainability research products published by the TEC MTY in 2016–2022 shows that 52.3% of the products were published in 2021 and 2022 (Figure 5).

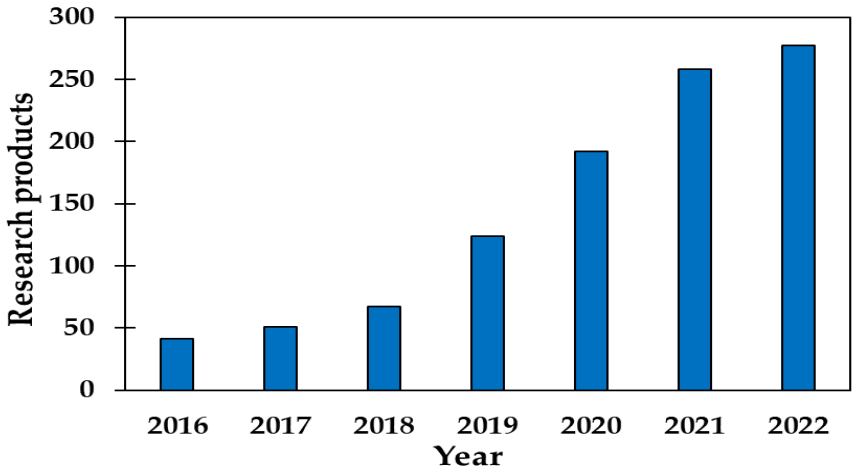

Figure 5. Published sustainability research products by TEC MTY in the period 2016–2022. (Source: Own elaboration).

Notably, the institution has six Strategic Focus Groups working directly with Sustainability: Energy and Climate Change, Economic and Environment Development, Sustainable Territorial Development, Science and Technology of Water, Social Innovation and Ethics, and Human Flourishing [25]. However, not only these Focus Groups are incorporating the sustainability vision in their research lines, but other groups are also focusing on it, as shown in Table 5. TEC MTY has begun to establish collaborations to foster sustainability. One of these is the establishment of the Energy Business Model Challenge with the power generator company Iberdrola [42], a competence for encouraging young entrepreneurs to propose sustainable solutions to the challenges in the energetic sector since 2017; the best project has been funded to be carried out under the advisory of Iberdrola and TEC MTY experts.

Table 5. Defined research lines related to sustainability at Tecnologico de Monterrey in 2022. (Source: own elaboration).

School	Strategic Research Group	Research Lines
School of Engineering and Sciences	Advanced manufacturing	Circular economies and eco-design
School of Engineering and Sciences	Bioprocesses	Bioprocess design; Innovative bioseparation technologies
Business School	Consumer Behaviour and Conscious Marketing	Responsible consumer behavior and social welfare
School of Social Sciences and Government	Economic and Environmental Development	Economic development; Social policy; Industrial economics
School of Engineering and Sciences	Energy and Climate Change	Energy efficiency: thermal and electrical; Clean energies: renewable and alternate; Climate change: mitigation, adaptation, and environmental benefits
School of Humanities and Education	Ethics and Human Flowering	Sustainability and the Anthropocene
School of Social Sciences and Government	Government and Public Entrepreneurship	Regional and City Development
Business School	Social Innovation and Sustainability	Ethics and social responsibility; Innovation of responsible and sustainable business models; Social entrepreneurship and high-value start-ups; Social impact evaluation; Sustainable clusters; Social innovation

Table 5. *Cont.*

School	Strategic Research Group	Research Lines
School of Architecture, Art, and Design	Sustainable Territorial Development	Resilience and adaptation to climate change; Analysis of territorial dynamics; Equitable cities
School of Engineering and Sciences	Translational Omics	Development of microbial technologies based on omics studies; Plant–microorganism interactions for solutions focused on agroecosystems
School of Engineering and Sciences	Water Science and Technology	Hydrological processes focused on water resources management in catchments; Advanced Treatment Processes and Reuse of Wastewater of domestic and industrial; Environmental geo-processes focused on the study of environmental impacts of human activities in the subsoil origin; Water Chemistry and Environmental Nanotechnology focused on the development of new and advanced materials

3.3. The Role of International Associations for Professional Development to Enhance Sustainability Initiatives with Universities

The formation of "a new type of university graduate" who is fully aware of sustainable development and capable of a holistic approach when facing challenges is required to meet society's problems and provide solutions through innovation and technology. Higher education programs and curricula must be revised to include these issues for the new type of professionals who can also inform, encourage, and guide society on the solutions to these new challenges. Likewise, HEIs have the responsibility to continue training graduates who have achieved the ethical–moral vision and the technical knowledge necessary to ensure the quality of life of future generations. For a sustainable world, qualified professionals with sustainability skills must continue learning to adapt to today's unsystematic, indeterminate, and dynamic risks.

The professionals of the 21st century have the responsibility to collaborate with critical thinking and systemic thinking, the ability to work in inter- and transdisciplinary frameworks, and have values consistent with the sustainability paradigm. Sustainability professionals highlight sustainability's technological and innovative role as a solution to vital environmental problems such as the climate crisis. Therefore, there is a need for continuing professional education in sustainability. There is clear leadership in continuing education in engineering for sustainable development that will apply multi-method experiential, active learning education for a resilient world and a sustainable future for all.

At the 2016 IACEE Global Conference in Porto, Portugal, IACEE members and representatives from various universities signed the Porto Declaration [43]. This statement is intended to continue IACEE's founding goals and lead members to foster sustainability in lifelong engineering learning and practice.

> *"Porto Declaration, 20 May 2016: Whereas the International Association for Continuing Engineering Education (IACEE) was founded in 1989 to foster a global network of organizations promoting lifelong engineering education.*
>
> *The IACEE recognizes the scale and complexity of the gap between existing solutions and our planet's needs. The IACEE is uniquely placed to act on this opportunity.*
>
> *The IACEE seeks to pivot the organization to connect individuals, universities, industry, government, and NGO organizations to meet humanity's grand challenges.*
>
> *Therefore, in keeping with its dedication to leading lifelong learning, the IACEE will develop global initiatives to address those 21st-century challenges threatening the survival of humankind through collaboration, design, creative thinking, and engineering.*

> *We, the undersigned, do hereby declare this at the IACEE 2016 Global Conference in Porto, Portugal, and pledge our commitment in actioning this call to service." (http://www.iacee.org/docs/PORTO_DECLARATION1.pdf (accessed on 1 February 2023))*

The role of associations such as IACEE and SEFI is to disseminate reports and reflections that contribute to achieving the global objectives of the UN's SDGs, promoting inclusive and sustainable development in universities, and fostering innovation. Some of the topics of interest included in the IACEE and SEFI agendas are:

- Identifying and understanding sustainability and education trends, approaches, programs, and other influential factors.
- Emerging trends in continuing education and adapting programs/approaches to meet these needs.
- Faculty development, support, and research.
- Identifying trends and adapting programs in universities.
- Academic–industry partnerships and impact on sustainability.
- New models in sustainability education and experience.
- Innovations in sustainability and continuing education.

Among the most critical IACEE projects related to sustainable development in universities, *SERinA* can be highlighted. The *SERinA* project was launched at the IACEE World Conference organized by the Tecnológico de Monterrey, Monterrey, Mexico, in May 2018 as an online portal dedicated to the support and promotion of engineering education and research linked to the concept of the 17 UN SDGs [6]. The SERinA project reported on May 2021 at the IACEE conference [44] intended to create a database of "Education, Research and Active Practices" highlighting initiatives for university students to be hopeful of the future and to develop a mindset of SDG practice within their intended projects of the future [45].

Among the most critical SEFI projects related to sustainable development in universities, *Erasmus+ A-STEP 2030* can be highlighted. The SEFI Special Interest Group on Continuing Education and Lifelong Learning undertook the *Erasmus+ A-STEP 2030* (Attracting diverse Talent to the Engineering Profession 2030) project for university students on sustainability and the future of engineering education. TU Dublin, Aalborg University, Metropolia University of Applied Science, BEST, Universum Global, SEFI, and nine other related partners are participating in the project, which was launched in September 2018 with the primary objective of developing an innovative curriculum to teach the appropriate skills and competencies for a sustainable future [46].

3.4. Discussion and Recommendation Guide for Universities on the Way to Sustainability

A qualitative analysis of content considering information from the initiatives and actions of the top ten best universities of the *UI GreenMetric* was performed. After reorganizing and summarizing the data, words were selected according to their relevance and frequency, which were recorded in an Excel file. Then, in a second Excel file, connections between words were established, and both files were fed to the *VOSviewer 1.6.18*® platform (https://www.vosviewer.com/ (accessed on 1 February 2023)) to create a word network (Figure 6). As observed, education and infrastructure are the main categories displaying more abundant actions. The high frequency of categories such as energy, water, and education show the most worked aspect in these universities located in the first places of the *UI GreenMetric* ranking. The actions about sustainable-related skills, courses, sustainability research, sustainable buildings, use of renewable energy sources, and reduction in carbon emissions were common in these universities. In the same way, less common but highlighted actions such as rainwater use and reduced green gas emissions are interesting since they create a difference in certain universities. Still, it needs to be worked on by other institutions yet.

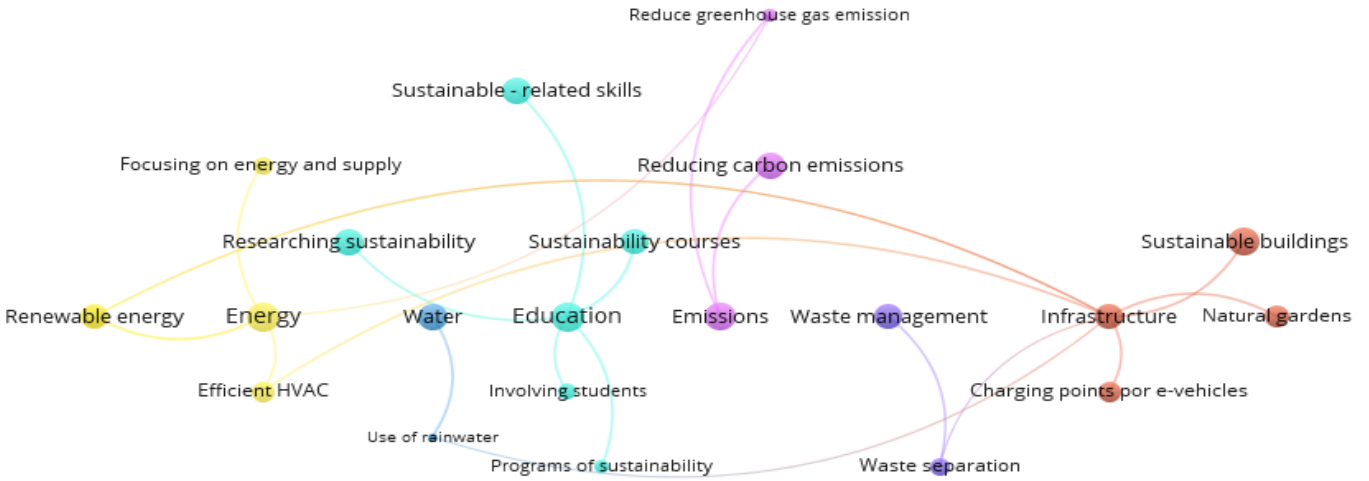

Figure 6. Word network of actions/activities implemented by top ten universities of the *UI GreenMetric.* (Source: own elaboration).

It has been evident that the reference ranking for measuring sustainability in HEIs is *UI GreenMetric*; however, more alternative scales are appearing, such as the *THE Impact Ranking* and the coming advertisements of SDG inclusion in the *QS Ranking*. In addition, the promotion of sustainable education comes not only from universities but also from multiple initiatives performed by independent education organizations such as IACEE in CEE through projects such as SERinA [43,45].

Figure 7 shows a word network considering this international panorama (*QS ranking*, *UI GreenMetric*, and education organizations) and the perspective of a particular institution, such as TEC MTY, where this sustainability concept is being lived. The network shares many of the main terms already shown in the word network for the top ten universities of the *UI GreenMetric* in Figure 6. However, a significant difference is the appreciation of words such as infrastructure, researching sustainability, and related SDGs such as SDG1 (no poverty), SDG2 (zero hunger), SDG5 (gender equality), SDG7 (energy), SDG14 (life below water), SDG11 (sustainable cities), and SDG17 (partnerships). The keywords *Education* appears again in the center of the network as a noun in this integral vision of sustainability trends, indicating that this aspect is fundamental for the incursion of universities in sustainability.

Few HEIs compete in the *UI Green Metric*. An explanation can be found in the interaction studies between the top 500 universities in the *Global University Rankings* (GURs) and top 500 universities in the *UI GreenMetric* ranking, reviewed by Muñoz-Suarez et al. in 2020. At the same time, a low correlation between academic performance and sustainable practices was identified, showing that older universities tended to be well located in the GURs. In contrast, the younger ones did in the *UI GreenMetric*. Geographically, it was evident that the European and North American universities were at the top of the GURs, and the Asian universities were at the top of the *UI GreenMetric* ranking [47]. An important conclusion that may be obtained is that the *UI Green Metric* is relatively young, and many universities have not participated in it yet. This idea is reinforced in our research because some universities encouraging sustainable education or research, individually or collectively, do not appear in the rankings (for example, three cases analyzed in the *SERinA* project: the University of Victoria, Massachusetts Institute of Technology, and Oxford University). In parallel, the changing historical performance of TEC MTY in the *UI GreenMetric* supports these ideas. Additionally, when the top ten universities in the recent the *THE Impact ranking* are observed, none of it matches with those in the *UI GreenMetric* or organizational initiatives.

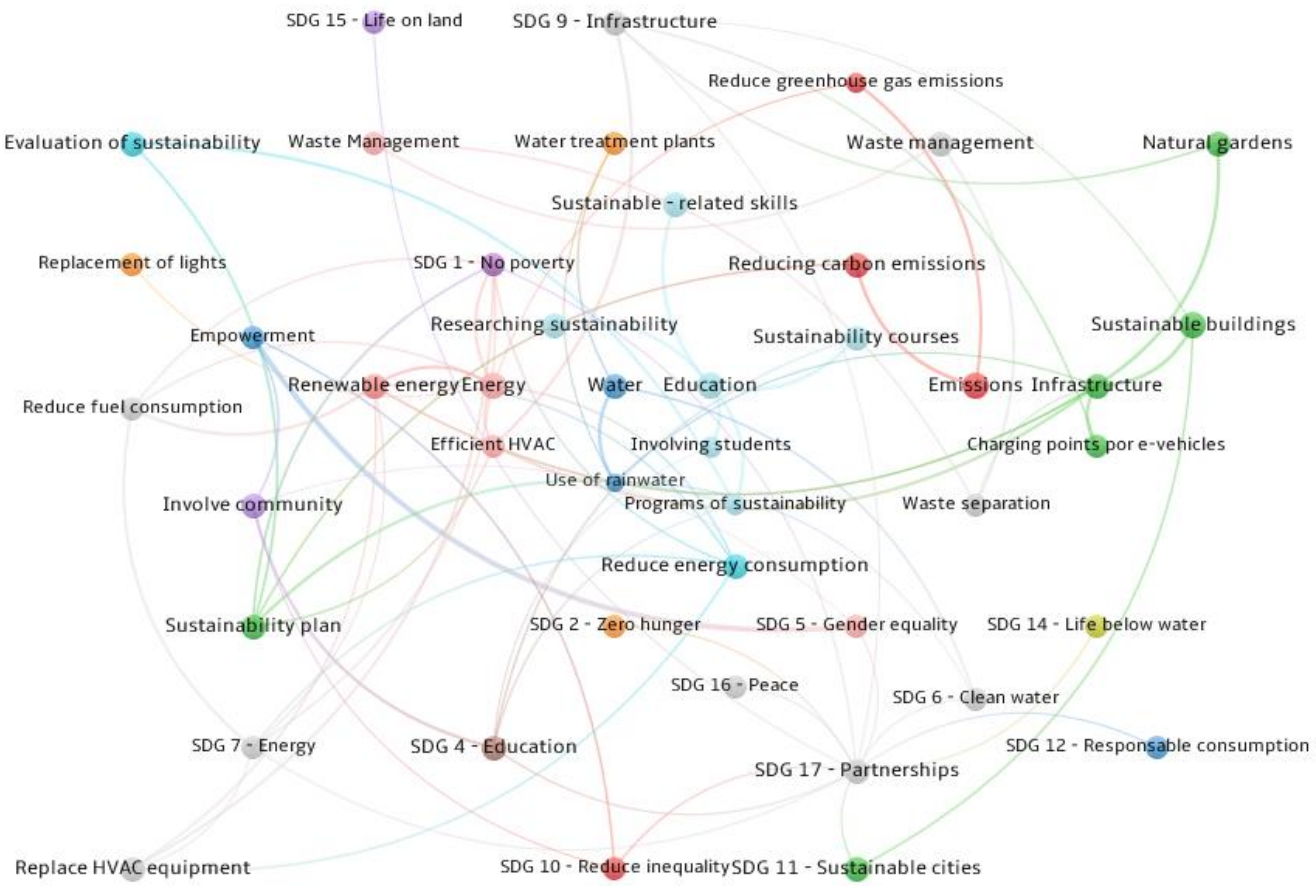

Figure 7. Word network of trends for universities and sustainability. (Source: own elaboration).

The same idea works as a driver for the analysis and recommendations performed in this section of our work since many HEIs are absent to be evaluated and considered; as stated in the introduction, it might require a little time for the GURs to incorporate sustainability as a category. The tendencies observed in the actions and word network presented here for the top ten universities should be attended.

Based on the analysis of the top ten universities of the *UI GreenMetric* and *THE Impact Ranking*, particularly TEC MTY, we suggest recommendations to simultaneously achieve sustainability in universities and participate in rankings (Figure 8). These recommendations will depend on the current location of universities in one of four stages, essentially defined according to the previous participation of HEIs in the most accepted sustainability ranking, *UI GreenMetric*, and summarized findings derived from this research work. The 4 stages are proposed: Stage 0 identified when a university is not involved in any sustainable activity or at least it is of their ignorance; in Stage 1, the institution has decided to progress toward sustainability due to the concept being well assimilated; for universities in Stage 2, sustainability is included in their mission, vision, and plans. For example, the Tecnologico de Monterrey may be classified in this stage. Stage 3 is reserved for HEIs well consolidated in sustainability and with a continuous sustainability program.

A common mistake that a university community may commit is only linking sustainability with "greenness" and beginning to create many "green areas" on their campuses, focusing only on the environmental aspect without attending to social or economic factors, as Sonetti et al. have pointed out [48]. This misconception of sustainability would have its origin in scarce diffusion, comprehension, and transcendence of the term, which is why we have set sustainability education as an initial step in recommendations. Awareness is a fundamental step to follow in adopting more complex sustainable measures. Little-compromised people will not adopt sustainable actions and thinking in their lives. Hence, it will not be a natural, standard, and attitudinal practice with a positive social effect and

advancing to Stages 2 and 3. It even may be said that sustainable awareness is one of the ingredients for a university in Stage 3. A second key element to be in mind for HEIs in Stage 3 is innovation; they must always be the vanguard offering new solutions related to crucial aspects of transport, climate, waste, and water treatment, as a result of the research and collaboration fostered in Stages 1 and 2.

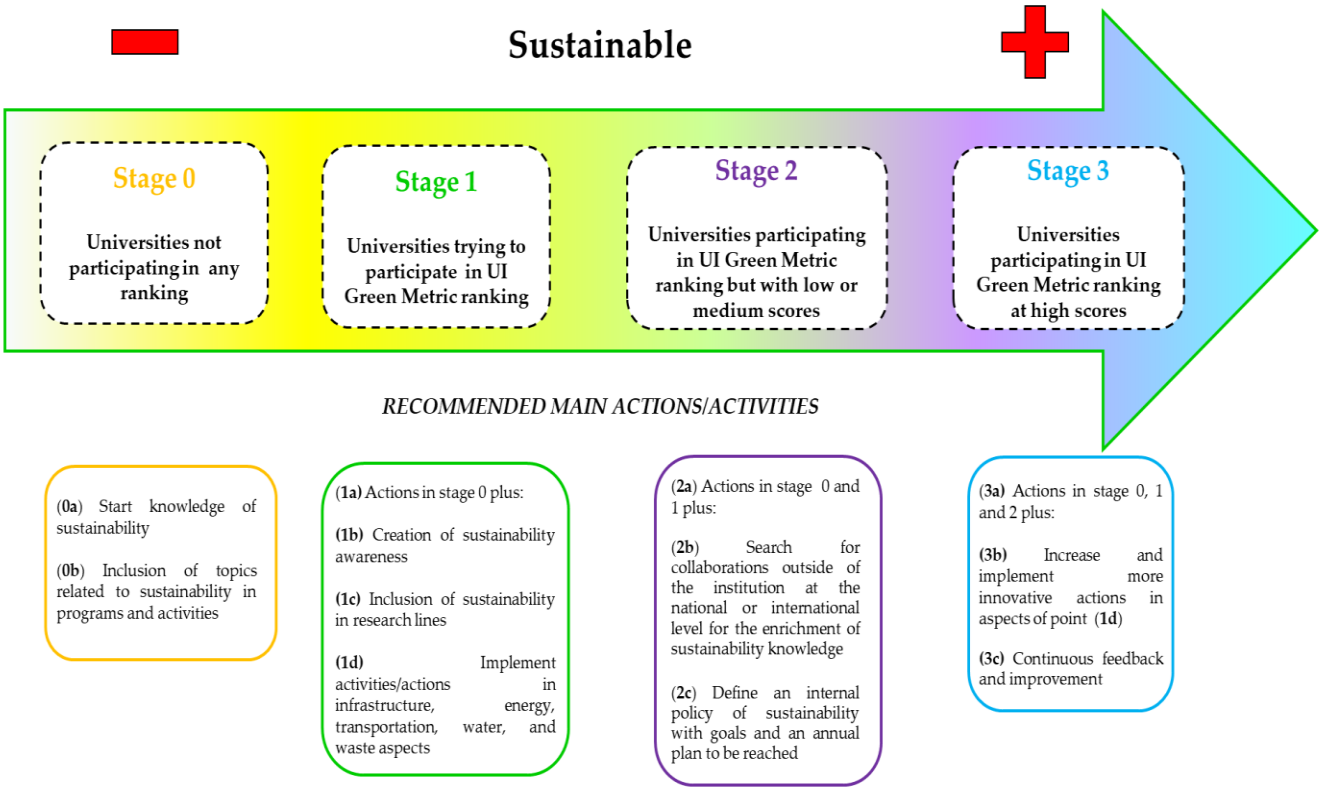

Figure 8. Main actions/activities suggested for HEIs on the way to participate in sustainability rankings and adopt sustainability. (Source: own elaboration).

4. Conclusions

Currently, there are two rankings for measuring sustainability in universities: *UI GreenMetric* and *THE Impact Ranking*. The first one is the most accepted ranking. The most sustainable universities in the *UI GreenMetric* ranking are characterized by implementing carbon emissions reduction, using renewable energy sources, waste treatment, green buildings and construction areas, and promoting biodiversity and healthy habits on campuses. The second one, the *THE Impact Ranking*, highlighted the universities that are attending primary SDG5 (gender equality), SDG6 (clean water and sanitation), SDG11 (sustainable cities and communities), and SDG12 (responsible production and consumption). The top ten universities in both rankings are different. Many other HEIs are carried out as sustainable actions without participating in rankings but through sustainability promotion in international associations for professional development and education, such as IACEE and SEFI. Particularly, the Tecnologico de Monterrey, in Mexico, is well located in both rankings (274th and 100–200th positions in the *UI GreenMetric* and *THE Impact Ranking*, respectively), and the carried-out actions cover five pillars: culture, mitigation, adaptation, education, and research and outreach. In general, it is noted that not only the efforts to maintain a sustainable building and environment are those that determine the degree of sustainability of a university but also the academic programs that form sustainable skills and graduates committed to sustainability in its three dimensions (social, economic, and environmental). Hence, education is the keyword found when necessary actions are analyzed. The recommendations with specific actions or activities to follow for sustainability adoption

by universities, considering four stages: sustainability ignorance; sustainability principles knowledge; sustainability adoption and planning; and consolidation in sustainability and continuous improvement. In this sense, sustainable education must be considered as the first step toward sustainability and ranking participation. It is essential to mention that there are still no indicators to measure the impact of education on the sustainability of the environment; what is the effect of carrying out actions to climb in the HEI sustainability ranking? It will be an incomplete objective to only be oriented to stay or advance in the rankings. Future research aims to measure the transformation toward a sustainable culture and their positive effects on each university community. However, even without these indicators, the IES sustainability rankings are helpful to ensure that students obtain the necessary sustainable competencies; their future application will depend on the strength of the teaching, the appropriate educational models, and personal commitment. There is still a lot of work to be performed, but this study will surely be helpful for HEIs in their reflection on the future of sustainability.

Author Contributions: Conceptualization, P.C. and L.A.M.-M.; introduction, L.A.M.-M.; methodology, P.C., L.A.M.-M. and J.M.-H.; investigation, L.A.M.-M., P.C., P.V.-V., J.M.-H., A.S. (Anthony Smith), A.S. (Alfredo Soeiro), A.K. and T.A.; visualization, N.O.-R.; results writing, P.C. and L.A.M.-M.; discussion and guidelines, L.A.M.-M.; review and editing, P.V.-V.; conclusion, L.A.M.-M. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Challenge-Based Research Funding Program, Institute for the Future of Education, Tecnologico de Monterrey, Mexico, grant number IJXT070-22EG51001.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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