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Using a Multi-Criteria Ranking Method to Assess Factors Influencing the Implementation of Sustainable Development at Higher Educational Institutions

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Abstract: Over the last years, there has been a significant increase in interest in sustainable development in higher education institutions, and many have begun to implement sustainable development into their system. Several sustainable development assessment tools have also been developed to help universities systematically measure, monitor, benchmark, communicate, and manage their sustainable development efforts. These efforts have led to mixed results. It seems that one of the main reasons for this situation is the non-systematic and non-holistic approach to implementing sustainable development in universities. Thus, it can be assumed that the implementation of sustainable development in a university should cover all dimensions of its functioning and involve actors within it. Therefore, the aim of this article is to present a tool (inspired by the concept of university sustainability), based on the method of multicriteria rankings, for assessing the factors influencing the implementation of sustainable development in higher education institutions at the level of departments, as relatively autonomous wholes, based on the analysis of departments at one of the leading technical universities in Poland. The proposed tool provides an opportunity for a more holistic view of sustainable development implementation, both by prioritizing factors and by considering that higher education institutions are systems that are, in fact, composed of two distinct but necessarily cooperating subsystems: the academic subsystem and the administrative subsystem. The proposal is preliminary, but it seems that given the relevance and urgency of the sustainable development issue, this is the direction to take in research on sustainable development management in higher education institutions.

Keywords: implementation of sustainable development; sustainable development management; higher educational institutions; university sustainable development; multicriteria ranking method

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1. Introduction

The number of publications on sustainable development (SD) in higher education institutions (HEIs) has increased significantly in recent years. In the last year alone (2022), 125 articles on this topic were published in the ScienceDirect database (search based on keywords "higher educational institutions" and "sustainable development"). A detailed analysis of the number of publications in the last decade (based on the criteria indicated above) is shown in Figure 1. Several reasons for this increase can be identified: firstly, sustainability has become an urgent issue (if only because of the real threat of climate catastrophe), secondly, it has become a problematic issue (if only because of the expectations exerted by stakeholders to take action and make decisions with care to maintain an ethical responsibility towards the social environment, the environment, or employees), and thirdly, it has become a strategic issue (if only because social and environmental aspects are starting to be considered as a source of competitive advantage and added value for organizations). Undoubtedly, therefore, growing economic, social, and environmental issues (known as the conceptualization of SD based on three pillars [1]) are becoming increasingly important

challenges for modern organizations, including HEIs, which, due to their role, if only in shaping social attitudes and creating innovative solutions, should play a special role in creating answers to these problems. The challenges associated with this concern are largely attempts to integrate SD into the current HEI management models. This is extremely difficult for two main reasons. Firstly, because the very concept of SD is still unclear [2]. Second and more importantly, HEIs as open and dynamic systems [3] are actually composed of two distinct, though necessarily collaborative, subsystems: the academic subsystem and the administrative subsystem. The academic subsystem encompasses teaching, learning, research, and the transfer of knowledge to the community (outreach) and broadly corresponds to Education for Sustainable Development (ESD) activities. The administrative subsystem, on the other hand, is related to the management of sustainability in universities and covers two main aspects: campus operations and management processes, while serving the academic subsystem to achieve its objectives [3]. Therefore, there is a legitimate trend in the administrative subsystem to adopt strategies and structures from the manufacturing sector [4,5]. The sector has adopted corporate sustainability (CS), applying it to the entire organizational system. In fact, CS contributes to sustainability while improving its long-term economic performance [6]. However, it should be emphasized that ESD in HEIs is implemented through mission functions such as teaching, research and outreach, institutional engagement, campus activities, and communication with stakeholders [7–10]. Therefore, ESD seems to be more related to the practices of sustainable development themselves. In contrast, HEIs to effectively implement SD should have a more integrated organizational structure and strategy for sustainability [11–13]. However, the literature so far does not provide a single model that encompasses all these characteristics [12], and sustainability is not yet an integral part of the university system [14]. The reasons for this range from the fact that different HEIs adopt different priorities for integrating sustainability [11], which is caused by the complex conditions of the social, economic, political, and cultural environment [15], to the fact that HEIs often still misunderstand sustainability [16]. Therefore, we assume that to talk about the implementation and consequently the management of SD in HEIs, the whole system, consisting of both academic and administrative subsystems, must be taken into account. Therefore, the university system partially integrates ESDU, but it is possible (and perhaps necessary) to integrate the concept of CS as a management approach into the administrative subsystem to improve it.

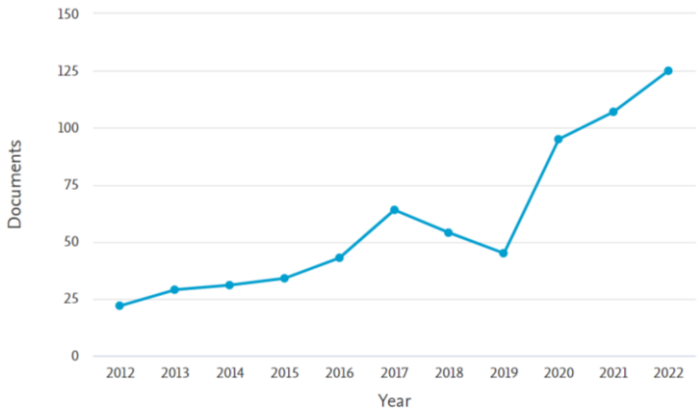

Figure 1. Number of publications in ScienceDirect between 2012 and 2022, search based on keywords "higher educational institutions" and "sustainable development". Source: https://tiny.pl/wnf45 (accessed on 15 January 2020) [14,17,18].

The implementation of SD in HEIs is related to the belief that HEIs should play a fundamental role in the implementation of SD because of their position and function in both generating and disseminating knowledge, innovation, and awareness [19–22]. As a result, many HEIs have begun to integrate SD into their systems (although, as ref. [23] notes, often only piecemeal) and assess and report on their progress in meeting their SD

obligations [24–30]. Various tools for assessing SD have been developed (an overview of these can be found in, among others, ref. [22,31–33]), to support HEIs in systematically measuring, controlling, comparing, and informing their efforts to implement SD. These tools are also used as benchmarking practices to compare the processes and performance indicators of different HEIs [22]. However, many authors note that the systematization used in these tools is not homogeneous—there are no common labels or objectives, and they include diverse tools, often with different objectives or methodologies for implementing sustainable development [22]. Indeed, some tools focus only on selected dimensions of SD implementation in HEIs, such as campus operations (e.g., Campus Sustainability Assessment Framework—CSAF [34]) or curricula (e.g., Sustainability Tool for Assessing University Curricula Holistically, STAUNCH [35]). Others are limited to evaluating only a selected aspect of SD, most often the environmental aspect (e.g., Campus Ecology [36], Environmental Performance Survey [37]). Still others, including the most popular at present, serve only as guidelines to support the communication of progress in SD implementation, rather than as requirements for the evaluation of this implementation itself.

This is the case with the guidelines, which suggest reporting SD for HEIs based on the Global Reporting Initiative (GRI) indicators (which, while covering environmental, social, and economic aspects and being the only tool that considers economic aspects in depth, are not adapted to the reality of the operations and organizational systems of HEIs [38,39]) and the Sustainability Tracking, Assessment and Rating System (STARS) [40], currently rated as one of the most transparent, comprehensive, and detailed tools, but which does not address the question of the financial benefits of SD [41–45].

A consequence, as discussed above, of the lack of systematization in the tools used is that there is ambiguity in the resulting assessments of SD implementation, depending on the tool used, which may translate into the realization of activities aimed at both SD implementation and SD management. Furthermore, as the authors [46] rightly state, it is important not only to use tools to assess SD in HEIs, but above all to involve different stakeholders, including internal stakeholders, in the process. Such an approach, based on the participatory participation of parties involved in the implementation of SD, should not only be a requirement when assessing the level of SD implementation, but also a guarantee of the integration of sustainability into university culture [47]. This is because it leads to a higher level of SD implementation [48], but more importantly, it is crucial to the implementation of SD in the university strategic planning, management, and development process [49].

As mentioned above, the implementation of SD in HEIs is often done in a fragmented manner. The reasons for this are both the complexity of the SD requirements themselves and the complexity of the HEIs systems. Previous work on the implementation of SD in HEIs (see, e.g., [50–53]) indicates that the implementation of SD requires not only a real interest in HEIs, but also a real commitment of staff (academic and administrative), supported by knowledge of SD, concrete actions taken in this regard (more important than the simple declaration of a desire to implement SD, the definition of an SD policy or even the formulation of SD action plans), and the need to overcome resistance to necessary changes. Furthermore, as ref. [45,54] shows, the implementation of SD in HEIs must at the same time presuppose the modification of existing structures and habits, which poses many challenges in terms of real commitment, the need for changes at the level of behaviour and values, and the need to involve a variety of resources. In addition, [32] notes that it is important in SD management that a critical mass of the entities that make up the higher education institution adopt the principles of sustainability in their tasks and responsibilities. Based on the analyses indicated, it can therefore be assumed that the implementation of SD in a higher education institution should, on the one hand, obviously include all dimensions of its operation and, on the other hand, realistically involve the entities within it. According to the authors of this article, the fulfilment of these conditions is possible when focusing on those SD activities that are indicated as key by the university staff (academic and administrative) responsible for the university's activities at the operational level. Therefore, the aim of the article is to propose a tool, based on the multi-criteria ranking method, to

rank the factors-elements of SD, allowing for the management of the implementation of SD at the university at the level of faculties, as relatively autonomous wholes, based on the analysis of faculties at one of the leading technical universities in Poland. The research presented in this article is inspired by the concept of university sustainability (USus), along with the measurement scale presented in [39]. The tool presented in the article is managerial in nature and can enable university authorities to compare the implementation of SD at the faculties level as semi-autonomous units, so that it is possible to identify those areas that, on the one hand, are crucial (in the subjective opinion of faculty management and implementing activities at the operational level) for the implementation of SD at the university-wide level and allow, according to the authors, for the actual implementation of SD in the university as a whole, defined as a system consisting of administrative and academic subsystems.

2. Materials and Methods

2.1. The University Sustainability Concept (USus)

When implementing SD, universities can translate their objectives into actions in different areas: education and curricula, research, community outreach, campus operations, organizational change management, institutional framework, assessment and reporting) [16,55]. In principle, they can achieve this by focusing on one or more domains or by adopting a holistic approach [39,56,57] or a systems thinking approach [58], which are increasingly identified as essential for the ability to realistically implement sustainability goals and management in HEIs. The ever-growing interest in SD initiatives in HEIs makes it increasingly important to measure, evaluate, and report on the progress of HEIs toward SD, in addition to a holistic approach [38]. In fact, this assessment is considered one of the most important dimensions of SD implementation in HEIs. Therefore, it should be carried out with specific tools to assess whether all possible dimensions of SD implementation are being met and whether the implementation is holistic in nature [32]. Well-developed tools can be used as benchmarking practices, but, above all, they need to be able to assess sustainability in HEIs without being ranked or competed with. The development of tools for assessing SD in HEIs has been devoted to a lot of conceptual and research work (see, e.g., [7]), while noting that these tools should be useful for monitoring and supporting SD management decisions [33,59], although this usefulness has not yet been fully demonstrated [60].

One of the more recent tools that inspired this article is the university sustainability (USus) concept presented in [39] which, according to its authors, complements existing tools such as the Sustainability Tracking and Assessment Rating System (STARS) and the Global Reporting Initiative (GRI). In addition to the theoretical construct, the concept includes the validated USus measurement scale, used for the empirical verification of SD management in HEIs. USus integrates concepts related to education for sustainable development in universities (ESDU) and concepts related to corporate sustainability (CS) by considering the HEI as a system consisting of academic and administrative subsystems. Usus, therefore, includes teaching and learning, research, and outreach from ESDU, which are in the academic subsystem, and campus operations, networking, strategy-structure, and governance from CS, which comprise the administrative subsystem. In addition, both subsystems share an assessment reports component.

2.2. Ranking of Sites in the Context of Multi-Criteria Assessments

The literature on the subject provides numerous examples of the application of multi-criteria methods in the decision-making process [61–63]. A commonly used method is the ranking of sites presented by [64]. This tool has found wide application in many scientific fields, including management science. Among the advantages of the presented method, the authors point out both its simplicity and its usefulness in the decision-making process [63].

The ranking process consists of determining the objects O that are the subject of the ranking. The object of ranking in a higher education institution can be factors that affect sustainability management.

Set of objects $O = \{O_1, O_{2,\ldots,}O_r\}$, where $\boldsymbol{r}$ is the number of objects tested.

Each object under analysis is a set of diagnostic variables X that describe phenomena in the object. In the case at hand, the diagnostic variables could be the assessments of experts or university faculty managers on the impact of a factor on sustainability management at the HEIs.

Set of diagnostic variables $X = \{X_1, X_{2,\ldots,}X_s\}$, where $\boldsymbol{s}$ is the number of diagnostic variables.

The basis for developing a ranking of the factors influencing sustainability management in a university is the division of diagnostic variables X into three subsets. The first set, known as stimulants, is the set of such variables whose increase should be equated with an increase and decrease with a decrease in the evaluation of a complex phenomenon. The second set comprises destimulants, that is, such diagnostic variables whose increase should be associated with a decrease in the evaluation of the phenomenon under consideration (while a decrease should be associated with an increase in the evaluation) [65].

The last set of diagnostic variables are the nominants. These are variables that have a specific value that is the most favorable from the point of view of the evaluation of the composite phenomenon. In order to perform a multi-criteria evaluation of individual phenomena, it is necessary to transform the values of the original characteristics. This requires a normalization process consisting of transforming diagnostic variables that, when unaffected, have values of a similar order of magnitude [64].

We standardize stimulants according to Formula (1)

$$z_{ij} = \frac{x_{ij} - \min\limits_{i} x_{ij}}{\max\limits_{i} x_{ij} - \min\limits_{i} x_{ij}} \tag{1}$$

where: $i = 1, 2, 3, \ldots, r$ and $j = 1, 2, 3, \ldots, s$

$$X_j \in S$$

S—a subset of diagnostic variables called stimulants.

The stimulants are normalized using Formula (2)

$$z_{ij} = \frac{\max\limits_{i} x_{ij} - x_{ij}}{\max\limits_{i} x_{ij} - \min\limits_{i} x_{ij}} \tag{2}$$

where: $i = 1, 2, 3, \ldots, r$ and $j = 1, 2, 3, \ldots, s$

$$X_j \in D$$

D—a subset of diagnostic variables called destimulants.

The nominants are normalized according to the nature that the variables take. When a nominant takes one specific value C_{oj}, we use Formula (3)

$$\begin{cases} \frac{X_{ij} - \min\limits_{i} X_{ij}}{C_{0j} - \min\limits_{i} X_{ij}}, & where\ X_{ij} < C_{0j,} \\ 1, & where\ X_{ij} = C_{0j,} \\ \frac{X_{ij} - \max\limits_{i} X_{ij}}{C_{0j} - \max\limits_{i} X_{ij}}, & where\ X_{ij} > C_{0j,} \end{cases} \quad X_j \in N \tag{3}$$

When the nominant is a set, Formula (4) should be applied.

$$\begin{cases} \frac{X_{ij}-\min\limits_{i} X_{ij}}{C_{1j}-\min\limits_{i} X_{ij}}, & where\ X_{ij} < C_{1j}, \\ 1, & where\ C_{1j} \le X_{ij} \le C_{2j}, \quad X_j \in N \\ \frac{X_{ij}-\max\limits_{i} X_{ij}}{C_{2j}-\max\limits_{i} X_{ij}}, & where\ X_{ij} > C_{2j}, \end{cases} \tag{4}$$

The method of normalization outlined above is referred to as the null unitization method. This is because it allows for a fixed reference point to be taken, where the interval of the normalized variable is fixed at 1, while the normalizations are in the interval <0.1> [64].

The result of the normalization is the matrix shown in Table 1.

Table 1. Matrix of normalized variables.

Object *i*-th	Diagnostic Variables			
	X*i*1	**X*i*2**	...	**X*ij***
C_1	z_{11}	z_{12}	...	z_{1j}
C_2	z_{21}	z_{22}	...	z_{2j}
...	...	...	...	...
C_i	z_{i1}	z_{i2}	...	z_{ij}

Source: own study.

The development of the ranking requires the determination of aggregate (synthetic) variables based on Formula (5)

$$Q_i = \sum_{j=1}^{s} z_{ij}\ (i = 1, 2, 3 \ldots, r) \tag{5}$$

where Q_i is the synthetic variable that is a multi-criteria evaluation of the composite phenomenon characterising the *i*-th object. The higher the value of the synthetic variable Q_i, the better the ranking of the object in question.

As indicated by [64], it is also possible to group objects together in order to distinguish between the best, average, and worst objects. Formula (6) can be used for this purpose.

$$U = \frac{\max\limits_{i} Q_i - \min\limits_{i} Q_i}{3} \tag{6}$$

obtaining a subgroup of the best sites for $Q_i \in (\max\limits_{i} Q_i - U,\ \max\limits_{i} Q_i >$

a subgroup of average objects for $Q_i \in (\max\limits_{i} Q_i - 2U,\ \max\limits_{i} Q_i - U >$

a subgroup of the worst sites for $Q_i \in (\min\limits_{i} Q_i,\ \max\limits_{i} Q_i - 2U >$

2.3. Using Facility Ranking to Assess Factors Affecting Sustainable Development Management in University Faculties

This section can be divided into subheadings. It should provide a concise and precise description of the experimental results, their interpretation, and the experimental conclusions that can be drawn.

Although the object-ranking method has found wide application in various scientific fields, including organizational management sciences, the authors of the article did not find in the literature any proposals for object-ranking in decision making in higher education institutions in the field of university sustainability management. As [66] points out, methods and tools are needed to facilitate decision making in HEI, including sustainability management. It should be emphasized that in HEIs the grouping of factors influencing sustainability management into individual subgroups can provide valuable management information. This is because grouping can indicate on which factors management should

focus its efforts to manage HEI in the most effective way. What activities should be taken into further consideration next when implementing SD in HEIs and, finally, in developing the university's sustainability strategy?

The use of site ranking incorporating multi-criteria assessments, according to the authors of this article, can have a significant impact on the effectiveness of sustainability management in HEIs. It can also provide one of the essential prerequisites for sound decision making [64].

2.4. Research Methodology

Figure 2 shows the implementation process of the proposed model.

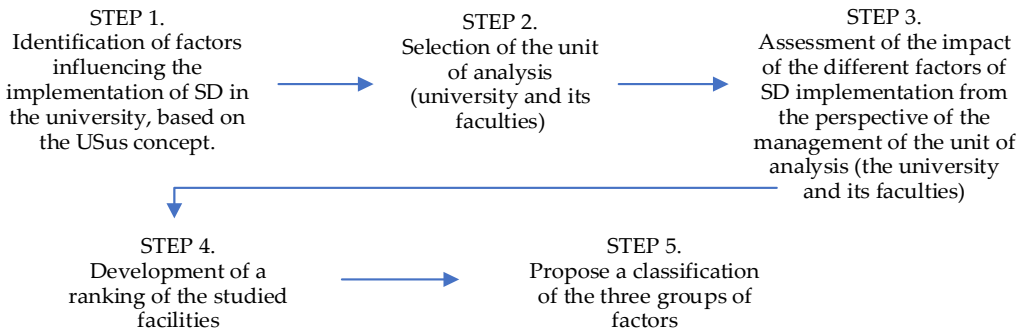

Figure 2. Proposed implementation of the proposed model. Source: own study.

The starting point of the proposed model is to identify the factors influencing the implementation of SD in HEI (Step 1). A further step is the selection of the research subject (Step 2). The subject can be the whole HEI or its departments (as in the case of the presented article). To assess the influence of individual factors on the implementation of SD at the university (Step 3), it is recommended that interview should be conducted with the university's top management or the management of the individual faculties (as in the case of the presented article). These interviews allow for the assigning of weights to the individual factors based on a 5-point Likert scale, where 1 means a very important factor and 5 means completely unimportant. The result of the interviews is the development of a ranking of the surveyed objects (Step 4) based on the procedure presented in Section 2.2 of this article and a proposal for the classification of the factors (Step 5) influencing the implementation of SD in the HEI, divided into a group of the most important, of average importance, and of no importance, from the perspective of the university management or individual departments.

As mentioned, the inspiration for the research presented in this article came from the concept of university sustainability (USus), together with the measurement scale presented in [39]. Inspired by this concept, the authors of this article decided, after necessary modifications, to use its assumptions to assess the factors influencing sustainable management within a university (Step 1). For this reason, in contrast to the original USus concept, not universities as complex wholes, but faculties as relatively autonomous systems were adopted as units of analysis. One of the leading technical universities in Poland, comprising 10 faculties, was chosen as the subject of the analysis. To do this, some modifications to the USus concept were necessary. To this end, the factors identified as a result of the thematic analysis performed by [39] condensed into a USus measurement tool were presented to a group of five experts familiar with sustainability practices at Polish universities, with a request to validate the questionnaire to determine which elements—factors of USus measurement—are administered by the faculties rather than the universities as a whole. This procedure was aimed at creating a tool, inspired by USus, which would be managerial in nature and would enable university authorities to compare faculties, as semi-autonomous units, so that it would be possible to identify those areas which, on the one hand, are crucial for the implementation of SD at faculty level, which will ultimately

translate into the implementation of SD at the level of the university as a whole. On the other hand, it may allow for an appropriate reallocation of resources (human, financial, physical, or informational) to strengthen those activities that, in the opinion of the faculty management, are key to the implementation of SD in the faculties, which will ultimately allow, according to the authors, for a more efficient and optimized implementation of SD in the university as a whole.

The subject of the analysis were 10 faculties at a university (Step 2). The above-mentioned group of experts, as a result of the validation of the original 32 factors (to assess the implementation of SD), selected, based on their expertise, 16 factors, as those administered by the departments. As a result of this validation, the following factors, assigned to the academic or administrative subsystems, were analyzed:

- C_1: In our faculty, SD is part of strategic planning (i.e., mission, vision, strategic plan, etc.)—administrative subsystem;
- C_2: In our faculty, there is an SD coordination (committee, office or person), identified in the organizational chart, that integrates all areas of the faculty—administrative subsystem;
- C_3: In the curricula of our faculty, students acquire SD skills such as systems thinking, critical thinking, teamwork, SD problem solving, future vision, self-awareness, or interdisciplinary work—academic subsystem;
- C_4: In the curricula of our faculty, students learn about topics related to SD—academic subsystem;
- C_5: Our faculty offers curricula in the field of SD—academic subsystem;
- C_6: Our faculty promotes interdisciplinary research projects that contribute to SD—academic subsystem;
- C_7: Our faculty provides services to communities to improve their quality of life—academic subsystem;
- C_8: Our faculty provides external consultancy on SD—academic subsystem;
- C_9: Our faculty participates in the development of public policies at the local, regional, national or international level—academic subsystem;
- C_{10}: Our faculty communicates adopted SD practices to the community (e.g., through website, campaigns, posters, etc.)—academic subsystem;
- C_{11}: Our faculty has advisory and intervention mechanisms in cases of ethical problems and corruption administrative subsystem;
- C_{12}: Our faculty participates in SD networks—administrative subsystem;
- C_{13}: Our faculty has interinstitutional agreements to develop cooperation in the field of SD—administrative subsystem;
- C_{14}: Information about our faculty is openly available—administrative subsystem;
- C_{15}: There is trust in decision-making bodies such as the Faculty Council —administrative subsystem;
- C_{16}: The institution's values, principles, standards, and norms of conduct are clearly stated in our faculty's bylaws—administrative subsystem.

The 10 structured interviews conducted by the authors of this article then asked the management of each faculty to assign (based on a 5-point Likert scale, where 1 meant very important and 5 completely unimportant) weights to all of the above-mentioned factors (Step 3). The results of this survey are presented in the Section 3.

3. Results and Discussion

Table 2 presents numerical information on the values of the diagnostic characteristics defined on a scale of 1 to 5, obtained from a structured interview with the management of each of the ten faculties of the university. The variables shown W1–W10 are the destimulants $\{W1, \ldots, W10\} \in D$. The recognition of variables influences the way they are normalized. Completion of the process of normalising the diagnostic characteristics enables us to proceed to the aggregation stage. This results in aggregate variables characterising each of the 16 factors.

Table 2. Numerical values of diagnostic characteristics.

	Diagnostic Variables									
Factor	**W1**	**W2**	**W3**	**W4**	**W5**	**W6**	**W7**	**W8**	**W9**	**W10**
C_1	2	3	2	2	2	1	1	2	5	4
C_2	4	3	3	2	3	2	2	2	2	4
C_3	3	2	3	2	2	3	2	3	3	3
C_4	2	2	2	1	2	2	3	5	3	3
C_5	1	3	3	2	3	4	2	3	3	1
C_6	3	2	2	2	2	3	4	4	2	2
C_7	4	4	3	4	3	2	5	3	3	2
C_8	5	4	5	2	1	1	2	2	4	3
C_9	4	2	3	2	1	2	2	3	2	1
C_{10}	3	1	2	3	2	1	1	2	1	2
C_{11}	3	3	4	4	3	2	3	2	4	3
C_{12}	4	4	3	1	2	3	2	4	5	6
C_{13}	2	2	3	2	1	2	1	2	4	3
C_{14}	5	1	2	3	2	1	3	2	3	3
C_{15}	1	1	2	2	4	2	2	2	2	3
C_{16}	2	2	1	1	2	2	1	1	2	2

Source: own study.

Next step (Step 4) was developing a ranking of the tested objects according to Section 2.2. The results of the normalization of the diagnostic characteristics and the values of the aggregate variables (synthetic) Q are presented in Table 3.

Table 3. Normalized values of the diagnostic variables and values of the synthetic variable.

Factor	Z_{i1}	Z_{i2}	Z_{i3}	Z_{i4}	Z_{i5}	Z_{i6}	Z_{i7}	Z_{i8}	Z_{i9}	Z_{i10}	**Q**
C_1	0.67	0.33	0.75	0.67	0.67	1.00	1.00	0.67	0.00	0.40	6.16
C_2	0.00	0.33	0.50	0.67	0.33	0.67	0.75	0.67	0.75	0.40	5.07
C_3	0.33	0.67	0.50	0.67	0.67	0.33	0.75	0.33	0.50	0.60	5.35
C_4	0.67	0.67	0.75	1.00	0.67	0.67	0.50	−0.33	0.50	0.60	5.7
C_5	1.00	0.33	0.50	0.67	0.33	0.00	0.75	0.33	0.50	1.00	5.41
C_6	0.33	0.67	0.75	0.67	0.67	0.33	0.25	0.00	0.75	0.80	5.22
C_7	0.00	0.00	0.50	0.00	0.33	0.67	0.00	0.33	0.50	0.80	3.13
C_8	−0.33	0.00	0.00	0.67	1.00	1.00	0.75	0.67	0.25	0.60	4.61
C_9	0.00	0.67	0.50	0.67	1.00	0.67	0.75	0.33	0.75	1.00	6.34
C_{10}	0.33	1.00	0.75	0.33	0.67	1.00	1.00	0.67	1.00	0.80	7.55
C_{11}	0.33	0.33	0.25	0.00	0.33	0.67	0.50	0.67	0.25	0.60	3.93
C_{12}	0.00	0.00	0.50	1.00	0.67	0.33	0.75	0.00	0.00	0.00	3.25
C_{13}	0.67	0.67	0.50	0.67	1.00	0.67	1.00	0.67	0.25	0.60	6.7
C_{14}	−0.33	1.00	0.75	0.33	0.67	1.00	0.50	0.67	0.50	0.60	5.69
C_{15}	1.00	1.00	0.75	0.67	0.00	0.67	0.75	0.67	0.75	0.60	6.86
C_{16}	0.67	0.67	1.00	1.00	0.67	0.67	1.00	1.00	0.75	0.80	8.23

Source: own study.

On the basis of the obtained results of the multicriteria evaluation, a ranking of factors influencing the implementation of sustainable management of the university was drawn up. As a result of this ranking key factors (step 5 of the proposed model), factors of average importance and irrelevant factors were identified. A list of these factors is presented below.

Key factors:

- C_{10}: Our faculty communicates adopted SD practices to the community (e.g., through website, campaigns, posters, etc.)—academic subsystem;
- C_{13}: Our faculty has inter-institutional agreements to foster collaboration on SD—administrative subsystem;
- C_{15}: There is trust in the decision-making bodies of our university, such as the Faculty Council—administrative subsystem;

- C_{16}: The values, principles, standards, and norms of conduct of the institution are clearly stated in our faculty's bylaws—administrative subsystem.

Factors of average importance:

- C_1: In our faculty, SD is part of strategic planning (i.e., mission, vision, strategic plan, etc.)—administrative subsystem;
- C_2: There is SD coordination (committee, office, or person) in our faculty, identified in the organizational chart, which integrates all areas of the faculty—administrative subsystem;
- C_3: In the curricula of our faculty, students acquire SD skills such as systems thinking, critical thinking, teamwork, SD problem solving, future vision, self-awareness, or interdisciplinary work—academic subsystem;
- C_4: In the curricula of our faculty, students are introduced to topics related to SD—academic subsystem;
- C_5: Our faculty offers curricula in the field of SD—academic subsystem;
- C_6: Our faculty promotes interdisciplinary research projects that contribute to SD—academic subsystem;
- C_9: Our department participates in the development of public policies at local, regional, national or international levels—academic subsystem;
- C_{14}: Information about our faculty is openly available—administrative subsystem.

Factors not relevant:

- C_7: Our faculty provides services to communities to improve their quality of life—academic subsystem;
- C_8: Our faculty provides external consultancy on SD—academic subsystem;
- C_{11}: Our faculty has mechanisms to advise and intervene in cases of ethical problems and corruption—administrative subsystem;
- C_{12}: Our faculty participates in SD networks—administrative subsystem.

The above classification of factors should be taken into account in both the implementation and management of SD at a university.

The aim of this article was to present a tool, based on the multi-criteria ranking method, for assessing factors influencing the implementation of SD within a higher education institution at the level of faculties, as relatively autonomous wholes, based on an analysis of the faculties at one of Poland's leading technical universities.

As a result of the study, three groups of factors influencing the assessment of sustainable management at a university were identified. The first group of factors—the most important (C_{10}, C_{13}, C_{15} and C_{16})—should be of particular interest to the university management in the process of continuous improvement and the intensification of work on SD implementation at the university. The factors identified relate, on the one hand, to the implementation of SD in strategic terms, including the existence of internal regulations in the form of institutionalized standards, norms, and operating principles and cooperation with stakeholders in the form of external institutions. On the other hand, the identified factors refer to such important elements for SD implementation as communication, norms and values, trust and standards of action. Therefore, this points to the need for a holistic implementation of SD in the faculties analyzed, as already pointed out by [39], as well as the need to implement SD across the academic and administrative subsystem divide. This may be due to the fact that Polish HEIs (and perhaps HEIs in general) are currently facing major changes caused by economic, political, and sociological factors. The current high competition on the market of educational services and the greater awareness and expectations of stakeholders in terms of the university's actions and decisions taking care of the ethical principles of responsibility towards the social environment, natural environment, or employees imply the necessity of assessing the factors influencing implementation of SD at the university. Polish HEIs, wishing to be competitive on the European and global markets, are forced to improve the way they function so far. The ability to quickly adapt to new environmental conditions and awareness of continuous change requires the management

to have a good knowledge of the phenomena and processes occurring in the organization. It seems important to use a managerial approach to management and, in particular, to apply such methods and tools supporting the implementation of SD of HEIs, which will consequently improve the current position of the HEI on the market.

Factors belonging to both subsystems, academic (C_7, C_8) and administrative (C_{11}, C_{12}), were also among the least important determinants of SD implementation. However, these factors should not be considered completely insignificant for SD implementation. According to the respondents, they are less important, which, based on the description of these factors, can be considered secondary to the most important factors.

Although the object ranking method has found wide application in various fields of science, including organizational management sciences [41,42], in the opinion of the authors of this article there is no proposal of object ranking in the decision-making process in higher education institutions. The necessity of taking immediate corrective measures and the search for effective tools facilitating the decision-making process seems fair and even necessary [44,45]. Therefore, this article presents a tool that attempts to address the challenges of implementing SD in HEIs from the perspective of its faculties, as relatively autonomous units. Their attempts to implement SD, both in relation to the academic subsystem (corresponding to education for sustainable development in HEIs-ESDU) and the administrative subsystem (corresponding to corporate sustainability—CS) translate (although only to a certain extent, related to the relative autonomy of the faculties) to the level of SD implementation in the HEI as a whole. However, the authors of this article are aware that certain aspects or practices of SD implementation may have been overlooked. Therefore, this tool is not a definitive tool, but an attempt to integrate the two subsystems. Indeed, existing frameworks and theoretical approaches in the literature often refer to one of the two, and by far more often issues related to SD implementation are addressed within the academic subsystem, which includes issues related to education, study programmes, or campus operations. On the other hand, issues related to the administrative subsystem, referring to issues of organizational management in the broadest sense, are less frequently addressed. Thus, according to the authors, this tool provides an opportunity to take a more holistic view of SD implementation, if only by prioritising factors. It also provides the opportunity to look holistically at the university as a complex system, which goes further than having a statement, commitment, or even a policy to run the university with environmental considerations.

4. Conclusions

This paper aimed to propose a tool, based on the multi-criteria ranking method, for ranking the factors-elements of SD, allowing the management of SD implementation in a university at the level of departments, as relatively autonomous wholes, based on an analysis of the departments at one of the leading technical universities in Poland. According to the authors, this tool can be a valuable source of information for university management. This is because it indicates which factors influencing the implementation of SD should focus their efforts on first, taking into account their own preferences and/or those of experts. It makes it possible to identify groups of factors with different degrees of importance from the point of view of the evaluators. It also provides information on what actions should be taken first to improve the implementation of SD at the university.

Grouping the factors that influence the implementation of SD into individual subgroups can provide valuable management information. This is because grouping can indicate which factors management should focus on in order to manage the university more effectively. The measures should be taken for further analysis in the development of the university's sustainability strategy. The use of a facility ranking that considers multi-criteria assessments, as already mentioned, can have a significant impact not only on the implementation of SD, but also on the effectiveness of sustainability management at HEIs. It can also provide one of the essential prerequisites for sound decision making.

The authors of this article are also aware of the weaknesses of the proposed tool. This is because the development of the ranking requires the identification of factors influencing the implementation of SD in HEIs, which can be time consuming, and the familiarity of HEI managers with the procedure for developing a ranking of facilities. It also requires skills related to the development of a mathematical model.

Implementing sustainability strategy measures in a university can be a costly process. Therefore, it is necessary to analyze the costs of implemented changes based on the activity-based costing method (activity-based costing) Although the presented instrument was made using the international and proven standards on which the USus concept that inspired this article is based, it could be improved by involving more universities to verify the results. Nevertheless, this tool could help to understand the priorities in the implementation of an SD in HEIs. A further direction of research will be the expansion of the proposed model with other tools and ranking methods, and to analyze and optimize the available resources of the university, which will be a further step in the ongoing research on sustainability management at the university. A desirable direction would be an attempt to combine the proposed tool with optimization tools, in particular with liner programming and goal programming.

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