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Article

Development Proposals for Implementing the 17 SDGs in Higher Education Institutions: Early Stages

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Abstract Universities, as key players in global development, have a vital role in implementing the Sustainable Development Goals (SDGs) within their environments. However, measuring progress toward the SDGs poses methodological challenges due to the complex framework comprising 17 goals, 169 targets, and 247 indicators. Within the diverse landscape of university ranking systems, in 2019 emerged the Times Higher Education Impact Rankings (THE IR) being so far the only ranking dedicated to evaluating the performance of Higher Education Institutions (HEIs) in relation to the SDGs. Despite its validation and participation, there are emerging issues, such as the need to consider local contexts and available resources. This study, originating from the Greek context, aims to serve as the initial stage in formulating a more practical and efficient assessment tool utilizing Multi-criteria Decision Making (MCDM/A), specifically by developing a streamlined set of indicators. Its primary objective is to introduce internationally applicable and unbiased indicators that can provide more accurate evaluations of universities' progress, toward achieving the SDGs. To achieve this, various criteria were applied to an existing set of indicators, to determine their effectiveness in measuring SDG implementation. The findings of this analysis reveal the emergence of 34 indicators that meet the specified criteria.

Keywords Sustainable Development Goals; university; rankings; sustainability; higher education institutions; indicators; assessment tools; MCDM/A; AHP

1. Introduction

The acknowledgment of education's role in driving environmental responsibility and conservation dates back to the 1972 Stockholm Conference [1,2]. Since then, there has been a substantial growth in initiatives, declarations, and charters advocating for sustainable development. A significant milestone was reached in 2015 when 195 nations globally approved the 17 Sustainable Development Goals (SDGs), emphasizing the necessity for integrated strategies and collaborative efforts across sectors to achieve lasting progress and responsible resource management [3]. However, the complexity of these goals, comprising 17 objectives, 169 targets, and 247 indicators, poses a significant challenge for measurement and progress tracking [4–8].

In this context, universities emerge as crucial players, serving as hubs of knowledge and innovation, and are essential for the effective implementation of the SDGs, starting right within their own campuses [9–14]. "Higher Education Institutions (HEIs) can significantly contribute to the sustainability challenge because of their function as hubs of learning, innovation, and research" [15]. Nonetheless, this raises a fundamental methodological question: How can progress toward the SDGs be accurately assessed, particularly within the diverse contexts of HEIs? This question gains further relevance considering the diverse nature of university environments.

While Times Higher Education Impact Rankings (THE IR) [16] stands as the only ranking system specifically designed to measure HEIs' performance against the 17 SDGs, it faces criticisms and controversies. Concerns have been raised regarding its ability to adequately account for local contexts and varying resource availabilities across different universities, potentially leading to biased outcomes. As De la Posa et al. [17] argue the methodology and criteria used in THE IR lack transparency, making it difficult to understand how universities are evaluated and ranked. They may potentially prioritize universities' reputation and marketing efforts over their actual contributions to sustainability and societal impact. THE IR may fail to capture the full range of activities and initiatives undertaken by universities to promote sustainability and address the SDGs. Their methodologies may not adequately consider the diversity of universities

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worldwide, leading to biases in the results and potentially disadvantaging certain types of institutions. Galleli et al. [18] mention while it may not be possible to have a single, universally appropriate assessment, rankings should be tailored to fit the contextual reality of each institution. Recognizing diverse contexts and needs is crucial for developing more relevant and effective sustainability rankings [17–20].

In response to these challenges, this research signifies the early stages of developing an innovative tool, originating from the Greek context, for evaluating university actions toward the SDGs, serving as both a measurement mechanism and a catalyst for ongoing improvement. The envisioned tool seeks to streamline the evaluation process by reducing the number of indicators and adopting a Multi-criteria Decision Making (MCDM/A) approach [21], focusing on identifying objective, internationally applicable indicators that offer a fair and accurate depiction of a university's progress towards the SDGs.

Given the diverse challenges universities face, such as efficiently addressing concerns like the adoption of SDGs, enhancing education quality, and optimizing campus performance while tackling economic, social, and environmental issues, an effective decision-making framework is crucial. MCDM/A approaches are valuable tools [21] in navigating this complexity. Decision-making involves selecting one or more options from a set of alternatives. Yet the optimal choice may not necessarily be among the available options. This complexity is further complicated by limited resources and numerous constraints. In this intricate process, incorporating expert opinions is vital, as their insights contribute significantly to identifying suitable alternatives and navigating educational sector challenges. The application of MCDM/A methods aligns with the need for a systematic and flexible approach, empowering universities to make informed decisions in the face of diverse and interconnected challenges. MCDM/A offers a systematic approach for evaluating and selecting the best option from a set of alternatives based on multiple, often conflicting, criteria [22]. It provides a structured framework for decisions making in complex situations where various factors need consideration. MCDM/A methods employ mathematical models and techniques to analyze and rank alternatives, facilitating informed decision-making in diverse fields such as business, engineering, and environmental management [23].

This study aims to develop a streamlined set of indicators to be used in an MCDM/A flexible assessment process, to evaluate universities' progress toward the SDGs. In other words, it seeks to present internationally applicable and objective indicators that can facilitate unbiased and accurate evaluations, ultimately enhancing the contribution of HEIs to the global sustainability agenda [24].

The research questions guiding this study are as follows:

RQ1: Can internationally applicable and objective indicators be developed to formulate a more feasible and effective assessment tool that considers local conditions and can be used to assess the current achievement of SDG implementation by universities?
RQ2: Is it feasible to develop a streamlined set of indicators for formulating a practical and efficient assessment process using MCDM/A?
RQ3: Is it possible to apply a number of criteria to an existing set of indicators to reduce their number for use in a new tool based on MCDM/A?
RQ4: What are the number and nature of these indicators?

As for the structure of this paper, Section 2 presents the literature review, Section 3 covers the methodology, results are presented in Section 4 while Section 5 addresses the discussion, and conclusions and future research are outlined in Section 6.

2. Literature Review

2.1. The Necessity to Measure the Achievement of SDGs

The 17 SDGs provide a universal framework aimed at addressing various global challenges, including poverty, inequality, climate change, environmental degradation, and peace and justice. HEIs have embraced the achievement of these goals, necessitating the development of comprehensive assessment frameworks to measure and guide their efforts [25]. While measuring sustainability is not new, using the SDGs provides a more comprehensive approach, addressing environmental, social, and financial aspects of sustainable development. Researchers, among others, have stated that: It is therefore challenging to develop specific indicators or tools that can value the goals' contributions or impacts [17,18,26–28].

Evaluating sustainability is essential for HEIs [17,19,29] and their administrative bodies, serving as a critical tool. It helps refine existing conditions and initiatives within the university and identifies areas for improvement, guiding future strategies toward sustainable progress [17]. This, in turn, aids in elevating both the visibility and prestige of the institution [19,29]. Sustainability ranking is still in its early stages of development globally, as widely recognized by scholars [29–32]. The voluntary nature of sustainability ranking within universities allows the choice from a wide range of methodologies, leading to sustainability rankings that exhibit variations in data collection, analysis, and interpretation of results. Thus, transparency regarding the criteria and methodologies utilized by different ranking organizations becomes limited, challenging stakeholders' ability to assess the reliability and validity of these rankings. [17,18]. The subjective nature of selecting and applying diverse frameworks can pose challenges for standardization and comparability, despite reflecting institutions' unique contexts and priorities [19]. The results, therefore, vary significantly, making it hard to conduct meaningful comparisons and assessments across different HEIs [17].

Addressing this issue requires a concerted effort toward harmonizing standards and establishing clear, universally applicable guidelines for sustainability reporting in higher education. This would not only enhance the comparability and consistency of sustainability rankings but also contribute significantly to advancing the global agenda for sustainable development within the realm of higher education [29,33–35]. The validity and effectiveness of global rankings are compromised by substantial differences in local socioeconomic, geopolitical, and historical contexts [17,18]. Lack of transparency in methodology and criteria, potential bias toward reputation and marketing efforts, limitations in capturing universities' full sustainability initiatives, influence on governance and resource allocation, methodological shortcomings, and an overemphasis on quantitative metrics are some of the concerns that De La Posa et al. [17] highlight.

The journey toward sustainability measuring tools in universities found its roots in initiatives like the Practical Campus Ecology launched in 1993 [36]. A review of the literature via Google Scholar reveals more than fifty assessment tools that have been developed since then [37–40]. These included Sustainability Assessment Questionnaire (SAQ) [41], Graphical Assessment of Sustainability in Universities (GASU) [42], Sustainability Tool to Assess Academic Research (STAAR) [43], Environmental Management System in Universities [44], Benchmarking Indicators Questions-Alternative University Appraisal (BIQ-AUA) [45], Adaptable Model for Assessing Sustainability (AMAS) in Higher Education [46], UI GreenMetric World University Rankings [47], Sulitest Tool [48], Regional Innovation Impact Assessment (RIIA) Framework for Universities [49], THE Impact Rankings [16], Sustainability Leadership Scorecard [50], Oikos international (for students) survey Positive Impact Rating [51], DECODE HEI Sustainability Analysis 2022 [52], The Sustainable Development Goals Report 2022 [53]. The most commonly used instruments in the university ranking domain are STAAR [43] and the UI GreenMetric [47], and the main characteristic of the tools developed to date is that they deal only with the measurement of environmental factors (e.g., setting and infrastructure, energy and climate change, waste, water, transportation, and education), omitting social and economic factors; furthermore, they are not without their flaws. To give an instance, examining two of the most prevalent evaluation tools, there is a criticism to consider. Specifically, STAAR has encountered criticism due to its roots in the American educational system and its tendency to focus on environmental performance evaluations. This focus has led some to view it more as a competitive benchmarking tool rather than a comprehensive ranking system [54]. In contrast, the UI GreenMetric primarily employs a campus-centric approach in its assessments. This approach may not fully accommodate the historical and structural complexities unique to European universities. Traditional European universities operate within frameworks that have evolved over centuries, making the application of a campus-based evaluation somewhat limiting. Additionally, declarations, frameworks, and actions geared toward sustainable development are frequently shaped by local or national contexts. These elements, while integral, do not wholly reflect the unique lifeworld of HEIs but rather constitute a portion of its complex tapestry [17,18].

In 2019, THE IR presented an initial extensive effort to measure the performance of HEIs in alignment with the 17 SDGs [14,16–18,29]. As it has been unanimously recognized with the adoption of SDGs social and economic factors are equally crucial for achieving sustainability.

2.2. Global Adoption and Challenges Encountered

The adoption of THE IR has gained participation from over 450 universities across 76 countries in 2019, expanding to more than 1406 universities across 106 countries in 2022 [16]. This underlines a strong global commitment to integrating sustainability into higher education. However, the application of THE IR has not been without challenges. The main setbacks of this ranking entail the following points. Resource Intensity: Institutions require dedicated teams for data submission, which may be a hurdle for resource-limited universities [17,19]. Data Reliability: The self-reported nature of the data raises concerns about its accuracy and potential biases [15,17,19]. Indicator Duplication: The option for HEIs to report on selected SDGs leads to challenges like double counting and indicator replication [17]. Lack of Standardization: The variability in assessment approaches and the issue of double counting obscure the transparency and meaning of the rankings [15,17,19]. Addressing these issues is crucial for a fair, accurate, and transparent assessment of universities' sustainability efforts [4,17,54,55].

2.3. Addressing the Challenges: The Need for Standardization

To rectify issues like double counting and to enhance the integrity of assessments, there is an urgent need for a standardized scoring methodology [19], especially for similar or identical indicators across various SDGs. This adjustment ensures a more reliable and meaningful evaluation of an institution's progression toward the SDGs.

A perfect example of double counting in this situation can be explained using the following framework: Consider a higher education institution that opts to be evaluated under both SDG 14 and SDG 15, selecting these two from a pool of optional SDGs. This scenario manifests a case of double counting, as the institution receives an evaluation rating twice for responding to a singular query, given the matching of indicators 14.4.1 and 15.4.1, both of which inquire about "Water discharge guidelines and standards". The question is identical in both contexts, aiming to uphold water quality to safeguard ecosystems, wildlife, as well as human health and welfare. This scenario not only exemplifies double counting but also unveils an inconsistency in the evaluative weight assigned to the response, dependent upon the SDG under which the question is addressed. Specifically, a response under SDG 14 counts for a contribution of 1.68% to the total score, whereas addressing the same question under SDG 15 results in a 2% contribution. This difference further amplifies the inadequacy in counting, as an institution responding to both SDGs accumulates a total of 3.68%, a figure that apparently surpasses the maximum allocable percentage for a single question, thereby resulting in a twisted and inflated evaluative outcome. The theoretical implication here is that the institution should, in fact, receive only one of the two percentages, either 1.68% for SDG 14 or 2% for SDG 15, to ensure an equitable and accurate representation of its performance in alignment with the SDGs.

2.4. The Special Case of Greek HEIs

In the Greek context, despite active engagement with the SDGs, there is a noticeable lack of objective rankings reflecting the progress of local institutions toward sustainability [15,17,56]. The existing frameworks, primarily international, may not be fully applicable due to unique local conditions and legal frameworks. For instance, specific indicators like female student admission rates are not relevant in Greece due to national-level anonymized written examinations. Recognizing and accommodating these unique circumstances is vital for an unbiased evaluation of the Greek HEIs' progress toward the SDGs [25,57].

2.5. Towards an Improved, Tailored Assessment Tool

It is also apparent that different sustainability issues captured in the choice of categories [20], indicators, and weightings are not equally relevant in all countries [58]. To effectively assess the SDG progress of universities, the development of a concise, flexible, and objective assessment tool is necessary. This tool should focus on essential sustainability components, reduce the number of indicators to prevent complexity, and maintain a balance between indicator reduction and the need for detailed data for accurate SDG assessment [15,18,20,55,58–60].

3. Materials and Methods

3.1. MCDM/A

The development of an MCDM/A [21,60–66] aimed at integrating the 17 SDGs within HEIs appears to be a practical solution, providing also the necessary flexibility. A multicriteria assessment framework is comprehensive as it encapsulates the full breadth of sustainability concerns within HEIs by Interdisciplinary Approach: It fosters collaboration across various academic disciplines, ensuring that sustainability is embedded in all facets of education and institutional operation. Balanced Decision-Making: The framework ensures that economic viability, social equity, and environmental responsibility are equally considered in institutional decisions. Stakeholder Engagement: It involves a diverse group of stakeholders, ensuring that multiple perspectives inform the pursuit of sustainability goals. Customization: It allows institutions to adapt their strategies to their unique contexts, addressing local and global sustainability challenges appropriately. Educational Impact: The framework guides curriculum development to produce graduates equipped to tackle sustainability issues comprehensively. Operational Alignment: It prompts institutions to examine and adjust their practices to be environmentally sound, socially just, and economically responsible. Measurable Targets: It facilitates the setting and tracking of specific sustainability objectives across all major domains. Ethical Consideration: The framework inherently supports ethical decision-making that respects cultural diversity and inclusivity. Future-Orientation: It encourages actions that consider long-term sustainability for future generations, aligning with the SDGs' overarching goals. In essence, a multicriteria framework integrates the three pillars of sustainability—economic growth, social inclusion, and environmental protection—to ensure that higher education institutions contribute effectively and responsibly to the SDGs [15,20,55]. Among the various tools offered by MCDM/A, the Analytic Hierarchy Process (AHP) [61–64] stands out as a logical choice for transparent and internationally comparable evaluations [65–67]. AHP equips us with the necessary tools as it facilitates the establishment of a hierarchical structure for criteria and their respective weights, thereby excelling at structuring the decision problem effectively [65–67]. This hierarchical approach enhances comprehension and provides the flexibility needed for adapting to the complexity of the problem. It begins with defining the ultimate goal at the top level, followed by decision criteria (indicators) at the second level, enhancing comprehension and adaptability to complexity. Depending on the intricacy of the evaluation, additional levels, such as sub-criteria, can be incorporated as needed, ensuring a thorough yet manageable evaluation of sustainability in higher education institutions concerning the SDGs. For the application of AHP, the first step is to establish the goal, which in this case is "Evaluating the HEIs based on SDGs". Criteria, referred to as indicators in this context, are then identified, with THE IR questionnaire serving as a primary reference [16,68,69]. Since this is the only tool so far, that claims to measure an institution's commitment to SDGs it seemed as a logical decision to try and identify useful indicators based on it.

The application of the AHP requires developing a goal hierarchy, in which the overall goal is set as well as the criteria and the decision alternatives. This hierarchical structure is rather important because the comparison of all elements is based on it. The next steps involve setting up a pairwise comparison matrix of criteria and ranking the relative importance between alternatives: Assess the relative importance between each pair of alternatives for each criterion, deriving weights for each alternative.

Following these steps ensures a systematic and comprehensive evaluation process. However, in this paper, we focus only on forming the hierarchical structure and forming the set of criteria as the decision problem and the goal is rather complex and a lot of research should be done to find a representative set of criteria.

3.2. Conducting Stage

The aim of this paper is to identify internationally applicable and objective indicators that can provide unbiased and accurate evaluations of universities' progress towards the SDGs.

Literature review: Upon completion of an initial investigation, it was found that throughout the years a lot of tools attempting to measure sustainability within tertiary education were initiated. The investigation involved tools that measure sustainability in educational institutions. Scrutinizing the literature, it was possible to find more than 59 assessment tools. The year range of their initiation spanned from 1993 to 2019 [36,70,71]. Applying the year limit 2015–2023, after the launch of the Agenda 2030, the search returned one ranking tool. That ranking tool is

THE Impact Rankings, launched in 2019 [16]. The investigation confirmed that no other ranking tool specifically focusing on the implementation of the SDGs in tertiary education was identified.

Desk search: Still some of the ranking tools were examined in order to spot if these hold any interest for this research. Two primary conclusions emerged from the analysis. Firstly, it was observed that all ranking tools predating 2015 predominantly focused on the environmental dimension of sustainability, neglecting the social and economic aspects. Secondly, the new rating system not only incorporates all sustainability dimensions covered by previous tools but also does so in a more thorough and comprehensive manner.

In order to spot the most useful indicators, a group of three experts was formed. All of them met the following criteria: having studies in the discipline of sustainability, having worked on sustainability for over twenty years, and having worked at the university for over twenty years. The working task of this group was to thoroughly review the indicators from THE IR [16] which specifically target sustainable development goals [66,72,73], in order to determine whether all indicators were useful or if improvements could be made and what could be the nature of these improvements. The main goal was to identify suitable indicators for a new approach, without compromising the quality and considering the local context. Table 1 illustrates the procedure for selecting the final indicators.

Table 1. The procedure for selecting the final indicators.

Action	Analysis	Reference
Literature review	A thorough examination of the literature was conducted, focusing on studies and research related to sustainability in higher education institutions. Keywords such as "University", "Sustainability", "Higher education institutions", "Indicators", and "Assessment tools" were used to gather relevant information.	[25,69,70,72,73]
Desk search	A desk search was performed to identify existing frameworks or approaches that have been used to rank universities' sustainability efforts. This search aimed to understand the methodologies and criteria used in previous studies.	[40–53,58,59,72,74]
SDGs as a starting point	The 17 SDGs were used as a foundational framework. These global goals provided a baseline for sustainability considerations and helped establish the main demands for ranking a university's implementation of sustainability.	[16]
Local legislation	The requirements and guidelines outlined in national legislation pertaining to sustainability in higher education institutions were taken into account. These legal frameworks provided additional criteria and considerations specific to the context of the study.	Greek Legislation
Problem-related expertise	The expertise and knowledge acquired by the researchers in the field of sustainability and higher education institutions were considered. This expertise helped in identifying criteria that are relevant, meaningful, and aligned with the specific challenges and context of the study.	Implementation of Study Analysis

SDGs as a starting point: The 17 SDGs were used as a foundational framework. These global goals provided a baseline for sustainability considerations and helped establish the main demands for ranking a university's implementation of sustainability. In order to ensure comprehensiveness and alignment with the full spectrum of sustainable development objectives, a comparative analysis was conducted against the 17 SDGs. This comparison served to validate that no critical elements or dimensions were overlooked in the assessment framework. By juxtaposing the indicators against the SDGs, the evaluation process aimed to verify that all relevant aspects of sustainability, as outlined by the SDGs, were adequately addressed. This meticulous comparison sought to mitigate the risk of any potential gaps or omissions, thereby enhancing the robustness and inclusivity of the assessment approach. In essence, the alignment with the SDGs facilitated a thorough examination, safeguarding against the oversight of crucial sustainability dimensions in the evaluation of universities' progress.

Local legislation: In a similar manner and with comparable aims, a thorough review was conducted to include the requirements and guidelines specified within local legislation governing sustainability in higher education institutions. This extensive examination involved analyzing national legal frameworks, including statutes, regulations, and guidelines relevant to sustainability practices within academic settings. By integrating these regulatory provisions into the assessment framework, the study ensured a detailed understanding of the contextual factors and compliance requirements unique to each geographical region. Additionally, this approach served to enhance the assessment criteria with locally tailored considerations, enriching the evaluation process with insights derived from the specific socio-political and environmental contexts in which universities operate. Thus, the integration of local legislation highlighted a commitment to comprehensive

evaluation, covering both global sustainability imperatives and region-specific mandates, thereby fostering a thorough and contextually appropriate assessment of universities' sustainability initiatives.

Problem-related expertise: The expertise and knowledge acquired by the researchers in the field of sustainability and higher education institutions were considered. This expertise helped in identifying criteria that are relevant, meaningful, and aligned with the specific challenges and context of the study. By using what they knew, the researchers were able to create assessment measures that were relevant to the real situations faced by universities.

Within the framework of THE Impact Ranking, fundamental principles guided the selection of indicators to ensure a thorough and effective process. These guiding principles encompassed several key aspects:

Completeness: This principle emphasized the importance of including all relevant aspects and dimensions of sustainability within the indicator selection process. It ensured that the chosen indicators provided a comprehensive overview of universities' efforts towards sustainability, leaving no significant aspect overlooked.

Operationality focused on selecting indicators that were practical and feasible to measure and implement. It ensured that the chosen indicators could be effectively utilized to assess and compare universities' performance in sustainability initiatives, without encountering logistical or methodological challenges.

Nonredundancy aimed to avoid duplication or overlap among selected indicators. It ensured that each chosen indicator provided unique and valuable information, thereby maximizing the insights gained from the assessment process while minimizing unnecessary repetition.

Minimality emphasized the importance of selecting a concise set of indicators that were sufficient to capture universities' sustainability performance without unnecessary complexity or redundancy. It aimed to streamline the indicator selection process, focusing on the most essential metrics to facilitate clarity and efficiency in evaluation.

By adhering to these foundational principles, the experts established a robust framework for selecting indicators that effectively captured universities' sustainability efforts, ensuring relevance, practicality, and clarity in the assessment process, as can be seen in Figure 1 [21].

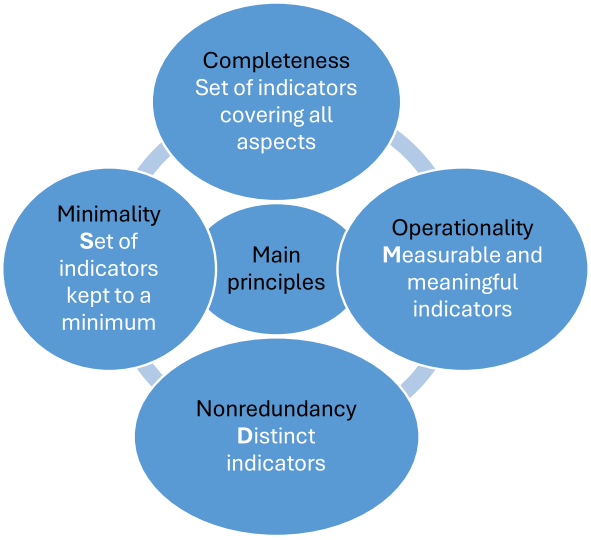

Figure 1. Foundational Principles for Selecting the Indicators [21].

To reduce the number of indicators, an Excel sheet was created for each SDG, featuring seven columns as depicted in Table 2 below:

Table 2. Presentation of Excel sheet main columns.

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
UN Targets	UN Indicators	THE Impact Rankings Indicators	Reasons for elimination	Indicators matching the criteria	Final Refined Indicators	Measurement Method

The first column (1) served to ensure oversight of the initial goals. The second column (2) served to ensure oversight of the actual UN Indicator. In the third column (3) the indicators that THE IR are using were placed. The fourth column (4) depicted the reasons for eliminating the indicators. The fifth column (5) served to consolidate indicators in order to avoid redundancy and excessive detailing. The sixth column (6) served to present the most prevailing indicators. The seventh column (7) presented the measurement method.

As depicted in Figures 2 and 3, the process involved eliminating redundant indicators, grouping related questions, and streamlining the assessment tool.

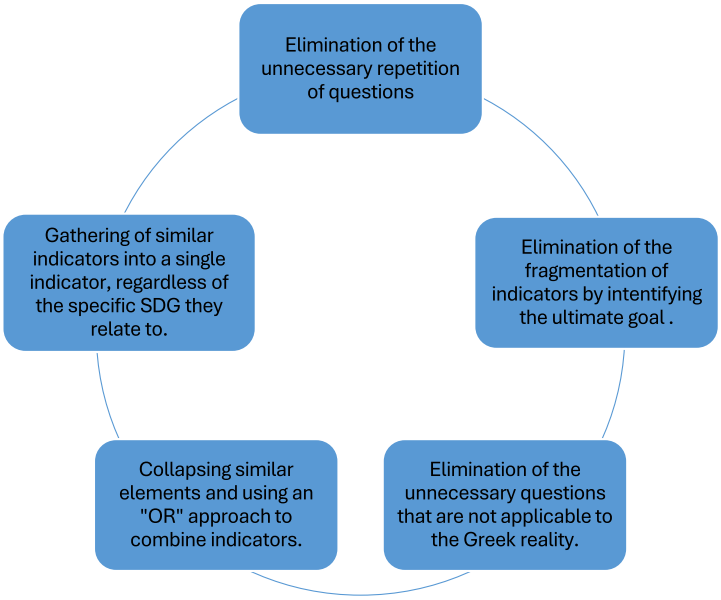

Figure 2. Steps taken to eliminate the set of indicators.

These changes maintained the assessment's reliability while improving its effectiveness. For instance, indicators were consolidated to avoid redundancy, and new indicators were added for completeness. A good example of elimination is combining Indicator I10, which addresses non-discrimination policies against women and transgender individuals, and protection for those reporting discrimination, under SDG 5 (Gender equality) rather than SDG 8 (Decent work and economic growth), thus avoiding redundancy. The application of these criteria to THE IR indicators resulted in a reduction from 231 to a final selection of 34 indicators, each accompanied by a description of their measurement methodology. In Figure 3 an example of eliminating and selecting indicators is given for helping in better understanding of the process.

This streamlined set of 34 criteria successfully strikes a balance, addressing the necessity for comprehensive SDG assessment while avoiding unnecessary complexity. This refined set of 34 indicators will be utilized for the objective evaluation of universities' progress toward the SDGs with the AHP method.

4. Results

In addition to the Excel sheets illustrating the rationale behind eliminating and differentiating indicators, another Excel sheet was created during the process of selecting the most suitable indicators. This sheet serves to summarize the process in a more understandable manner. It provides a summary of the initial number of indicators, the final count, as well as the number of indicators gathered, those deemed non-applicable and duplicated indicators. As depicted in Table 3 below, the number of non-applicable indicators is 54, and there were 27 instances of duplicate indicators. These figures affirm the initial hypothesis that numerous inconsistencies and improper indicators exist within this ranking set. All this work for the study was conducted during spring 2023.

		Clean Water and Sanitation							
SDG 6		**TARGETS**			**THE IMPACT RANKINGS**				
		DESCRIPTION	INDICATOR		THE INDICATORS	**Reasons for elimination**	**Indicators matching the criteria**	**Final Refined Indicators**	**Measurement Method**
	6.5	By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.	6.5.1 Degree of integrated water resources management	6.3.1	Wastewater treatment A process in place to treat wastewater.	EXISTENCE OF RELEVANT REGULATIONS AND LAWS AND IMPLEMENTETION BY CENTRAL GOVERNMENT		*Wastewater treatment **AND** Prevent water system pollution*	*Have a process in place to treat wastewater **AND** to prevent polluted water entering the water system, including pollution caused by accidents and incidents at the university.* *Up to three points based on:* *• Existence of process – one point* *• Evidence provided – up to one point* *• Is the evidence provided public – one point*
		By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.	6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation	6.3.2	Preventing water system pollution Processes to prevent polluted water entering the water system, including pollution caused by accidents and incidents at the university.	CONSOIDATION WITH 6.3.1, 6.3.4 AND **TARGET 14, 14.4.1**			
	6.6	By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.	6.6.1 Change in the extent of water-related ecosystems over time	6.3.3	Free drinking water provided Provide free drinking water for students, staff and visitors (e.g. drinking water fountains).	GENERAL PRACTICE IN GREECE			
	6.a	By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies.	6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan	6.3.4	Water-conscious building standards Apply building standards to minimise water use	Water-conscious building standards Apply building standards to minimise water use	Water-conscious **building standard**s Apply building standards to minimise water use. Water-conscious **planting** Plant landscapes to minimise water usage. (e.g. use drought-tolerant plants)	*Water-conscious building standards AND Water-conscious planting.*	*Apply building standards to minimise water use **AND** Plant landscapes to minimise water usage. (e.g. use drought-tolerant plants)* *Up to three points based on:* *• Existence of standards – one point* *• Evidence provided – up to one point* *• Is the evidence provided public – one point*

Figure 3. Example of Eliminating and Selecting the Indicators.

Table 3. Indicator selection summary.

	SDG	INITIAL INDICATORS	FINAL INDICATORS	GATHERED	NON-APPLICABLE	DOUBLE
1	**No Poverty**	13	2	7	4	1
2	**Zero Hunger**	14	2	12		1
3	**Good Health and Well-being**	10	2	8	1	
4	**Quality Education**	10	3	8		
5	**Gender Equality**	18	4	7	5	5
6	**Clean Water and Sanitation**	15	2	8	6	1
7	**Affordable and Clean Energy**	15	3	9	5	1
8	**Decent Work and Economic Growth**	13	0	5	5	1
9	**Industry, Innovation and Infrastructure**	4	1	4		
10	**Reduced Inequalities**	17	1	11	2	
11	**Sustainable Cities and Communities**	19	2	12	4	1
12	**Responsible Consumption and Production**	14	3	3	2	6
13	**Climate Action**	11	2	7	3	
14	**Life Below Water**	18	1	3	1	6
15	**Life On Land**	15	1	3	6	4
16	**Peace, Justice and Strong Institutions**	16	1	5	10	
17	**Partnerships for the Goals**	9	4	5		
	TOTAL	**231**	**34**	**117**	**54**	**27**

4.1. Which are the Final Indicators

As it has already been mentioned the final set of indicators was 34. Out of them, 33 were based on the original indicators. Still, many of these had to be altered since a huge fragmentation was detected. The solution was given by prioritizing the possibility of selection between equivalent acts. To clarify this with an example indicator I30: Research for the goals, means that any kind of research for the goals is accepted, without distinguishing between goals and without prioritizing one goal over another. Throughout the paper, we will signify the SDGs with the capital letter *G* and the appropriate number, and the indicators will be signified with the capital letter *I* and their number. Below Figure 4 depicts the AHP hierarchy and the final set of 34 indicators in accordance with the SDG that they originate from.

4.2. Final Indicators Measurement

In accordance with the AHP method which involves pairwise comparisons of criteria and alternatives in order to perform these comparisons effectively, numerical values are necessary to quantify the relative importance or preference of one criterion over another. AHP employs consistency checks to ensure the reliability of the decision-making process. Without numerical values, it would be challenging to assess the consistency of judgments made during pairwise comparisons. AHP utilizes mathematical operations such as normalization and aggregation to derive priority weights for criteria. These operations rely on numerical values to compute meaningful results. Assigning numerical values to criteria helps to make the decision-making process more objective. It provides a structured approach for decision-makers to evaluate and compare criteria based on empirical data rather than subjective opinions alone. Numerical values facilitate the analysis of decision models generated through AHP. They enable decision-makers to interpret results, identify trade-offs, and make informed decisions based on quantitative insights. To apply values to the indicators, we followed the same measurement approach as that used by THE IR in assessing the criteria.

The measurement methodology for the indicators is outlined in Table 4. Specifically, 21 out of the 34 indicators are measured similarly, with an additional 9 indicators following a similar approach, while the remaining 7 are measured differently. This measurement methodology allows us to obtain the needed numerical values for computing the results.

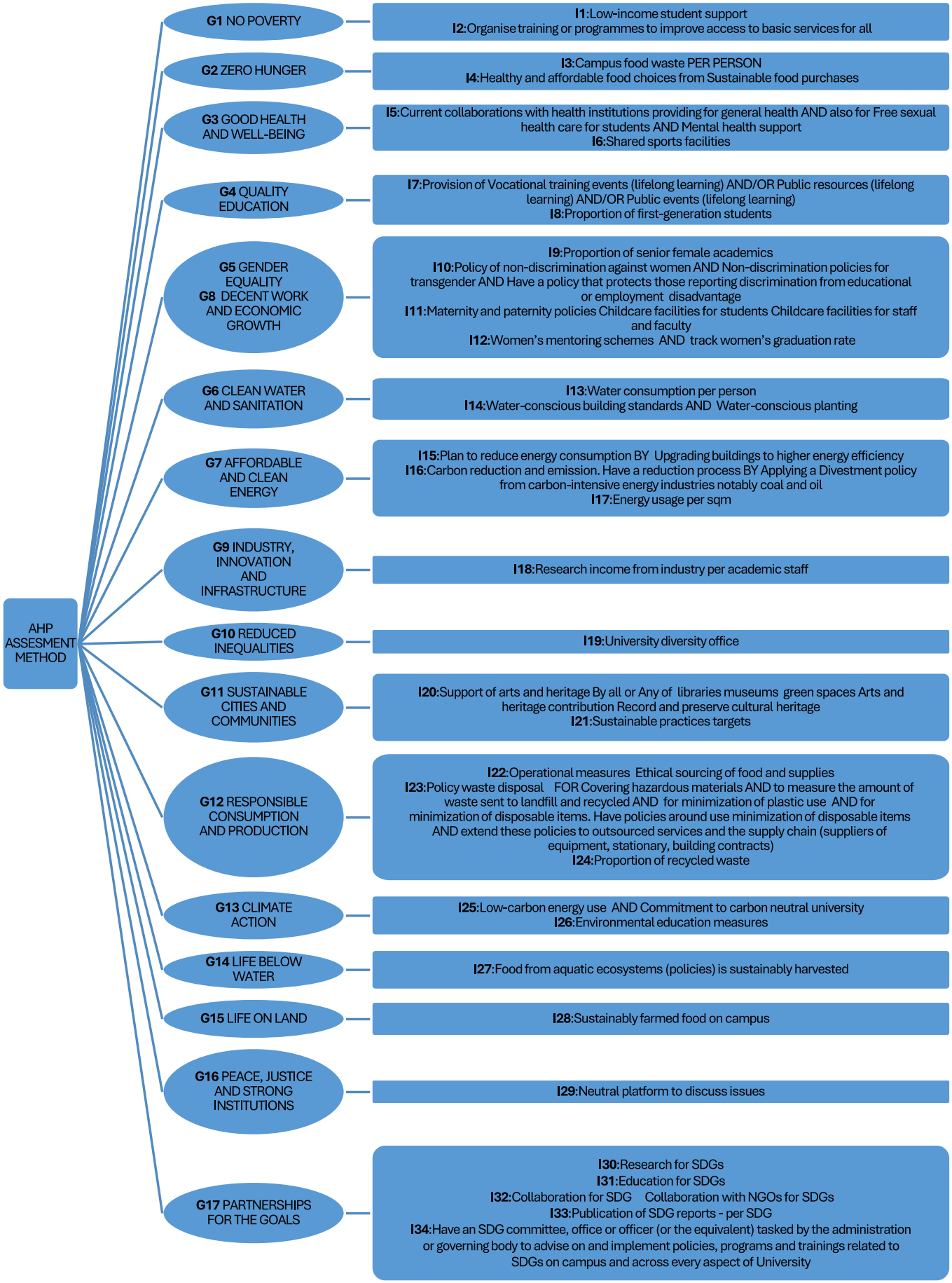

Figure 4. AHP Hierarchy, Target, Goals, and Indicators.

Table 4. Indicators measurement.

Indicator	Measurement
I1, I2, I4, I5, I6, I7, I12, I14, I19, I20, I21, I26, I29, I31, I32, I34.	The way that they are measured is they are given up to three points based on: • Existence of (relevant indicator)—maximum one point for free • Evidence provided—up to one point • Is the evidence provided public—one point
I10, I11, I15, I16, I22, I23, I25, I27.	This set of 9 indicators is measured in a similar manner but they are given a total of up to four points based on: • Existence of (relevant indicator)—one point • Evidence provided—up to one point • Is the evidence provided public—one point • Is policy created or reviewed in the period 2015–2023—one point
Indicator I3	Total food waste/Number of campus population
Indicator I8	Number of students starting a degree/Number of students graduating
Indicator I9	Number of female senior academic staff/Number of senior academic
Indicator I13	Inbound (treated/extracted water)/Number of campus population
Indicator I17	Total energy used (Total energy used in Gigajoule (GJ))/University floor space (Floor space of the university buildings in square meters (m^2))
Indicator I18	Research income by subject area: STEM /Number of academic staff by subject area: STEM or Research income by subject area: Medicine/Number of academic staff by subject area: Medicine or Research income by subject area: Arts & Humanities/Social sciences/Number of academic staff by subject area: Arts & Humanities/Social sciences
Indicator I30	Measure the proportion of academic publications, paper views, CiteScore

5. Discussion

This section explains the rationale behind the selection of the final indicators and underscores their significance. Sustainable development (SD) issues revolve around the examination of SDGs, consisting primarily of indicators and targets that necessitate systematic analysis. It is crucial to recognize the interconnected nature of these objectives. MCDM/A methods, particularly in the realm of sustainable energy decision-making [64], have been widely utilized to enhance the potential for more sustainable decision-making processes, encapsulating the classical triad of sustainability (economic-environmental-social). Among the various MCDM/A methods, the AHP stands out as a comprehensive and widely applied technique with numerous applications in SD fields. AHP facilitates decision-making through a systematic and mathematical approximation of the decision-making process, resulting in diverse practical applications.

To construct an AHP application for evaluating universities' implementation of SDGs and establish an organized decision-making process, the research follows the structured four-step AHP methodology. The initial step involves defining the problem and determining the desired knowledge. The second step entails structuring the decision hierarchy, beginning with the decision goal, followed by broad objectives, and intermediate criteria, and concluding with the lowest level, typically a set of alternatives. In this study, emphasis was placed on essential aspects of sustainable development goals to create the necessary hierarchy and identify contributing criteria. While the subsequent steps of the method were not implemented in this research, they involve constructing pairwise comparison matrices in the third step, where each element in the upper level is compared to those immediately below it. The fourth step utilizes priorities obtained from comparisons to weight priorities in the level immediately below, continuing this process until the final priorities of alternatives in the bottommost level are determined. The contribution in proposing a set of indicators for measuring universities' alignment with the SDGs significantly enhances existing knowledge by providing a structured and comprehensive framework. Here are the pros of the proposed indicators:

Comprehensive Coverage: The indicators cover a wide range of SDGs, ensuring that multiple aspects of sustainability are considered, thus providing a holistic view of a university's contributions.

Specificity: Each indicator is clearly defined and measurable, allowing for an accurate assessment of a university's performance in each area.

Relevance: The indicators directly align with the goals and targets of the SDGs, ensuring that the measured aspects are meaningful in the context of global sustainability efforts.

Actionable Insights: By measuring specific activities and outcomes, the indicators provide actionable insights for universities to identify strengths, weaknesses, and areas for improvement in their sustainability initiatives.

Comparability: The proposed indicators allow for the comparison of results across different universities, facilitating benchmarking and sharing of best practices.

Alignment with AHP Method: The use of the AHP method enhances the robustness of the measurement framework by providing a systematic approach to prioritize and weigh different indicators based on their relative importance.

Comparing the obtained results with existing ones allows for validation and refinement of the measurement framework, ensuring its effectiveness and relevance. Additionally, the analysis may reveal new research directions or topics, such as exploring the impact of specific university initiatives on SDG attainment, assessing the effectiveness of different approaches to sustainability education, or investigating the role of partnerships in advancing SDG-related goals. Overall, the proposed indicators contribute significantly to the field of sustainability assessment in higher education and provide valuable insights for future research and practice.

The Rationale behind Each Chosen Indicator

The study attempts to address the goal of SDG 01, which is "No Poverty", and focuses specifically on universities' contributions toward poverty alleviation. The two indicators that were chosen are: Indicator I1—Low-income student support and Indicator I2—Organize training or programs to improve access to basic services for all. The aim of the chosen indicators is to examine the focus on universities' support for poor students and the provision of training or programs to improve access to basic services for all. The chosen indicators predominantly concentrate on universities' support for low-income students. It is undoubtedly important to support students from low-income families, as this is a powerful tool to impact poverty reduction within communities. The two main deficiencies faced by poor students are the lack of financial resources to study and the lack of literacy to manage situations such as improving access to basic services, a measure that can empower them. And despite it could be argued that a more holistic approach could encompass a wider range of initiatives, many universities, among them public ones do not have the financial resources to allocate. These two indicators have been selected, as they wield significant influence in evaluating the contribution of universities to society in addressing poverty.

Aligned with SDG 02: Zero Hunger, this indicator I3 evaluation focuses on higher education institutions' commitment to combat food waste and address hunger among students. Two key indicators assess campus food waste per person and the provision of healthy, affordable, and sustainably sourced food options. This approach aligns directly with SDG 02's objectives, reflecting a comprehensive strategy to eradicate hunger and promote sustainable agriculture. Indicator I4 emphasizes the importance of sourcing food responsibly, considering environmental and social impact. By addressing both food waste reduction (Indicator I3) and the availability of sustainable food choices (Indicator I4), the assessment encourages universities to adopt holistic solutions, recognizing their influential role in modeling sustainable practices.

Aligned with SDG 03: Good Health and Well-being, the SDG 03 score emphasizes higher education institutions' commitment to health. Indicators I5 and I6 assess collaborations with health institutions and shared sports facilities, recognizing tangible contributions to well-being. By addressing diverse health needs and promoting health equity, universities play a vital role in advancing global efforts to achieve universal health coverage and improve health outcomes for all. Access to recreational spaces and opportunities for physical activity aligns with global efforts to enhance public health and ensure a holistic approach to well-being. It motivates universities to prioritize health, advancing the goal of ensuring healthy lives for all.

In line with SDG 04, Quality Education, the SDG 04 score assesses universities' role in lifelong learning and inclusive education through two key indicators. Indicator I7 evaluates contributions to lifelong learning, emphasizing vocational training events and public resources. These initiatives support the development of lifelong learners, empower individuals to reach their full potential, and advance the goal of quality education for sustainable development. Indicator I8 gauges inclusivity by calculating the proportion of first-generation students starting a degree, reflecting a commitment to diverse student populations. These indicators effectively measure universities' contributions to the overarching goal of SDG 04. The evaluation is crucial for promoting lifelong learning, inclusive education, and aligning with global education targets. It encourages universities to foster diverse student populations, contribute to personal and professional development, and enhance global competitiveness. Additionally, the assessment aligns with SDG 04's interconnected goals, ensuring that educational institutions actively contribute to a more equitable, knowledgeable, and interconnected world.

The SDG 05 + SDG 08 Decent Work and Economic Growth score ranking aims to commend universities for their active efforts toward gender equality and inclusivity, both in academic roles and as responsible employers, aligning with the overarching goals of SDG 05 and its connection with SDG 08. Emphasizing the significance of creating a campus atmosphere free from discrimination that fosters diversity and gender equality, and promotes a culture of respect and fairness within the university community. The evaluation focuses on four key indicators. Indicator I9: Proportion of Senior Female Academics measures gender representation in leadership roles among senior academic staff. Indicator I10: Non-discrimination Policies for Women and Transgender evaluates universities' commitment to creating an inclusive academic environment, emphasizing the importance of policies and their accessibility. By eliminating barriers to equal opportunity and advancement, universities contribute to building more equitable, resilient, and sustainable societies where everyone can thrive and fulfill their potential. Indicator I11: Maternity and Paternity Policies, Childcare Facilities assesses the availability of family-friendly policies and facilities for students and staff. Universities offering parental policies and childcare facilities support SDG 05 and SDG 08, promoting gender equality, decent work, and inclusive, sustainable development. These initiatives align with the UN's sustainable development agenda, advancing progress towards a more equitable society. Indicator I12: Women's Mentoring and Graduation Tracking, evaluates initiatives such as mentoring schemes and tracking graduation rates for women. Universities implementing women's mentoring and tracking graduation rates support SDG 05 and SDG 08, promoting gender equality in education, leadership, and employment. These efforts align with the UN's sustainable development agenda, advancing progress towards a more equitable and sustainable future.

The SDG 06 score ranking commends universities for active contributions to water conservation and pollution control, aligning with the overarching goal of SDG 06. Measuring water consumption I13, is critical for environmental sustainability, aiding resource management, conservation efforts, and prevention of depletion. It safeguards ecosystem health, supports climate change adaptation, prevents pollution, protects human health, and promotes sustainable agriculture and responsible industrial practices. Moreover, water measurement is essential for policy development and enforcement, ensuring standards, resource allocation, and accountability. Overall, it is a vital element in maintaining environmental health and resilience. By indicator I14 Water-conscious building standards AND Water-conscious planting, universities contribute to the conservation and sustainable management of water resources, ultimately supporting broader efforts to achieve water security and sanitation for communities.

SDG 07 score, Affordable and Clean Energy, focuses on universities' energy consumption, policies, and commitment to energy efficiency. Indicator I15, Plan to Reduce Energy Consumption, evaluates universities' plans to reduce overall energy consumption through energy-efficient renovations. Universities contribute to mitigating climate change, promoting environmental sustainability, and supporting the transition to clean energy sources. Indicator I16, Carbon Reduction and Emission, measures the commitment to reduce carbon dioxide emissions by divesting from carbon-intensive energy industries. By reducing investments in coal and oil, universities contribute to mitigating climate change, decreasing carbon emissions, and advancing the transition to renewable and sustainable energy sources. Indicator I17, Energy Usage per Square Meter, quantifies energy usage efficiency in university facilities per square meter. Universities cultivate a sustainable culture through energy awareness, stakeholder engagement, and behavior change, promoting responsible energy use, conservation, and sustainability both on campus and in wider communities. These indicators highlight universities' contributions to SDG 07 by addressing energy reduction, carbon management, and efficient energy usage. Assessing these factors is crucial to promoting sustainability, reducing environmental impact, and advancing the goal of Affordable and Clean Energy.

The SDG 09 score emphasizes universities' role in innovation and industry support, with Indicator I18 assessing research income from industry per academic staff in specific subject areas. Universities drive sustainable development goals by bridging academia and industry, fostering innovation, technology transfer, and infrastructure development. Research income from industry demonstrates their dedication to tackling global challenges like climate change, energy sustainability, and environmental conservation through collaborative projects and knowledge exchange. This criterion aligns with SDG 09, recognizing universities for their contributions to industry, innovation, and infrastructure through research income generation. This assessment is essential for evaluating efforts in serving industry needs and promoting innovation, supporting economic

development, knowledge transfer, innovation ecosystems, infrastructure enhancement, talent development, and global competitiveness.

The SDG 10 score assesses universities' commitment to reducing inequalities through non-discrimination policies, specifically Indicator I19, which evaluates the presence of a University Diversity Office. This indicator is important for recognizing and commending universities actively fostering an inclusive academic environment aligned with SDG 10: Reduced Inequalities. The assessment is vital for promoting inclusivity, policy implementation, positive recognition, and direct contribution to global targets. By tackling inequalities in higher education, they promote social mobility, economic development, and social cohesion, driving progress towards sustainable development. Evaluating Indicator I19 is essential for acknowledging universities' dedication to SDG 10 and fostering a diverse and equitable campus.

The SDG 11 score evaluates universities' contributions to sustainable cities and communities through Indicators I20 and I21, focusing on arts, heritage, and sustainable commuting. Understanding these endeavors is essential for preserving cultural heritage, promoting eco-friendly commuting, engaging with the community, and aligning with the global goal of SDG 11.

Universities promote inclusive and sustainable urbanization by preserving cultural heritage, engaging communities, enhancing green spaces, and conserving intangible cultural heritage. They contribute to creating safe, accessible urban environments prioritizing cultural preservation, social cohesion, environmental sustainability, and community well-being. Universities promote sustainable and inclusive urban environments by setting targets for sustainable commuting, aiming to reduce environmental impact, enhance mobility, and foster social equity.

The SDG 12 score assesses universities' commitment to responsible consumption and production through Indicators I22, I23, and I24, critical for promoting ethical sourcing, waste reduction policies, and increased recycling in line with SDG 12. Ethical sourcing (Indicator I22) prioritizes fair treatment of workers and environmental considerations. Universities implement ethical sourcing policies to reduce environmental degradation, ensure social responsibility, support fair trade, conserve natural resources, promote transparency, and align with SDG 12 for sustainable consumption and production. This fosters a more sustainable and equitable world. Waste reduction policies Indicator I23 covers hazardous materials, recycling, plastic use minimization, and disposable item reduction. By implementing and adhering to these policies, universities aim to protect the environment, reduce waste generation, mitigate plastic pollution, promote sustainable consumption practices, ensure supply chain sustainability, enhance transparency and accountability, and commit to continuous improvement. This collective effort aligns with the broader goal of achieving sustainable consumption and production patterns outlined in SDG 12, contributing to a more sustainable and equitable future. Indicator I24 focuses on the proportion of waste recycled. This assessment aligns with SDG 12, showcasing universities' global contributions to sustainable consumption and production. Recognizing these efforts is vital, encouraging responsible resource use and waste reduction, and fostering a generation committed to sustainability. Universities, as key influencers, play a pivotal role in global efforts toward ethical and sustainable practices, shaping future leaders and fostering innovation in environmental stewardship.

The SDG 13 score assesses universities' commitment to climate action using Indicators I25 and I26, focusing on low-carbon energy usage, carbon neutrality, and environmental education. Indicator I25 evaluates the adoption of low-carbon energy sources and commitment to carbon neutrality, aiming to reduce carbon footprints, promote renewable energy, demonstrate climate leadership, plan emission reduction, engage stakeholders, and enhance accountability. These efforts align with Goal 13's objectives of integrating climate measures into policies, enhancing climate education, and encouraging public participation in climate action.

Meanwhile, Indicator I26 evaluates universities' efforts in environmental education, acknowledging their significant contributions to climate change mitigation, in line with SDG 13. Assessing these indicators is crucial for promoting carbon neutrality, environmental education, global impact, and preparedness for climate change, thereby fostering sustainability and alignment with SDG 13. Universities play a pivotal role in raising awareness, fostering collaboration, supporting government initiatives, engaging communities, and promoting accountability in addressing climate change. They offer climate education, devise action plans, collaborate with stakeholders, and share evidence to empower individuals, strengthen governance, build resilience, and catalyze collective action towards achieving SDG 13 objectives.

The SDG 14 score assesses universities' commitment to protecting life below water through Indicator I27, which evaluates the sustainable harvesting of food from aquatic ecosystems on

campus. Appreciating these actions is vital to advancing sustainable practices, preventing harm to ecosystems, and aligning with the global aim of SDG 14: Life Below Water. This criterion assesses observable contributions to safeguarding aquatic ecosystems, emphasizing the importance of responsible food sourcing in university campuses.

The SDG 15 score assesses universities' commitment to protecting life on land through Indicator I28, which evaluates the sustainability of food sourcing and farming practices on campus. Acknowledging this endeavor is essential to foster sustainable land utilization, prevent ecosystem degradation, and adhere to the worldwide objective of SDG 15: Life on Land. This criterion assesses tangible contributions to safeguarding land ecosystems, emphasizing the importance of responsible food sourcing and farming practices within university campuses.

The SDG 16 score assesses universities' commitment to peace, justice, and strong institutions through Indicator I29, which evaluates whether the university provides a neutral platform for open discussions among political stakeholders. Recognizing this effort is vital for fostering an environment that supports freedom of speech, academic freedom, and critical thinking. This criterion assesses actual contributions to the broader goal of SDG 16: Peace, Justice and Strong Institutions, emphasizing universities' role in promoting an inclusive and open discourse.

The SDG 17 score assesses universities' contributions to the SDGs through Indicators I30 to I34. Evaluating partnerships, education, collaboration with NGOs, publication of progress reports, and the existence of an SDG committee is fundamental. These criteria reflect universities' comprehensive commitment to sustainable development goals, fostering collaboration and promoting best practices on a global scale. Assessing these indicators is essential for acknowledging universities' active role in advancing the broader goals of SDG 17: Partnerships for the Goals. Indicator I30, Research into partnership for the goals, measure SDG 17 in universities via partnership research and metrics like academic publications, paper views, and CiteScore offers a strong framework to evaluate and boost their sustainable development contributions, fostering collaboration, knowledge sharing, and societal impact.

Indicator I31, *Education for SDGs*, measures education for SDGs in universities boosts awareness, capacity building, innovation, and global citizenship, driving progress towards SDG 17 and sustainable development goals.

Indicator I32, *Collaboration for SDG, Collaboration with NGOs for SDGs*, measures SDG collaboration in universities boosts knowledge exchange, community engagement, interdisciplinary solutions, scalability, and alignment with SDG 17, improving effectiveness in addressing global challenges sustainably.

Indicator I33, *Publication of SDG reports—per SDG*, measures SDG reports publication in universities enhances transparency, accountability, tracking, communication, learning, and alignment with SDG 17, driving continuous improvement in sustainability efforts for meaningful progress towards global goals.

Indicator I34, *Have an SDG committee….*, has a core concept of boosting effectiveness in sustainability endeavors through strategic alignment, comprehensive approaches, expert guidance, coordination, collaboration, monitoring, evaluation, and capacity building. Universities achieve this by appointing dedicated structures or personnel to oversee SDG-related activities, enhancing their capacity to collaborate with stakeholders and attain common sustainability objectives.

The above presents the rationale behind choosing and promoting the selected indicators over the other existing ones.

6. Conclusions and Future Research

The importance of education in sustainability was first underlined by the Burtland [1] report more than 50 years ago. Half a century later the HEIs are still paving their way to sustainability. The concept of sustainability now encompasses social and economic dimensions alongside environmental concerns, as highlighted by the introduction of the SDGs in 2015, which encapsulate the key aspects of sustainable development.

This study addresses the challenge of developing a flexible ranking system for universities' adoption of SDGs, one that takes into account local contexts. Tools created so far lack the consideration of local contexts.

Initially, the focus was on developing a user-friendly and efficient tool for generating precise rankings. After careful consideration, we chose the AHP as the most suitable method for this task. AHP stands out among other MCDM/A models due to its hierarchical representation of decision problems, comprehensive criteria structuring, and weight estimation methods. This hierarchical

approach enhances comprehension and adapts well to the complexity of the problem. Additionally, AHP helps identify inconsistent data, making it invaluable for projects and collaborative endeavors.

The endeavor to establish a comprehensive set of indicators fulfilling the criteria of Completeness, Operationality, Nonredundancy, and Minimality [21] yielded 34 indicators. This proposed approach offers a standardized and impartial method, facilitating equitable reporting crucial for international rankings. It can serve as a communication tool for comparing universities across diverse parameters while considering local contexts. Additionally, it enables institutions with limited resources to achieve a fairer ranking, giving them a chance to show their results.

This paper carefully outlines the 34 indicators and their measurement, aiming to encompass all impact areas and themes addressed by the SDGs. The goal was to create a user-friendly yet precise tool accessible to institutions lacking resources but keen on demonstrating their commitment to sustainability. Indicators were categorized under the 17 SDGs, avoiding duplications.

The selected indicators cover a wide range of sustainability dimensions outlined by the SDGs, including social, environmental, and economic aspects. They address various goals such as no poverty, zero hunger, good health and well-being, quality education, gender equality, clean water and sanitation, affordable and clean energy, decent work and economic growth, industry, innovation and infrastructure, reduced inequalities, sustainable cities, and communities, responsible consumption and production, climate action, life below water, life on land, peace, justice, and strong institutions, as well as partnerships for the goals.

For example, indicators such as low-income student support and campus food waste per person directly relate to the goal of no poverty and zero hunger, respectively. Similarly, indicators like shared sports facilities and completion rate proportion of first-generation students contribute to promoting good health and well-being and quality education. One of the limitations is that while the selected indicators touch upon various aspects of sustainability, some goals and targets are not fully represented.

While there is merit in expanding the scope of AHP-based assessments to include additional sustainability dimensions and societal impacts, doing so requires careful consideration of the inherent complexities, subjectivity, and resource constraints involved. Balancing comprehensiveness with feasibility is essential to ensure the effectiveness and relevance of the assessment methodology.

The limitation of this study lies in that it only represents an initial step in applying the AHP method, focusing on selecting appropriate indicators. A further limitation is that so far it only takes into account the Greek context, by considering the legislation and practices that apply in Greek tertiary education. To enhance its universality, testing across diverse institutions and national contexts is essential. Taking into account the unique characteristics of each country, such as those of Greece, customized indicators may be necessary. Following this, conducting cross-country comparative analyses can identify key indicators for precise and internationally comparable measurements. This may lead to the creation of additional "national" indicator sets.

A plan in future work is to calculate criteria and indicator weights and apply the AHP method. This will complete the AHP model, thus forming the complete ranking system. Then the proposed model could be further validated by comparing the results, after applying it in a wide number of HEIs, especially among different countries.

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Data Availability

Data supporting this study are openly available from Microsoft SharePoint at https://ioniogr0-my.sharepoint.com/:x:/g/personal/kkabassi_ionio_gr/EWIWyM5hy6FPpByq9YctlxUBejfGrxRV1xwSVSW2sW_-zw?rtime=7b96yolD3Eg.

Author Contributions

Conceptualization: M.K, A.M., & K.K.; Data curation: M.K.; Investigation: M.K.; Methodology: A.M, M.K., & K.K.; Resources: M.K.; Supervision: A.M., & K.K.; Writing – original draft: A.M., & M.K.; Writing – review & editing: A.M, M.K., & K.K.

Conflicts of Interest

The authors have no conflict of interest to declare.

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