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On the need to adjust indicators in rankings examining the implementation of sustainability concepts at Universities

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Abstract

The purpose of this article is to propose additional criteria in popular UI GreenMetric ranking, which examines a university's commitment to sustainability issues. These criteria relate to knowledge of basic concepts related to the circular economy. Sustainable development (SD) and circular economy (CE) are increasingly influencing social, economic and political life in many countries, including Poland. Many SD measures are introduced top-down, through regulations. Grassroots initiatives are also very important, including those based on popularizing the idea of CE, including through rankings. Currently, however, the rankings mainly count the initiatives undertaken by university authorities, student involvement is not very important. The publication analyzes selected secondary and own research in the field of CE knowledge and recognizes the research gap of lack of systematic analysis in this area. An opportunity for improvement in this area may be to supplement the ranking with verification of basic concepts related to SD and CE. Basic information on the Sustainable Development Goals, as well as education for SD was presented based on current literature. Then the results of a survey on knowledge and attitudes about CE were presented. Additional criteria in the existing ranking, related to the dissemination of knowledge about SD and CE, were proposed. The analysis concluded that education about CE should take place at the university level in all fields of study, not only those related to natural sciences or economics. It is also important to involve the student community in popularizing these concepts.

Keywords: circular economy, sustainable development, education, carbon footprint, water footprint

JEL classification: B55, Q50

1. Introduction

The concept of sustainable development has been of interest to scientists and politicians for several decades. The culmination of this interest took place at the 2015 UN Summit, which adopted the 2030 Agenda for Sustainable Development. The World Commission on

Environment and Development defined it as development that meets the needs of the present without compromising the ability of future generations to meet their needs. At that time, leaders of UN member countries, signing the document "Transforming Our World: The 2020 Agenda for Sustainable Development" made an ambitious commitment to take action to reduce poverty in all its forms, ensure access to education, to food and clean water, take action for equal opportunities, promote human rights, peace and stability in the world, protect the environment, mitigate climate change, access to sustainable energy sources. The document contains 17 Sustainable Development Goals (SDGs) and associated 169 actions to be achieved by all parties - national governments, international organizations, NGOs, the scientific and business sectors, and citizens. They are centered around 5 areas: people, planet, prosperity, peace, partnership (United Nations, 2015). In recent years, the goals have become more recognized, and include improving education, counting on the support of higher education institutions that have the capacity to engage in SD and promote the achievement of the goals (Chankseliani, McCowan, 2021).

Against the backdrop of previous approaches to the concept, the understanding of SD enshrined in the Agenda strongly emphasizes the social dimension. The concept of sustainable development itself is ambiguous, as reflected in the publication, which brings together more than 100 definitions to capture the different contexts (Eizaguirre, García-Feijoo, Laka, 2019).

One of the key vehicles in spreading sustainability is education. Avila-Gutierrez stresses that economic practices should be shaped in such a way that they not only take into account environmental and social aspects, but also emphasize the perspective of future generations, which is also reflected in education (Ávila-Gutiérrez et al., 2020). For now, however, the aspect of future generations in the context of sustainable generational development is not emphasized enough (Korhonen et al. 2018). An important element and factor responsible for the success of sustainable development is the circular economy (CE), while with this concept the emphasis on the social factor is also not emphasized enough. This problem is pointed out by some researchers of the issue. Julian Kirchherr, Denise Reike and Marko Hekkert, who analyzed more than 100 definitions of CE, found a small share of terms referring to broad social issues (Kirchherr et al. 2017). Meanwhile, the social aspect, including education, is crucial. The main problem with the modern economic model is the pattern that is still in place, in which resources are turned into products, and the latter into waste, products too quickly "stop", do not get recirculated (Hobson, Lynch, 2016). In this situation, the role of schooling and education to change this perception is very important. The link between education and perceptions of environmental issues was demonstrated more than two decades ago (Bradley et al. 1999). Slightly earlier, the concept of a sustainable university emerged (Velazquez et al. 2005). Interest in the concept of education for sustainable development and higher education for sustainable development (ESD, HESD) also dates back more than three decades. However, it was verbalized during the UN Conference on the Environment held in Rio de Janeiro in 1992 (UNCED, 1992). At the time, it was emphasized that education was an important factor in achieving SD. Today, the understanding of ESD is much broader and includes issues such as environmental education, political education, development education, global education, peace education, intercultural education, as well as health education.

With regard to ESD, the HESD concept is expanded to include scientific issues, it is primarily a new area of research. Hallinger and Chatpinyakoop analyzed 1,459 documents indexed in the Scopus database related to higher education for sustainable development

between 1998 and 2018 (Hallinger P, Chatpinyakoop, 2019). Education will play a key role in global efforts to achieve the UN Sustainable Development Goals, according to their analysis. The authors also observed an emerging interdisciplinary field of study that could influence policy and practice in the coming years. This interdisciplinarity is also expressed through the umbrella concept proposed by some researchers, that is, encompassing a variety of disciplines and fields (Klein et al., 2003; Blomsma, Brennan, 2017). As far as ESD and HESD are concerned, an important demand is to modify the prevailing economic paradigm. As a result of the growing popularity of the concept of sustainable development, alternative positions are emerging that propose a radical departure from the pro-growth concept (Kopnina, 2020).

Both terms, ESD and HESD, emerged after the Rio conference as an alternative to the phrase "environmental education" (i.e. education for, about and with the environment). The adoption of these terms into scientific and economic circulation is one of the results of the changes in thinking catalyzed by the report Changes in thinking catalyzed by the UN report. ESD can be defined as an educational process characterized by approaches and methods aimed at developing awareness of sustainability issues (e.g., social, political, economic and environmental issues). This differs from previous approaches that emphasized environmental issues. In the aforementioned article, Hallinger and Chatpinyakoop pointed out that HESD is mainly prevalent in countries around Western Europe and English-speaking countries. This has been confirmed in other studies (Hallinger, Kovačević, 2018).

This is a challenge for the countries of Central and Eastern Europe, which are in the EU, but on the other hand are just catching up with "old" Europe. These countries include Poland. The key here is the role of higher education, which will shape cadres for the economy. In the context of adapting the principles of sustainable development to economic life, the concept of HESD seems important, because of the influence of university graduates on the shape of future economic models. Changing the education model in this regard is a major challenge. Education should not be neutral to the field of SD. The key, therefore, is a shift toward fostering strategic thinking is considered the most critical strategy for mobilizing the capacity to change development trends away from business-as-usual scenarios (Kopnina, 2015). Helen Kopnina believes that environmental education must strive to actively provide solutions that include, among other things, a steady-state economy. However, there is still a problem in this area, decisive changes have not been brought about by the UN Decade of Education for Sustainable Development (DESD), which covered the period 2005-2014 (Huckle, Wals, 2015).

Recent years have not brought important changes in this area. As early as 2010, the results of a study on the barriers that may limit the activity of higher education institutions in this area were published. It was pointed out, among other things, that admittedly some of these barriers are diminishing, such as the abstract nature of sustainability being translated into more concrete benefits and solutions. At the same time, however, it was concluded that there are still other problems, such as the varying levels of consideration of global climate change issues in the academic programs of universities (Filho, 2010). Admittedly, contemporary studies indicate some positive developments, showing that higher education institutions are making a valuable contribution to the UN Sustainable Development Goals. Still, experts believe that more attention needs to be paid to the need to revise curricula and research programs. First and foremost, the Sustainable Development Goals should be taken into account. In addition, the study found that

students do not seem to be proactive in demanding more teaching content and research opportunities related to the Sustainable Development Goals (Filho et al., 2023).
A final important issue worth mentioning is that for SD and CE there are no universal indicators with which to measure progress and implementation. It is worth noting that GOZ indicators have been an extremely intensively studied issue for at least several years, as manifested in numerous publications on the subject (Saidani, 2019; Helander, Petit-Boix, Leipold, Bringezu, 2019; Elia, Gnoni, Tornese, 2017; Di Maio, Rem, 2015; Haupt, Moriguchi, 2007; Korhonen, 2004).
The described difficulties in the implementation of SD principles, including in education, are universal, specific to Poland as well. Among the growing number of publications in this area, one can find similar statements related to the too slow pace of dissemination of SD principles (Buchcic, 2016, Batorczak, Klimska, 2020). An additional problem that can be observed in Poland is the small number of surveys of knowledge and attitudes about SD and CE, both among students and the general population. An additional shortcoming is the issue of regular monitoring of indicators. There are several ways to measure SD in the research circuit. One of them is the HDI (Human Development Index). Another indicator is the Ecological Footprint, an aggregate measure of the cumulative amount of demand for land and water due to human activity. The most common way to describe and measure progress toward the Sustainable Development Goals is to use a set of statistical indicators. The website of the Central Statistical Office includes indicators that monitor the Agenda 2030 Sustainable Development Goals. In the case of Agenda 2030, the indicators are grouped by Sustainable Development Goals. However, the issue of education itself is addressed relatively rarely in the context of indicators. Meanwhile, since SD knowledge supports students in developing key competencies such as systems thinking and integrated problem solving to address these challenges, this area is worth monitoring.
One challenge that is important in the context of SD education is the development of internationally comparable indicators (Veidemane, 2022). It should be noted that there are many attempts being made in this direction. An increasingly popular indicator is the UI GreenMetric World University Rankings, which since 2010 has been examining universities' commitment to environmental issues (among them are infrastructure, climate and environmental concerns, transportation, water and electricity consumption or waste management). Also important to the organizer is the wealth of educational offerings and research activities undertaken in the area of environmental protection in the broadest sense. The methodology of the ranking is based on a set of simple and easy to collect criteria for each university, which are related to the key aspects of sustainable development used to implement the ranking. There are six criteria - setting and infrastructure (SI), energy and climate change (EC), waste (WS), water (WR), transportation (TR) and education (ED) - and 39 indicators are linked to the criteria. GreenMetric functions as a guide that encourages universities to integrate sustainability into their practices; since its categories are developed in accordance with the Sustainable Development Goals (UI GreenMetric). It is worth looking at this indicator, which is an interesting measurement tool, although the procedure involved has some imperfections. It will be proposed to supplement it in the context of Polish universities.

2. Material and methods

The research gap in education measurement (ESD, HESD) is worth defining and thinking about what solutions can be implemented. In Poland, ESD is implemented more at the level of primary and secondary schools, the concept of SD and some of its assumptions are included in the curriculum content, but this can be considered more like environmental education. Higher education institutions introduce elements of HESD, but do not do so systematically.

All the more reason to appreciate such a ranking as is GreenMetric's UI. The criteria are based on the following principles. The ranking of participating universities is based on their self-assessment against 39 indicators divided into 6 categories:

- setting and infrastructure (e.g., the percentage of the campus devoted to green space, the size of the budget for sustainability measures, adaptation of the campus to the needs of people with disabilities and mothers with children),
- energy and climate change (e.g., carbon footprint, renewable energy sources, devices to reduce energy consumption, university programs for climate change),
- waste (e.g., recycling programs, how organic, inorganic and toxic waste is managed, and wastewater management),
- water (e.g., water conservation programs, water recycling programs, use of devices that reduce water intake),
- transportation (e.g., percentage of parking areas in relation to campus area, transportation services offered by the university, programs for green transportation)
- education (e.g., research for sustainability, events promoting sustainability, number of student organizations for sustainability).

For each of the indicators, the self-assessment must be documented, such as in the form of photos, videos or calculations made based on the indicated formulas.

This ranking, while valuable because it promotes SD principles, has some shortcomings, especially in terms of verifying basic knowledge among students. Therefore, one more area will be proposed, in terms of knowledge of basic terms: circular economy, water footprint, carbon footprint and product life cycle. They will be briefly clarified.

Circular economy

A number of definitions have emerged to describe CE, often differing significantly from one another. It is worth citing the universal understanding described by the Ellen MacArthur Foundation, according to which it is the consideration, as early as the design stage, of repair and remanufacturing and maintaining at all times the highest utility and value of products, components and materials, separating technical and biological cycles (Ellen MacArthur Foundation, 2015). This definition is representative of the CE discussion, as it focuses on the technical and economic aspects.

Carbon footprint

The concept of carbon footprint has become so popular that one can observe the spread of the term beyond professionals. Carbon footprint (CF) is defined as the total number of greenhouse gases emitted at each stage of production and transportation of a product, expressed in units of carbon dioxide [Minx et al., 2009). The concept of CF appears most often in the climate discussion along with the thread of indicators. In order to induce the

smallest possible carbon footprint, it is advisable to carry out correct measurement, as well as recording of greenhouse gases by companies and other entities.

Water footprint

Water footprint (WF) is related to the determination of indirect and direct water consumption. Initially, the term water footprint referred to the water used to produce and deliver products. At the beginning of the 21st century, Arjen Hoekstra coined the term water footprint understood as the overall consumption of freshwater resources in volumetric terms (expressed, for example, in m3 for a given product per year). In addition to a product, WF can also refer to a process, a company, a region and a country (Hoekstra, Hung, 2002).

Product life cycle

The product life cycle is most often understood as a succession of interrelated stages, beginning with the research and development phase, through the acquisition and processing of raw materials needed to produce a particular product or service, the manufacturing phase of the product or service, the distribution and use of the product, and finally the management and final disposal of end-of-life waste (the cycle can apply to a product or service). The concept was described as early as the 1960s (Levitt 1965). This concept, analyzed at various levels, remains one of the main reference points in the context of economic research. Particularly relevant is the context of environmental analysis of the product life cycle, which includes the effects of human-induced environmental stresses affecting nature. This, in turn, is related to the previously cited concepts of carbon footprint and water footprint.

Extended Producer Responsibility

The main idea behind Extended Producer Responsibility (ERP) is to make the manufacturer responsible for the product until the end of the cycle. ROP was first defined in 1990 by Thomas Lindquist (Lindhqvist, Lidgren, 1990). In 1994, the OECD's Pollution Prevention and Control Group began its work, and just a year later, at the Waste Minimization Workshop in Washington, DC, it made public an interim report. It presented the key tenets of the strategy in the area of waste reduction. In the course of further work, the key elements of the ROP were developed, which can be summarized around the following assumptions: minimizing the amount of waste generated in connection with economic activity, realizing the established levels of recovery and recycling, causing a reduction in the demand for primary raw materials and energy, realized through the recovery of recyclable materials from waste, encouraging the creation of legislative instruments to motivate producers to take measures to prevent waste (Extended Producer Responsibility, 2001).

The example of Poland (research) shows that knowledge of these areas is unsatisfactory. Meanwhile, in order to distinguish universities in the field of SD, it is worth ensuring that members of the student community have a basic knowledge of the subject. The cited surveys, although not systematic, provide some insight into this situation in Poland. In this situation, universities could make greater efforts to expand this knowledge.

The studies described below are not the only ones in this area in Poland. However, it is important to emphasize the research gap. Some of the studies cited are causal in nature, and one should be treated as a pilot study. Studies 2-4 concern residents of the Małopolska province. However, they may be interesting material for reflection on HESD.

2.1 Survey 1

According to the 2017 survey "The state of knowledge of Poles about the circular economy". The survey was conducted on 04-05.07.2017 by SW RESEARCH agency using the method of online interviews (CAWI) on a representative sample of 1004 Poles over the age of 16. The survey was conducted on behalf of Stena Recycling. The survey indicated to what extent Poles' pro-environmental attitudes translate into their awareness of implementing circular economy principles in Poland. Nearly three out of four respondents have not encountered the term GOZ at all - 41% have never heard of it, and as many as 30% do not know if they know it. Among Poles who have heard of GOZ (29%), most associate the term mainly with environmental issues: the possibility of reducing landfills and waste (57%) and improving the environment in general (49%). The fewest respondents mentioned GOZ in the context of new EU regulations (24%), green product design (28%) and CSR (29%) (The Responsible Business Forum, 2017).

2.2 Survey 2

The research was conducted in March-June 2017. The survey group was adult residents of Małopolska province. The research was conducted through a traditional and online survey questionnaire. A total of 430 residents of Malopolska province participated in the survey. In this survey, knowledge of what GOZ is was declared by 55.3 percent of respondents (Nowaczek et al., 2017).

2.3 Survey 3

Another survey was conducted in 2019. 282 residents of Malopolska took part in the survey. The survey was conducted by means of a traditional questionnaire The first three questions concerned the respondents' knowledge of the basic concepts related to GOZ: water footprint, carbon footprint and product life cycle. 83% of respondents declare knowledge of the term product life cycle. Knowledge of the term carbon footprint is declared by 41% of survey participants, and water footprint by 26% (Sabal, Iwaszczuk, 2021).

2.4 Survey 4

The survey was conducted in December 2021-January 2022 and had a pilot nature. It was carried out by the author, based on an online survey. It was participated by students, adult residents of Malopolska province, the sample was 95 people. The first three questions asked respondents about their knowledge of basic terms related to GOZ: water footprint, carbon footprint and product life cycle. The term product life cycle is known to 83.2 percent of respondents. The term carbon footprint is known to 80 percent of respondents. Knowledge of the term water footprint is declared by 64.9 percent of respondents. Familiarity with the term ERP was also asked. Only 35 percent of respondents declared familiarity with the term.

Survey 4 was conducted among the student community. The others were completed by adults over the age of 18. Due to the heterogeneous nature and the relatively small sample, no firm conclusions can be drawn. However, the cited data show a trend. Indeed, the surveys show that knowledge of basic concepts is relatively low, but slightly higher among the student community. It should be emphasized once again that the research is causal in nature and there is a research gap in this area. All the more justification, however, for the claim that the ideas of SD and CE should be promoted among the academic community, and at the same time this area should be researched. A good opportunity to do so is through rankings, including the cited UI GreenMetric.

3. Discussion

The organizer of the UI GreenMetric ranking (Universitas Indonesia) emphasizes that in developing the methodology it relied on a broad philosophy that includes the pillars of sustainability: Environmental, Social and Economic. Criteria include issues related to the university's campus (including the size of green spaces), electricity consumption due to its relationship to carbon footprint, water consumption, waste management, environment and infrastructure, and education and research. In addition, how the university responds to or deals with sustainability issues through policies, actions and communications is evaluated. The scores for each category are numerical, and the data is processed statistically, based on a scale indicated by the organizer. The authors themselves indicate that they are constantly revising the criteria and weights to reflect the contributions of the participants and the current state of knowledge in the field. They declare their willingness to listen to suggestions.

As mentioned, the ranking itself is a very valuable initiative, with interest in the initiative growing every year, with more and more universities applying. Nevertheless, some modifications that took into account students' knowledge in this area would be beneficial. They are presented in Table 1.

Table 1: Proposal to complete the ranking GreenMetric UI Category indicators

GreenMetric UI Category	Selected indicators from the category	Proposal to supplement the indicator	Justification
Settings and infrastructure	Scale of SD budget, percentage of campus devoted to green areas	Introduction of the 5 concepts into the subject program	Knowledge on this topic introduced in various subjects will contribute to greater awareness of
Energy and climate change	Carbon footprint, renewable energy sources, devices that reduce energy consumption	Promotion of the term CF and product life cycle	Reporting information on carbon footprint, without a broader context, concerns only university

			authorities, meanwhile it is crucial to involve the student community
Waste	Waste management method, recycling programs	Dissemination of knowledge of the term EPR	Students, as the future workforce of the economy, should be aware that in addition to recycling, reducing production counts, which facilitates EPR
Water	Water recycling programs, measures to reduce water intake	Promotion of the term WF	Spreading the term WF can lead not only to a reduction in water intake at the university, but also in other places where students will be working
Transportation	Transportation services offered by the university, green transportation, parking area	Dissemination of knowledge on the relationship between transportation and CF	A key competency is to understand why a change in transportation style contributes to reducing the carbon footprint, from the production process to the end of the vehicle's life
Education and research	Research for SD, promotion of SD, student organizations for SD	Revised knowledge of the terms CE, WF, CF, product life cycle, EPR	The need for testing would motivate university authorities to promote these terms

Source: own elaboration based on https://greenmetric.ui.ac.id/about/methodology

When it comes to supplementing the curriculum, an important problem arises, namely the lack of placement of SD and CE on the map of scientific fields and disciplines. The discussion of education for sustainable development has been accompanied by the development of many scientific disciplines, such as biology, physics, management science, economics, and at the same time several disciplines have emerged as a result of the interaction of these areas, such as eco-design and environmental economics. All of these areas can be subsumed into SD, but that doesn't solve the problem. It seems that SD or CE cannot be treated as a discipline with a specific paradigm, in the sense proposed by Thomas Kuhn (Kuhn, 1962). This means that the basic concepts of SD and CE need to be disseminated in different contexts, courses and subjects. This is especially important, among other things, because the ranking is intended for all universities, that is, not just those specializing in the sciences or economics. Therefore, it is necessary to treat these concepts universally, since they touch virtually all fields and disciplines present at universities.

4. Conclusions

Universities from all over the world are currently participating in the described ranking, as the organizers do not foresee restrictions in this area. This is certainly a great advantage of this initiative. The concepts of SD and CE should be promoted in all countries, but it should be noted that the degree of implementation depends on the political and economic situation of the country. Involvement in such rankings is a great opportunity for countries that are undergoing a rapid path of economic development. Such an example is Poland, which began its capitalist transformation just over 3 decades ago. University involvement in rankings related to the dissemination of SD principles is a good opportunity to increase knowledge of the subject among students, who will shape the economic development of countries.

Implementation of SD principles is largely top-down, through centrally introduced laws and regulations. This is very important, as it sets the framework for administration, local governments or entrepreneurs. In the case of Poland, as in other EU countries, certain trends are outlined by the community. However, grassroots involvement, which is possible through universities, is also very important. As mentioned, there is relatively authoritative research on knowledge and attitudes in Poland. The research presented here shows some trends indicating insufficient knowledge in the area of basic concepts in SD and CE. Participation in the rankings is a good opportunity to engage university authorities and students in the process of implementing key SD principles.

Another problem evident in Poland is the research gap when it comes to knowledge in this area. On the one hand, there is an increasing number of scientific publications on SD and CE, on the other hand, the number of quantitative and qualitative studies is insufficient. In this case, too, participation in the rankings, but also the discussion of the topic itself, can be beneficial to the academic community.

The knowledge economy should touch areas such as SD and CE. As it is still difficult to classify them into specific disciplines, it seems optimal at the university level to supplement programs with small slices of this knowledge. Motivating universities to such solutions, which is done voluntarily (this is how the rankings are mostly structured), can bring satisfactory solutions. The implementation of the indicators themselves is currently based on the efforts of university authorities, with limited involvement of students. The

proposed adjustment could have a positive effect in terms of greater involvement of the "agents" of SD and CE, which are students.

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