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PROBLEMY EKOROZWOJU – PROBLEMS OF SUSTAINABLE DEVELOPMENT
SUBMITTED: 28.IX.23, ACCEPTED: 22.X.23, PUBLISHED ON-LINE: 8.01.24
2024, 19(1): 261-274
https://doi.org.10.35784/preko.5384

Measuring the Impact of Higher Education in Promoting Sustainable Development Goals: Analysis of the Arab Universities' Performance

Badanie wpływu szkolnictwa wyższego na promowanie Celów zrównoważonego rozwoju: analiza wyników z arabskich uniwersytetów

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Abstract
Sustainability's global importance has amplified the role of universities in achieving the UN Sustainable Development Goals (SDGs) through research, education, and community engagement. This study aims to provide valuable insights into the role of Arab universities in promoting sustainability within the context of global higher education. This study analyzes the performance of 200 universities from 15 Arab countries in the THE IMPACT Rankings. Their performance was compared to 135 universities from three of the leading world-class higher education systems: Canada, UK, and USA. Results: A global demand for sustainable development, Arab universities face challenges in improving their contributions to the SDGs and sustainability rankings. Despite the impressive growth in the participation of Arab universities in THE IMPACT Rankings yet lags in quality and impact of Arab universities contributions towards SDGs. The policy implications underscore the importance of institutional commitment to sustainability in Arab universities, urging the alignment of policies, funding, and curriculum with the United Nations Sustainable Development Goals (SDGs). Arab universities need to bridge performance gaps, promote green initiatives, and contribute effectively to the achievement of SDGs while recognizing the diverse socio-economic context and priorities of the Arab region.

Key words: higher education, sustainability, Sustainable development goals, SDGs, Arab universities

Streszczenie
Globalne znaczenie zrównoważonego rozwoju wzmocniło rolę uniwersytetów w osiąganiu jego celów poprzez badania, edukację i zaangażowanie społeczne. Niniejsze badanie ma na celu zbadanie roli arabskich uniwersytetów w promowaniu zrównoważonego rozwoju w kontekście światowego szkolnictwa wyższego. W badaniu tym analizowano wyniki 200 uniwersytetów z 15 krajów arabskich w rankingach THE IMPACT. Ich wyniki porównano z wynikami 135 uniwersytetów z trzech wiodących na świecie systemów szkolnictwa wyższego: Kanady, Wielkiej Brytanii i USA. Wyniki: W obliczu globalnego zapotrzebowania na zrównoważoność arabskie uniwersytety stoją przed wyzwaniami związanymi z poprawą swojego wkładu w Cele zrównoważonego rozwoju i rankingi zrównoważoności. Pomimo imponującego wzrostu udziału arabskich uniwersytetów w rankingach THE IMPACT, nadal występują opóźnienia w jakości i wpływie wkładu arabskich uniwersytetów w realizację Celów zrównoważonego

rozwoju. Implikacje polityczne podkreślają znaczenie instytucjonalnego zaangażowania na rzecz zrównoważoności na arabskich uniwersytetach, wzywając do dostosowania polityki, finansowania i programu nauczania do Celów zrównoważonego rozwoju ONZ (SDGs). Arabskie uniwersytety muszą wypełnić istniejące luki, promować zielone inicjatywy i skutecznie przyczyniać się do osiągnięcia zrównoważoności, uznając jednocześnie zróżnicowany kontekst społeczno-gospodarczy i priorytety regionu arabskiego.

Słowa kluczowe: szkolnictwo wyższe, zrównoważony rozwój, Cele zrównoważonego rozwoju; SDGs, arabskie uniwersytety

Introduction

The rise of sustainability as a global priority has led to an increased demand for universities, and higher education institutions (HEIs) to demonstrate their commitment and contributions to the United Nations Sustainable Development Goals (UN SDGs) (Leal et al., 2019) thus, the role of universities in promoting sustainable development has gained significant attention in recent years (Findler, 2019) As key stakeholders in achieving SDGs, universities play a vital role in shaping the future of community through research, innovation, education, and community engagement (Hammer, 2023). This role in fostering sustainability has been acknowledged, emphasizing their potential to develop future leaders, generate groundbreaking research, and promote transformative learning (Chankseliani, 2021).

As a result, measuring and assessing the ways in which universities contribute to the SDGs has emerged as a key area of scholarly inquiry, with researchers calling for the development of indicators and evaluation frameworks that capture the multifaceted nature of their impact (Trencher, 2014; Disterheft, 2015). This burgeoning field of research underscores the need for a comprehensive understanding of the role of HEIs in addressing the complex and interconnected challenges of sustainable development, ultimately informing institutional strategies and policymaking in support of a more equitable and resilient global future.

Consequently, there is growing competition among world-class universities to showcase their strengths and achievements in this area, as evidenced by their performance in SDG-related rankings. The increased demand and competition in SDG rankings can be attributed to several factors. First, universities recognize the importance of addressing global challenges, such as climate change, poverty, and inequality, and are increasingly committed to fulfilling their social and environmental responsibilities (Waas, 2010). Second, university stakeholders, including students, staff, faculty, and funding bodies, are increasingly interested in sustainability performance, driving universities to demonstrate their commitment to sustainable development (Abubakar,2020) Moreover, a strong performance in SDG rankings can enhance a university's reputation, attract funding and resources, and help recruit high-quality students and faculty members (Altbach, 2018). As a result, universities are increasingly investing in sustainability initiatives, research, and partnerships to improve their performance in these rankings and differentiate themselves from their peers.

Frameworks and Indicators for Measuring University Impact on SDGs

Several frameworks have been developed to assess the performance of universities in relation to the SDGs. Some of the most widely recognized are the Times Higher Education (THE) Impact Rankings (THE, 2023), the QS World University Rankings (QS, 2023), the Sustainability Tracking, Assessment & Rating System (STARS) [11] and The UI GreenMetric World University Rankings (AASHE, 2023).

THE IMPACT Rankings, launched in 2019, provide a global assessment of universities' contribution to the SDGs. This ranking uses a range of indicators, including research, teaching, knowledge transfer, and societal engagement, to evaluate universities' performance across all 17 SDGs. The rankings use a weightage system to provide an overall score for each institution, which is then used to create a global ranking (THE, 2023).

The QS World University Rankings, established in 2004, provide an annual assessment of university performance based on six indicators, including academic reputation, employer reputation, faculty/student ratio, citations per faculty, international faculty ratio, and international student ratio. Although not specifically focused on the SDGs, the QS rankings can provide insights into universities' contributions to sustainable development through research and education (QS, 2023).

STARS, developed by the Association for the Advancement of Sustainability in Higher Education (AASHE), is a self-reporting framework that allows institutions to measure their sustainability performance across four main categories: Academics, Engagement, Operations, and Planning & Administration (AASHE, 2021). While not specifically designed for measuring SDG impacts, STARS has been used to assess universities' progress towards the goals (AASHE, 2023; Leal, 2022).

The UI GreenMetric World University Rankings initiated by Universitas Indonesia in 2010, has emerged as a significant global ranking system that assesses the sustainability performance of universities (UI GreenMetric,

2022). The ranking evaluates universities based on six main dimensions, including setting and infrastructure, energy and climate change, waste, water, transportation, and education (Disterheft, 2015). By providing an internationally recognized benchmark, the UI GreenMetric encourages universities to improve their sustainability efforts and share best practices. This ranking system has gained increasing prominence, with over 900 universities from 94 countries participating in the 2020 edition (UI GreenMetric, 2022).

The role of Arab universities in advancing the SDGs has been gaining increased attention, as these institutions are considered key players in shaping the sustainable development of the Arab region (Demaidi, 2021). Recognizing their strategic importance, Arab universities have started to embrace the 2030 Agenda for Sustainable Development through various initiatives, programs (Singh, 2023).

One of the notable efforts in the Arab region is the establishment of the Arab Network for Sustainable Development (ANSD) in 2015, which seeks to promote the integration of the SDGs into higher education curricula and research agendas. This network encourages collaboration among universities, policymakers, and other stakeholders in addressing regional sustainability challenges (ANSD, 2015). Arab universities have also taken steps to promote interdisciplinary research on sustainable development issues, recognizing the need for a comprehensive understanding of the interconnected challenges faced by the region (Zaidan, 2019). Some Arab universities have established research centers focused on sustainability, aiming to foster innovation and knowledge exchange in areas such as water and energy management, climate change, and sustainable urban development (Omar, 2023). Additionally, Arab universities have been actively involved in forging partnerships with international organizations and other regional institutions to advance the SDGs. For example, the Arab States Research and Education Network (ASREN) has been instrumental in facilitating research collaboration and capacity-building initiatives among higher education institutions in the region (ASREN, 2021).

The aim of this study is to comprehensively examine the participation, performance, and contributions of Arab universities in sustainability rankings, specifically comparing them to the performance of prestigious higher education systems in Canada, the United Kingdom, and the United States. By focusing on these regions, the study seeks to assess the extent to which Arab universities are actively engaged in addressing the United Nations Sustainable Development Goals (UN SDGs) and contributing to sustainable development. Furthermore, the study aims to highlight the potential areas of strength and improvement among these universities in their pursuit of sustainability, ultimately informing strategies, policies, and collaborative efforts that can contribute to a more equitable and resilient global future.

To the best of our knowledge, this is the first study addressing the participation and performance of universities in the Arab countries, compared to university's performance of leading and world-class higher education systems in three countries: Canada, United Kingdom, and United States.

Study design, data, and methods

200 Arab universities who participated in the THE IMPACT Rankings 2023 were analyzed, constituting 15 Arab countries (Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Tunisia, and the United Arab Emirates).

The participation of the 200 Arab universities were compared to 109 North America and 461 European universities shared in THE IMPACT Rankings with emphasizing on 135 universities from three leading world-class higher education systems in three countries: Canada, United Kingdom, and United States. Furthermore, the performance of participating universities in each SDG indicated by their existence in the THE IMPACT Rankings 2023 clusters were measured and analyzed.

THE IMPACT Rankings were selected to analyze and measure the commitment, participation, and performance of theses universities in the sustainability ranking due to its publicity and be the first and only global university ranking system that address and assess universities impacts to sustainability as well as comprehensiveness cover of the 17 UN SDGs by setting 105 indicators and conducting 220 measurements (THE, 2023).

The SDGs THE IMPACT rankings are used as framework to evaluate the performance and contribution of universities in addressing these challenges; As THE IMPACT Ranking methodology, world universities must show their interest in at least 3 SDGs in addition to mandatory participation in SD17.

THE IMPACT Rankings measure global universities' success in delivering the UN SDGs through calibrated indicators to provide comprehensive and balanced comparisons across three broad areas: research, outreach, and stewardship. The evaluation of university performance on all 17 UN SDGs.

The data for THE IMPACT Rankings results (from the 1st round in 2019 to the last edition 2023) were collected for the participating universities. The data gathering involved the universities' names, participation in each SDG as well as their ranking scores and positions. The data were analyzed using Statistical Package for the Social Sciences V25 (SPSS, IBM, USA). Data between universities and two groups were compared and the differences were analyzed. Chi-squared Test Used for P-values. The level of significance was set at a $p<0.05$.

Results

The results of this study provide an extensive and comprehensive analysis of Arab universities' participation and performance in THE IMPACT Rankings over the years 2019 to 2023, compared to participated universities from Canada, UK, and USA.

The increased engagement of world universities in fulfilling their responsibilities and influences in relation to the SDGs is highlighted by the growing interest in the participation in the annual THE IMPACT Rankings. Notably, from 2019 to 2023, there is more than a threefold increase in the number of world universities partaking in these rankings, Table 1 and Figure 1.

Table 1. The increased participated universities in THE IMPACT Rankings

Participated Universities	Year				
	2019	2020	2021	2022	2023
Algeria	3	4	6	5	14
Bahrain	3	3	3	2	2
Egypt	16	23	31	36	37
Iraq	3	18	37	47	58
Jordan	1	5	11	13	16
Kuwait	1	1	1	3	3
Lebanon	2	4	6	6	7
Morocco	1	2	7	8	11
Oman	0	0	0	1	1
Palestine	1	2	2	4	6
Qatar	1	1	1	1	1
Kingdom Saudi Arabia (KSA)	3	5	12	22	25
Sudan	0	0	1	1	2
Tunisia	3	5	6	5	7
United Arab Emirates (UAE)	2	3	4	8	10
Canada	10	19	23	24	26
United Kingdom (UK)	26	34	50	53	58
United State of America (USA)	31	31	45	42	51
Total Participated Arab Universities	40	76	128	162	200
Total Participated Canada, UK, USA Universities	67	67	118	119	135
Overall world universities	467	768	1117	1407	1591

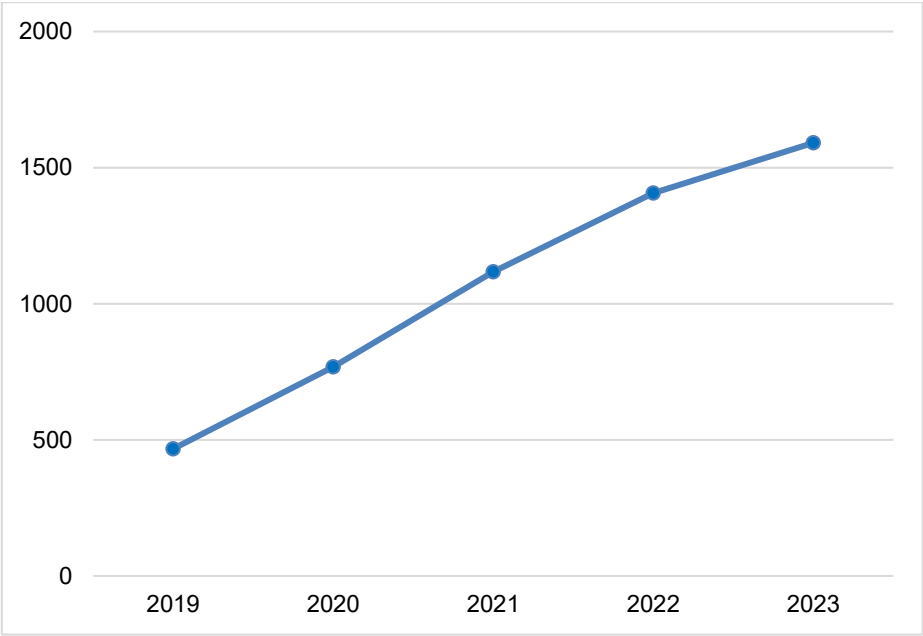

Figure 1. The growing participated world universities in THE IMPACT Rankings (THE IMPACT, 2023)

Similarly, it is evident that participation of Arab universities in THE IMPACT Rankings has significantly increased over the years, from 40 in 2019 to 200 in 2023. This showcases a growing awareness and commitment towards sustainability among Arab universities, Table 1, Figure 2. Moreover, there is also the same trend through increased participated Canada, UK, USA universities in THE IMPACT Rankings.

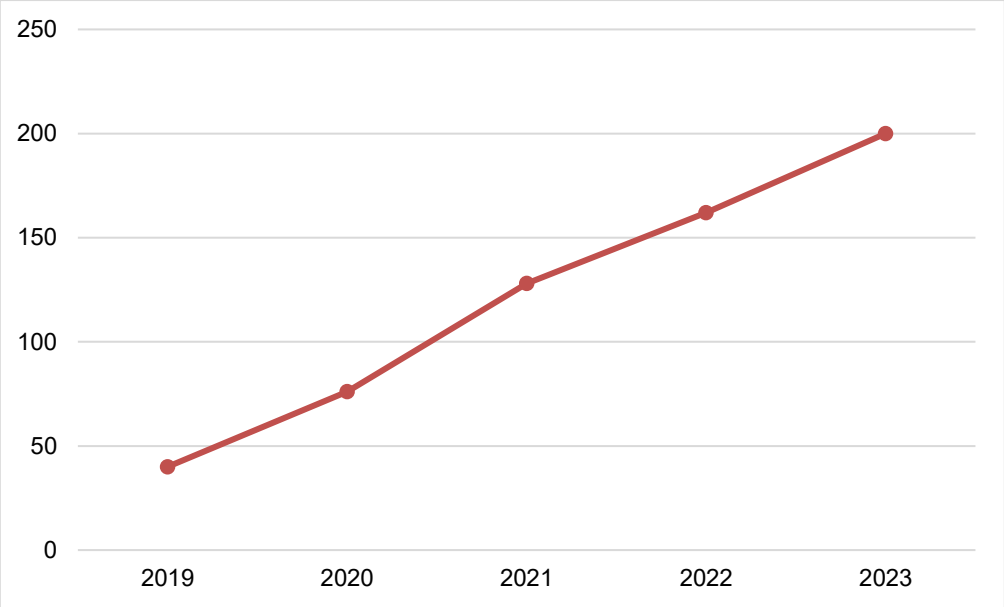

Figure 2. The growing participated Arab universities in THE IMPACT Rankings (THE IMPACT, 2023)

Table 2. suggests a parity between Arab universities and their counterparts in Canada, UK and USA in relation to their engagement with SDGs 3, 5, 6, 8. This represents a shared commitment towards advancing Good Health and Well-being, Gender Equality, Clean Water and Sanitation, as well as Decent Work and Economic Growth. On the other hand, the analysis highlights a heightened level of involvement by Arab academic institutions in SDGs 1 and 4.

Table 2. Percentage of studied universities that participated in each SDG (THE IMPACT Rankings, 2023)
Chi-squared Test Used for P-values

SDG	Participated Arab Universities		Participated CAN, UK, USA Universities		P value
	Number	(%)	Number	(%)	
SDG-1 (No Poverty)	120	60%	58	43%	<0.05
SDG-2 (Zero Hunger)	77	38%	63	47%	<0.05
SDG-3 (Good Health and Well-being)	162	81%	115	85%	>0.05
SDG-4 (Quality Education)	175	87%	89	66%	<0.05
SDG-5 (Gender Equality)	142	71%	97	72%	>0.05
SDG-6 (Clean Water and Sanitation)	93	46%	61	45%	>0.05
SDG-7 (Affordable and Clean Energy)	105	52%	81	60%	<0.05
SDG-8 (Decent Work and Economic Growth)	102	51%	80	59%	>0.05
SDG-9 (Industry, Innovation and Infrastructure)	81	40%	66	49%	<0.05
SDG-10 (Reduced Inequalities)	107	53%	103	76%	<0.005
SDG-11 (Sustainable Cities and Communities)	83	41%	83	61%	<0.005
SDG-12 (Responsible Consumption and Production)	66	33%	81	60%	<0.005
SDG-13 (Climate Action)	79	39%	85	63%	<0.005
SDG-14 (Life below Water)	53	26%	58	43%	<0.005
SDG-15 (Life on Land)	58	29%	68	50%	<0.005
SDG-16 (Peace, Justice and Strong Institutions)	98	49%	91	67%	<0.005
SDG-17 (Partnerships for the Goals)	200	100%	135	100%	<0.005

An intriguing inference drawn from Table 2, Figure 3 and 4 elucidates a marked under-representation of Arab universities in the SDGs 7 and 9, to 16. Conversely, Canadian, UK, and USA universities demonstrated substantial engagement in these respective SDGs. This suggests an established recognition, awareness, and interest from these institutions concerning the critical issues surrounding Industry, Innovation and Infrastructure, Reduced Inequalities, Sustainable Cities and Communities, Responsible Consumption and Production, and Environmental issues. This interest extends to aspects of Climate Change, Energy, Terrestrial and Marine Life, Life Below Water, Life on Land, and Peace, Justice and Strong Institutions. This disparity may underscore a potential opportunity for growth and enhancement within Arab universities, specifically through a greater incorporation of environmental-centric objectives into their strategic vision and operational agendas.

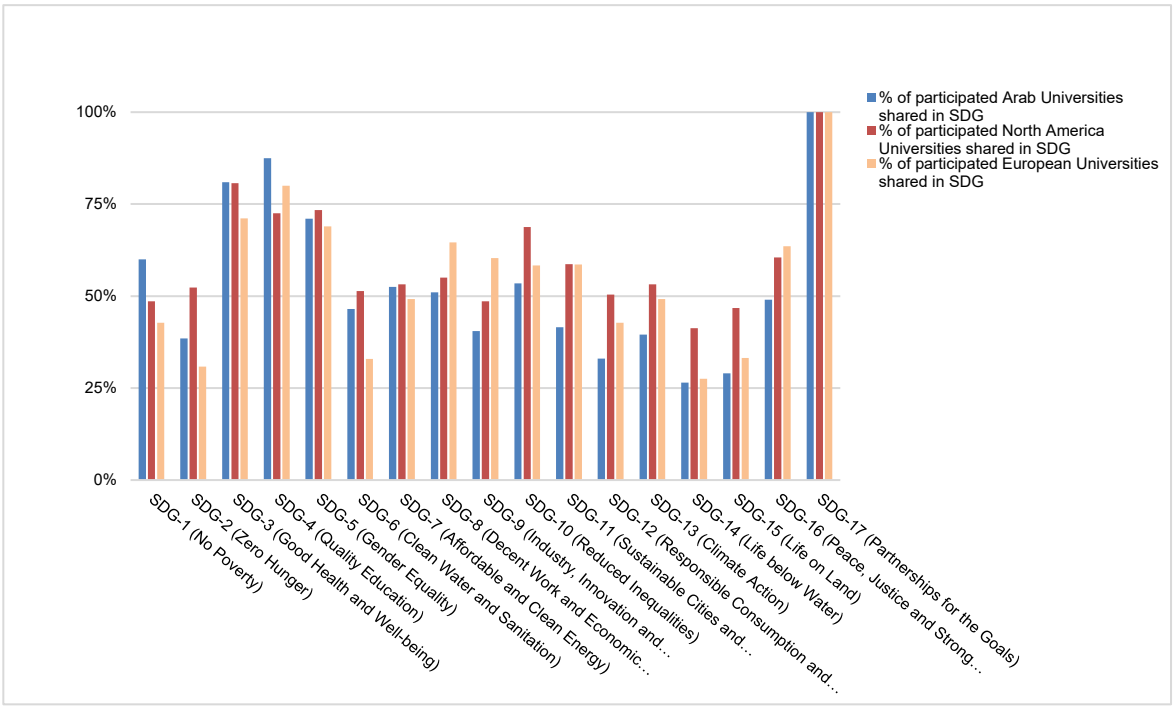

Figure 3. Percentage of Arab Universities participated in each SDG compared to North America and European universities (THE IMPACT Rankings, 2023)

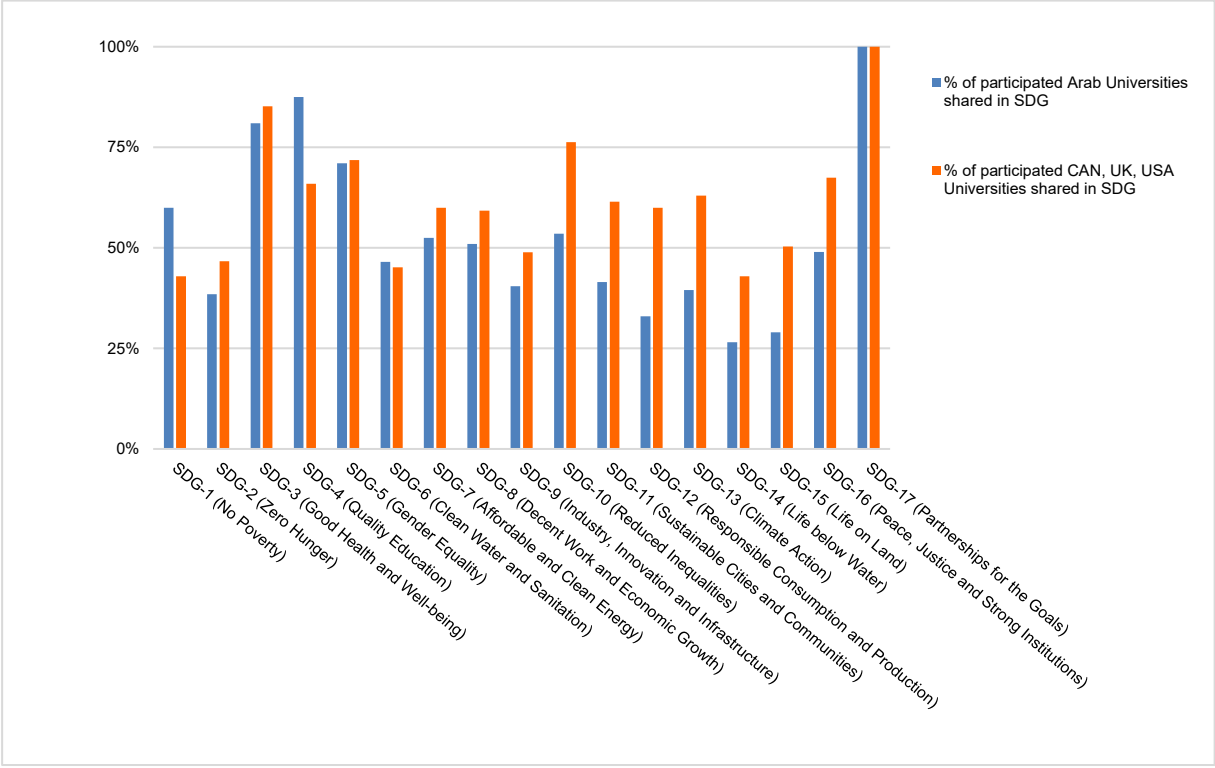

Figure 4. Percentage of Arab Universities participated in each SDG compared to CAN, UK and USA universities (THE IMPACT Rankings, 2023)

Table 3. highlights a substantial disparity in the performance of Arab universities in the 2023 THE IMPACT Rankings, in comparison with institutions from Canadian, UK and USA universities across all ranking categories. A striking absence is observed in the representation of Arab institutions within the overall top 100 universities with a stark contrast to the 49 institutions from Canada, the UK, and the USA. Furthermore, a significant fraction of Arab universities participating in the rankings (48.5%) exhibit weak performance, languishing in the lower echelons of the rankings and securing positions beyond the 1000th, Figure 5.

Table 3. Appearance of Arab universities in Overall 2023 THE IMPACT Rankings different cluster's levels compared to CAN, UK, USA, universities

Universities Cluster, 2023 THE IMPACT Rankings	Appeared universities in the Cluster /Total participated (%)				P value
	Participated Arab Universities		Participated CAN, UK, USA Universities		
	Number	(%)	Number	(%)	
Top 100	0/200	0.0%	49/135	36.3%	<0.005
101-200	7/200	3.5%	27/135	20.0%	<0.005
201-600	38/200	19.0%	36/135	26.7%	<0.005
601-1000	58/200	29.0%	16/135	11.8%	<0.005
+1000	97/200	48.5%	7/135	5.2%	<0.005

CAN: Canada; UK: United Kingdom; USA: United States of America

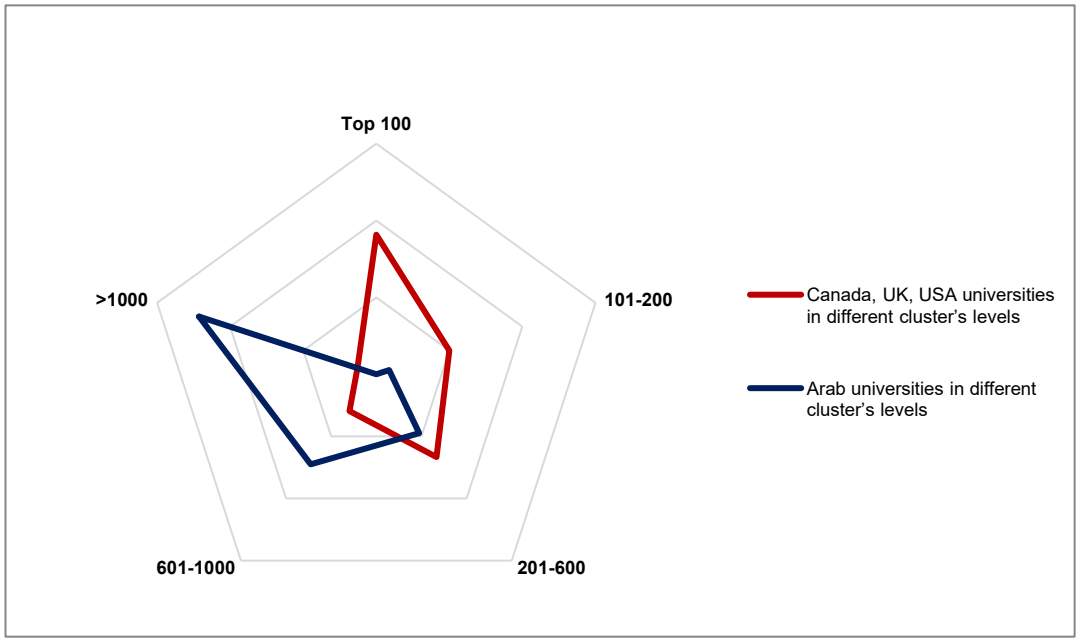

Figure 5. Appearance of studied universities in different Ranking cluster's (THE IMPACT Rankings, 2023)

Furthermore, figure 6 showed the performance of Arab universities in each SDG compared to Canada, UK and USA universities indicated by their ratio of appearance in the top 100 universities to their participation in that SDG in 2023 THE IMPACT Rankings.

The performance of Arab universities in SDGs is generally lower compared to universities from Canada, the UK, and USA. More than half of participated Canada, UK and USA universities were appeared in the top 100 universities ranking in SDG 1 – No poverty, SDG 2 – Zero hunger, and SDG 15 – Life on land compared to Arab universities that appeared to be less performed in these SDGs, 9.2%, 3.9% and 3.4% respectively. Furthermore, SDG 12 – Responsible consumption and production and SDG 13 – Climate action had no Arab universities appeared in the top 100 for both SDGs. The trend of Canada, UK and USA universities outperforming Arab institutions continues for other SDGs except for SDG 4 – Quality education where interestingly, Arab universities have a higher appearance ratio in the top 100 list at 9.1% compared to Canada, UK and USA universities at 3.4% (Table 4).

Discussion

In recent years, there has been growing interest in the role of higher education institutions in promoting sustainability and addressing global challenges outlined in the United Nations' SDGs. THE Impact Rankings serve as a tool for measuring university performance in this regard. The growing global universities' interest in participation in the annual THE IMPACT Rankings clearly demonstrates the burgeoning commitment of these institutions towards contributing to the global agenda set by the SDGs. The escalating interest indicates a shift in academic focus, from a traditional role of teaching and research to a more encompassing one that also includes sustainable development. The heightened participation in these rankings over the years serves as an affirmation of universities' increased sense of responsibility towards the achievement of these global goals. (El-Jardali, 2018; GUNi, 2018).

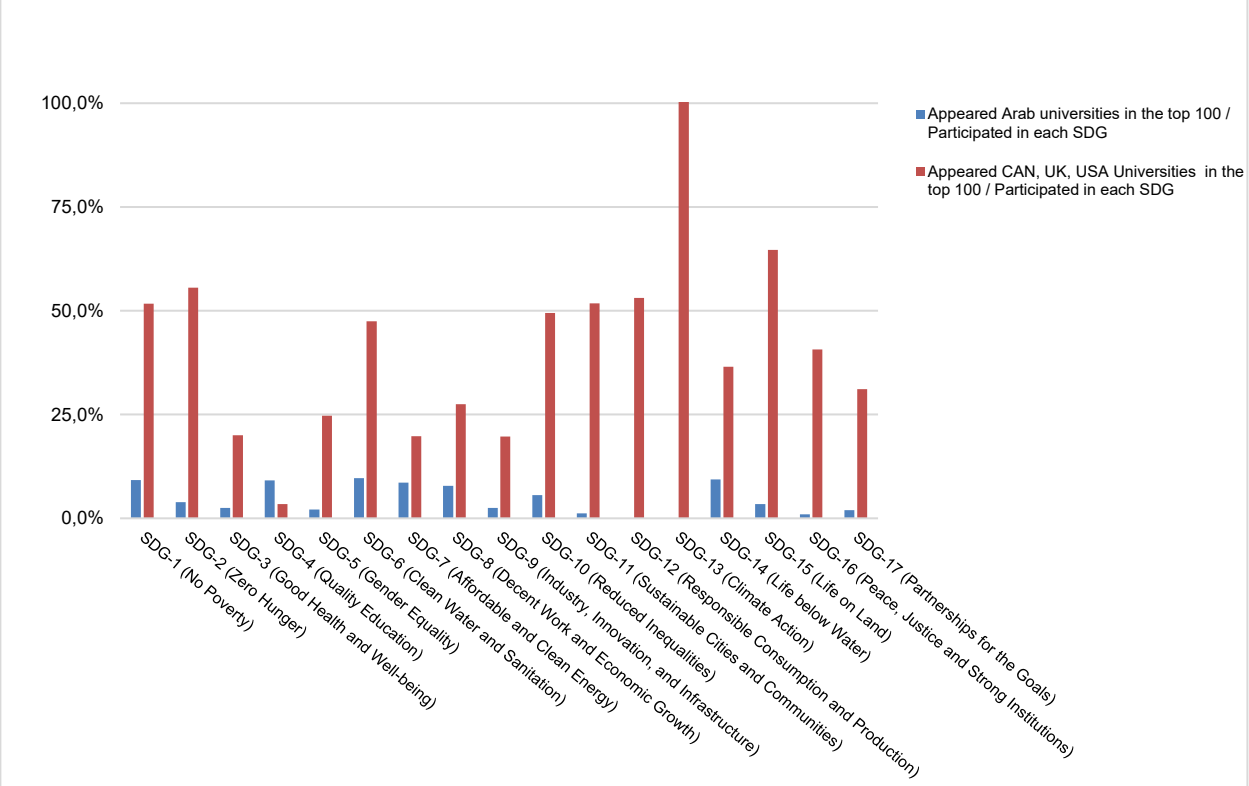

Figure 6. Performance of Arab universities in each SDG compared to Canada, UK and USA universities indicated by their ratio of appearance in the top 100 universities to their participation in that SDG (THE IMPACT Rankings, 2023)

Table 4. Performance of Arab universities in each SDG compared to Canada, UK and USA universities indicated by their ratio of appearance in the top 100 universities to their participation in that SDG in 2023 THE IMPACT Rankings (Chi-squared Test Used for P-values)

SDGs, 2023 THE IMPACT Rankings	Appeared universities in the top 100 / Participated in each SDG				P value
	Participated Arab Universities		Participated CAN, UK, USA Universities		
	Number	(%)	Number	(%)	
SDG-1 (No Poverty)	11/120	9.2%	30/58	51.7%	<0.005
SDG-2 (Zero Hunger)	3/77	3.9%	35/63	55.6%	<0.005
SDG-3 (Good Health and Well-being)	4/162	2.5%	23/115	20%	<0.005
SDG-4 (Quality Education)	16/175	9.1%	3/89	3.4%	
SDG-5 (Gender Equality)	3/142	2.1%	24/97	24.7%	<0.005
SDG-6 (Clean Water and Sanitation)	9/93	9.7%	29/61	47.5%	<0.005
SDG-7 (Affordable and Clean Energy)	9/105	8.6%	16/81	19.8%	<0.005
SDG-8 (Decent Work and Economic Growth)	8/102	7.8%	22/80	27.5%	<0.005
SDG-9 (Industry, Innovation, and Infrastructure)	2/81	2.5%	13/66	19.7%	<0.005
SDG-10 (Reduced Inequalities)	6/107	5.6%	51/103	49.5%	<0.005
SDG-11 (Sustainable Cities and Communities)	1/83	1.2%	43/83	51.8%	<0.005
SDG-12 (Responsible Consumption and Production)	0/66	0.0%	43/81	53.1%	<0.005
SDG-13 (Climate Action)	0/79	0.0%	37/85	43.5	<0.005
SDG-14 (Life below Water)	5/53	9.4%	31/58	36.5%	<0.005
SDG-15 (Life on Land)	2/58	3.4%	44/68	64.7%	<0.005
SDG-16 (Peace, Justice and Strong Institutions)	1/98	1.0%	37/91	40.7%	<0.005
SDG-17 (Partnerships for the Goals)	4/200	2.0%	42/135	31.1%	<0.005

CAN: Canada; UK: United Kingdom; USA: United States of America

It is essential to recognize that although THE IMPACT Rankings is just one way to assess university performance in sustainable development and measures institutions' performance and contribution towards the UN SDGs; Other metrics and indicators could provide additional insights into the performance of universities in the Arab region,

Canada, UK, and USA. The data presented in this analysis is a snapshot of the universities' performance in THE IMPACT Rankings, and it should be interpreted in conjunction with other relevant data and qualitative information. Furthermore, the universities are included in THE IMPACT overall ranking if they submitted data against SDG17 and at least 3 other SDGs, as per THE IMPACT Rankings criteria which emphasizing the importance of collaboration and global partnerships in achieving the SDGs. Thus, all participating universities must show their interest in participation in SDG-17 (Partnerships for the Goals) indicating that universities are encouraged to engage in collaborative efforts and build partnerships across institutions, sectors, and borders to address the SDGs. This can create an enabling environment for sharing best practices, resources, and knowledge on sustainable development, leading to a more effective and comprehensive approach to tackling the SDGs.

200 Arab universities were participated in the THE IMPACT Rankings 2023, constituting 15 Arab countries; The lack of appearance universities from other Arab countries may be attributed to political or economic issues in their countries.

It is evident that there has been an upward trend in Arab universities' participation in THE IMPACT Rankings. The impressive growth in the participation of Arab universities in THE Impact Rankings from 40 in 2019 to 200 in 2023 signifies the region's positive strides in incorporating sustainability in higher education. Despite numerous challenges faced by the region such as political instability, resource constraints, and socio-economic disparities (UNDP, 2020). This trend aligns with the increasing recognition of higher education's role in driving SDGs worldwide (UNESCO, 2020).

This way, the amplified involvement by Arab academic institutions in SDGs 1 and 4 could be attributed to the unique socioeconomic challenges that Arab nations face, notably poverty, which imposes direct implications on their societies and economies. Thus, these institutions may demonstrate an increased predisposition towards research focusing on poverty mitigation, with the goal of aligning their efforts with national developmental strategies. Furthermore, the notable emphasis on SDG-4 (Quality Education) by Arab universities potentially underscores a concerted endeavor to augment the standard and accessibility of education, a critical component for the progress of their respective communities.

The data presented suggests a parity between Arab universities and their counterparts in Canada, UK, and USA in relation to their engagement with SDGs 3, 5, 6, 8 which represents a shared commitment towards advancing Good Health and Well-being, Gender Equality, Clean Water and Sanitation, as well as Decent Work and Economic Growth.

Interestingly, while Arab universities have a higher participation rate in certain SDGs, they lag in other SDGs concerning industry, innovation, sustainable cities and communities, environmental issues, climate change and energy, as well as peace and justice. Despite the universities are increasingly recognized as pivotal actors for promoting SDGs, through their research, education, leadership, and community engagement activities and the noted successes of implementing SDGs initiatives through adequate institutional frameworks, there are challenges in extending the experiences to other universities, especially in some Arab countries where the number of participating universities remains low, indicating a need for stronger institutional policies and governmental support in these countries. Some sustainability initiatives are led by SDGs champions, although SDGs needs to be *institutionally embedded* and not depend on single actors (Niedlich et al., 2020; Abubakar, 2020).

The participation of universities in Canada, UK, and USA has also increased, but at a slower pace. Still, despite a smaller absolute number of participating universities, these countries have a significantly higher proportion of universities ranked within the top 200, implying a higher quality of SDG engagement (THE, 2023).

However, when considering their positioning within the rankings, a significant majority of Arab universities (77.5%) rank below 600. This indicates a disparity in the quality and impact of their contributions towards SDGs when compared with universities from Canada, UK, and USA. It suggests a gap in either the resources, policies, or practices that these universities employ in relation to sustainable development (Lozano, 2023).

Regarding to the performance of Arab universities in each SDG; In terms of Overall performance and the ratio of appearance in the top 100 universities to participation in each SDG, universities from Canada, UK, and USA perform markedly better across most SDGs compared to Arab universities.

The greatest areas for Arab universities, where they had the highest ratios of appearance in the top 100 to participation, were SDGs 1 (No Poverty), 4 (Quality Education), 6 (Clean Water and Sanitation), and 14 (Life Below Water). These SDGs had ratios between 9.1% to 9.7%. However, these ratios still pale in comparison to the lowest ratio for Canada, UK, and USA universities, which was 3.4% for SDG 4 (Quality Education).

Conversely, Arab universities had the lowest ratio of appearance in the top 100 to participation in SDGs 11 (Sustainable Cities and Communities), 16 (Peace, Justice, and Strong Institutions), and were not represented at all in the top 100 for SDGs 12 (Responsible Consumption and Production) and 13 (Climate Action), suggesting a significant gap in these areas. These SDGs are typically linked with environmental sustainability, which could reflect the relatively lower emphasis or resources allocated to environmental research and operations in Arab universities which is allied with the low number of Arab universities, 9 universities, that are ranked in atmospheric science research and innovations according to SCIMAGO Institution Rankings 2023 (Lozano, 2023; SCIMAGOIR, 2023).

The discrepancies observed between the performances of Arab universities and those in Canada, the UK, and the USA might be attributed to various factors. These could include the differences in educational infrastructures, governmental policies, research funding, and priorities in these regions. Many studies have discussed the differences in higher education systems and their influence on university performances as well as these studies have highlighted that Western universities often benefit from a high level of autonomy, which has been linked to improved performance in global university rankings (Salmi, 2008). On the other hand, Arab universities often operate within more centralized systems, which might limit their flexibility and capacity to innovate (Marginson, 2011).
In terms of participation in SDGs, regional priorities and challenges might explain the focus of universities. Arab universities showing strengths in SDGs 1 (No Poverty) and 6 (Clean Water and Sanitation) could be responding to pressing regional issues such as water scarcity and economic disparity (World Bank, 2018). Meanwhile, the strong focus on social justice and sustainability issues in Canada, UK, and USA universities might be reflective of broader social movements and policy priorities in these regions (Kharas, 2019; Abera, 2022).
This difference in rankings might be attributed to several factors, specifically, universities in developed countries tend to have stronger infrastructural capacities, institutional policies favoring sustainable practices, more financial resources to devote to SDG-related research and projects that enable them to better contribute towards SDGs (Lambrechts, 2019; GUNi, 2020). Moreover, the culture of sustainability is often more embedded in these institutions, further driving their performance in this area (QS,2023).
This disparity is not surprising, as it mirrors the socio-economic context and development priorities of the Arab region (Bystrov, 2021) as well as the Arab universities often spotlight SDGs related to immediate societal needs (e.g., health and education). Given the region's high poverty rates, unemployment, and health challenges, it is logical that universities have focused on these immediate societal needs (Waas, 2010). However, the underrepresentation in environmental and urban sustainability SDGs may suggest a need for Arab universities to broaden their commitment towards a more holistic contribution to all SDGs, aligning with the interconnected nature of these goals (World Bank, 2023).
Furthermore, the absence of Arab universities in the top 100 of THE Impact Rankings or the vast difference between the Arab universities and those from Canada, UK, and USA in the top 200 positions raises critical questions about the factors hindering Arab universities from reaching similar achievements. The highlighted significant performance gaps between Arab universities and those in Canada, UK, and USA may referring to many contributing factors including resources, research capacity, policy support, and regional priorities. Improving the performance of Arab universities in the SDGs and global rankings would likely require multi-faceted strategies, including increased investment in research, capacity-building, policy reforms, and partnerships (Romani et al., 2009).
This could be an area for future research and policy development, focusing on overcoming these barriers and promoting best practices. Arab universities have unique socio-economic and political contexts compared to their Canada, the UK, and USA counterpart universities. Consequently, their priorities and approaches to SDGs may differ based on local and regional challenges. This could explain the varying levels of participation in different SDGs among Arab universities. While Arab universities are increasingly engaged with the SDGs, there remain areas for improvement, particularly regarding the quality of this engagement and the balance across different SDGs. Universities should explore ways to enhance their contribution to the SDGs, informed by best practices from higher-ranked institutions. Policymakers and university leaders should also pay attention to the uneven distribution of SDG engagement and explore strategies to foster more balanced and holistic contributions to these goals (Leal et al, 2020).
Despite the efforts of Arab universities, challenges remain in fully integrating the SDGs into the operations and curricula of Arab universities. Factors such as the lack of financial resources, institutional inertia, and insufficient awareness of the SDGs among faculty and students have been identified as potential barriers to progress [14, 36]. Moving forward, it is crucial for Arab universities to continue developing and implementing strategies that support the SDGs, while engaging in ongoing dialogue and collaboration with regional and global partners to ensure the sustainable development of the Arab region (El Zayat, 2018; Al-Sayari, 2020).
As Arab universities continue to advance the SDGs, it is important to recognize the opportunities and challenges that lie ahead. Capacity building and human resource development are key aspects of this endeavor, with the aim of nurturing future leaders and professionals who can contribute to the sustainable growth of the Arab region. This may involve the development of new academic programs, interdisciplinary courses, and faculty training on sustainability topics to ensure that students are equipped with the necessary knowledge and skills to address complex sustainability challenges (Zaidan, 2019).
Furthermore, strengthening regional collaboration is essential for Arab universities in their pursuit of the SDGs. This can be achieved through initiatives such as joint research projects, knowledge-sharing platforms, and academic exchange programs that facilitate the sharing of expertise and best practices among institutions in the Arab region (ASREN, 2021; Omar, 2023). In addition, Arab universities should seek to engage more effectively with external stakeholders, such as governments, the private sector, and civil society organizations, to foster multi-sectoral partnerships and co-create innovative solutions for sustainable development (Al-Sayari, 2020).

Moreover, Arab universities must also prioritize the assessment and monitoring of their progress towards the SDGs, using appropriate indicators and evaluation frameworks (Demaidi, 2021). This would allow institutions to measure their impact on sustainable development, identify areas for improvement, and establish benchmarks for comparison with other regional and global universities (López, 2022).

Finally, addressing the existing barriers to SDG integration in Arab universities requires the commitment of institutional leadership to allocate sufficient financial resources, develop strategic plans, and promote a culture of sustainability within their organizations (Demaidi, 2021). By taking these steps, Arab universities can effectively contribute to the achievement of the SDGs and promote a more sustainable and prosperous future for the region.

Ultimately, the performance and participation of universities in the SDGs are influenced by various factors, including their ranking, resources, and national priorities. While there are differences between universities in Arab and Western countries, it is essential to recognize that sustainable development is a global challenge that requires collaborative efforts across borders. By fostering partnerships and learning from each other's experiences, universities can play a vital role in driving progress toward the United Nations' Sustainable Development Goals.

Policy implications for Arab Higher Education can be summarized in the following:

- *Strengthening Institutional Policies:* Arab universities should focus on developing and implementing institutional policies that prioritize sustainability across all aspects of operations, including research, teaching, community engagement, and campus management. This can foster a culture of sustainability and drive the integration of SDGs into university strategies.
- *Investment in Research and Innovation:* Arab governments and funding bodies should allocate resources to support research and innovation in areas related to SDGs that are currently underrepresented. This could involve establishing research centers, providing grants, and fostering collaboration between universities and industries to address pressing regional challenges.
- *Capacity Building and Faculty Training:* Universities should invest in training programs for faculty and staff members to enhance their understanding of sustainability concepts and approaches. This will enable them to effectively incorporate sustainability topics into curricula, research projects, and institutional strategies.
- *Promoting Interdisciplinary Collaboration*: Arab universities should encourage interdisciplinary collaboration to address the interconnected nature of the SDGs. By fostering collaboration across departments and faculties, universities can develop holistic solutions to complex sustainability challenges.
- *Enhancing International Partnerships:* Arab universities should actively seek partnerships with international institutions to facilitate knowledge exchange, joint research projects, and best practice sharing. These partnerships can enhance research capacity, promote innovation, and broaden the universities' impact on the SDGs.
- *Supporting Regional Initiatives:* Governments and university leadership should support and participate in regional initiatives like the Arab Network for Sustainable Development (ANSD) that promote collaboration among universities, policymakers, and stakeholders to address regional sustainability challenges.
- *Promoting Public Awareness:* Arab universities should play a role in raising public awareness about the importance of sustainable development. By organizing seminars, workshops, and public lectures, universities can engage with communities and promote a deeper understanding of the SDGs.
- *Aligning National Policies with SDGs:* Arab governments should align their national policies with the SDGs and provide incentives for universities to contribute to sustainable development. This could include funding for research projects, establishing sustainability-focused grants, and recognizing universities for their contributions.
- *Monitoring and Evaluation:* Universities should establish mechanisms to continuously monitor and evaluate their progress towards the SDGs. Regular assessments using appropriate indicators can help universities identify areas for improvement and track the effectiveness of their sustainability initiatives.
- *Institutional Autonomy and Flexibility*: Arab universities should strive for greater institutional autonomy, which can enable them to respond more effectively to sustainability challenges and develop innovative strategies for SDG integration.
- *Promoting Green Campus Initiatives:* Universities should work towards making their campuses more sustainable by implementing energy-efficient practices, reducing waste, and promoting environmentally friendly transportation options.
- *Government Support for Research Funding:* Governments should increase funding for research initiatives related to sustainability, with a specific focus on environmental and climate-related research, in order to address gaps identified in certain SDGs.
- *Capacity-Building for Governance and Leadership:* Arab universities should provide training programs and workshops for university leadership and governance bodies to enhance their understanding of sustainable development concepts and strategies.
- *Encouraging Multi-Sectoral Partnerships:* Governments, universities, and industries should collaborate to create platforms for multi-sectoral partnerships that can lead to innovative solutions for sustainability challenges. Such collaborations can bring together expertise from various fields and sectors.

- *Promoting Green Entrepreneurship:* Universities should support and encourage students and faculty to engage in green entrepreneurship, fostering innovation and the development of sustainable solutions that can contribute to multiple SDGs.
- *Promoting SDG Integration in Curriculum:* Universities should review and revise their curricula to ensure that SDG-related topics are integrated into various disciplines, ensuring that students graduate with a deep understanding of sustainability challenges and solutions.
- *Promoting Diversity and Inclusion:* Universities should prioritize diversity and inclusion within their institutions, reflecting the principles of the SDGs. This can involve creating inclusive environments that value various perspectives and experiences.
- *National Policy Dialogues:* Governments should facilitate national policy dialogues involving universities, businesses, civil society, and policy makers to collectively address sustainability challenges and develop strategies for advancing the SDGs.
- *Long-Term Funding Commitments:* Governments and funding agencies should provide long-term and sustainable funding commitments for universities' SDG-related initiatives, allowing institutions to plan and implement impactful projects over extended periods.
- *Enhancing Data Collection and Reporting:* Universities should improve their data collection and reporting mechanisms to accurately measure their progress toward the SDGs. This data transparency can help identify gaps and areas for improvement.
- These policy implications reflect the need for comprehensive and coordinated efforts from governments, university leadership, stakeholders, and international partners to foster a culture of sustainability within Arab universities and beyond. By addressing the challenges and leveraging the opportunities highlighted in this study, Arab universities can play a pivotal role in driving sustainable development in the region and contributing to the global achievement of the United Nations Sustainable Development Goals.

Conclusion

The growing demand and competition among world-class universities to contribute to the SDGs and excel in sustainability rankings reflect the increasing importance of sustainable development as a global priority. Arab universities strive to demonstrate their strengths and achievements in this area; While they have shown commendable progress in engaging with the SDGs, they face substantial challenges to improve the quality and breadth of their contributions. Despite the impressive growth in the participation of Arab universities in THE IMPACT Rankings which signifies the region's positive strides in incorporating sustainability in higher education; the lags in quality and impact of Arab universities contributions towards SDGs when compared with universities from Canada, UK, and USA suggest a gap in either the resources, policies, or practices that these universities employ in relation to sustainability. Universities, governmental, non-governmental organizations on the local, regional, and international scales must collaborate to overcome these challenges and foster a robust culture of sustainability within higher education in the Arab region, in addition to prioritizing sustainability issues through policies and initiatives. Furthermore, strengthening research capacity, integrating sustainability into curricula, establishing partnerships, fostering a sustainability culture, engaging in regional and international networks, sharing best practices and benchmarking, developing SDG-aligned policies, leveraging regional strengths, encouraging student involvement, securing funding for sustainability initiatives, and regularly monitoring and reporting progress can improve Arab universities' impact on sustainability and enhance their contribution to global challenges. By implementing these measures, Arab universities can play a transformative role in addressing regional and global sustainability challenges and advancing the United Nations' Sustainable Development Goals.

Author contributions

All authors similarly contributed to the article: (1) study conceptualization and design, data analysis and interpretation; (2) investigation, article drafting; and (3) final article review and approval.

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2) Comprehensive Analysis of Mahasarakham University's Sustainability Efforts and Global Ranking Achievement in 2024 (2025)	JOURNAL OF ECOHUMANISM (Article From : CREATIVE PUBLISHING HOUSE)

25th JUNE 2025

SOURCE: PERPUSTAKAAN UTM

Journal of Ecohumanism
2025
Volume: 4, No: 2, pp. 66 – 79
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v4i2.5782

Comprehensive Analysis of Mahasarakham University's Sustainability Efforts and Global Ranking Achievements in 2024

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Abstract

Universities play a pivotal role in advancing global sustainability through education, impactful research, and environmentally responsible operations. This study evaluates the sustainability initiatives of Mahasarakham University (MSU) in alignment with the UI Green Metric World University Rankings criteria, with a particular focus on its performance in 2024. Since joining the rankings in 2011 with an initial total score of 4,781 points, MSU has steadily improved, achieving a total score of 8,475 points in 2024. The analysis examines three primary dimensions: the integration of sustainability into academic curricula, where sustainable courses increased to 55 programs out of 95 total offerings; the enhancement of sustainability-focused research, reflected in a 77% increase in related publications over the past three years; and the implementation of community engagement projects, which rose significantly from 44 projects in 2021 to 71 in 2023. The findings demonstrate MSU's consistent progress, with notable achievements in aligning its strategic plans with sustainability goals. However, challenges remain in optimizing resource allocation and expanding international collaborations. By synthesizing lessons learned and analyzing trends, this study identifies best practices and offers strategic recommendations for MSU and other institutions aspiring to excel in global sustainability benchmarks. The results underscore universities' essential role as catalysts for sustainable development, providing actionable insights into enhancing operational efficiency and academic contributions.

Keywords: *UI Green Metric World University Rankings, Mahasarakham University, Environmental Management, Sustainability.*

Introduction

The UI GreenMetric World University Rankings were initiated by Universitas Indonesia (UI) in 2010 to assess and promote sustainability efforts in higher education institutions worldwide. Serving as a tool for measuring universities' sustainability policies and programs, the UI GreenMetric has since grown into a global benchmark for sustainable campus practices. The ranking framework is grounded in the principles of environment, economy, and equity, offering universal criteria and indicators that are adaptable across diverse institutions and regions (Leal Filho et al., 2019; Berchin et al., 2021; Galleli, et al., 2022; Leal Filho et al., 2023; Domingos et al., 2024). Initially, the 2010 rankings included 95 universities from 35 countries. By 2024, participation had expanded to 1,477 institutions across 95 countries, reflecting the increasing recognition and commitment to sustainability in higher education (UI GreenMetric, 2024). The rankings have not only become a tool for assessing performance but also a platform for sharing best practices among institutions worldwide (Suwartha et al., 2019; Bagire et al., 2024; Kherazi et al., 2024).

The six core categories of the UI GreenMetric—Setting and Infrastructure, Energy and Climate Change, Waste Management, Water Usage, Transportation, and Education and Research—serve as the foundation for evaluation. These categories are weighted to reflect the significance of various sustainability dimensions, with Education and Research being particularly crucial (Muñoz-Suárez et al., 2020; Atici et al., 2021;

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Journal of Ecohumanism
2025
Volume: 4, No: 2, pp. 66 – 79
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v4i2.5782

Boiocchi et al., 2023; Smolennikov et al., 2024). The emphasis on Education and Research aligns with the role of universities in driving societal progress through knowledge creation and dissemination. Furthermore, these categories underscore the integration of sustainable practices in campus operations, curriculum design, and institutional research agendas (Fallah Shayan et al., 2022; Mokski et al., 2023; Rasli et al., 2024). This structured framework has encouraged universities to adopt a more holistic approach to sustainability.

Thai universities have been active participants in the UI GreenMetric rankings since its early years, reflecting the country's growing emphasis on integrating sustainability into higher education. Institutions such as Kasetsart University, Mahidol University, and Chiang Mai University have consistently performed well, leveraging their strong research capacities and sustainable campus initiatives. By 2024, over 59 Thai universities had joined the rankings, demonstrating a commitment to advancing sustainability in education and operations. These universities focus on areas such as renewable energy, waste management, and biodiversity conservation, aligning their strategies with Thailand's national sustainability goals (Tangwanichagapong et al., 2017; Tabucanon et al., 2021). Furthermore, initiatives like the Green University Network of Thailand have facilitated collaboration among institutions, enabling them to share best practices and collectively improve their performance in global rankings (GUNT, 2022). This collaborative approach has not only elevated the international standing of Thai universities but also highlighted their role in contributing to sustainable development in the region (Charmondusit and Saingam, 2024).

Mahasarakham University (MSU), a leading state university in Thailand, has participated in the UI GreenMetric rankings since 2011. The university's commitment to sustainability is evident in its mission to provide education, conduct impactful research, and offer community services while preserving cultural heritage (Mahasarakham University, 2023; UI GreenMetric, 2024; Phrophayak et al., 2024; Sribanasarn et al., 2024). MSU aligns its strategic plans with the United Nations' Sustainable Development Goals (SDGs) and has consistently improved its ranking through dedicated efforts in sustainability-oriented education, research, and operations. In 2024, MSU achieved a total score of 8,475, demonstrating significant progress from its initial participation in 2011.

The focus on education and research is central to MSU's sustainability strategy. With 55 sustainable academic programs among its 95 offerings and a strong emphasis on sustainability-related research, the university exemplifies its role as a driver of innovation and community engagement. MSU's efforts extend to infrastructure development, resource management, and fostering collaborations that enhance its capacity for sustainable development.

This study evaluates MSU's progress in achieving sustainability goals within the framework of the UI GreenMetric rankings. By analyzing data and trends from 2011 to 2024, the research highlights key achievements, challenges, and strategies that have shaped the university's trajectory. The findings contribute to a broader understanding of how universities can align their operations, curriculum, and research with global sustainability benchmarks, serving as a model for other institutions.

Material and Methods

Study Area

Mahasarakham University (MSU) has undergone significant development since its inception, establishing the Khamriang Campus in Kantarawichai District to accommodate its growing needs and expanding operations. Located approximately seven kilometers from the original campus, Khamriang Campus now serves as the administrative and academic hub of the university. With 17 faculties, 2 colleges, and 1 institute actively operating, MSU has gained recognition as one of Thailand's fastest-growing universities. The university's enrollment has seen a remarkable increase, rising from fewer than 10,000 students in its earlier years to over 40,000 students at present. This growth is supported by the ongoing construction and expansion of faculty buildings and other infrastructure on the Khamriang Campus. The total area of the main campus spans an impressive 1,697,600 square meters, making it well-equipped to support the university's diverse academic, research, and extracurricular activities. As shown in Figure 1, the Khamriang

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DOI: https://doi.org/10.62754/joe.v4i2.5782

Campus layout integrates sustainability principles, with open spaces, green areas, and facilities that reflect MSU's commitment to eco-friendly practices and sustainable development, aligning with its role in the UI GreenMetric rankings. This strategic expansion underscores MSU's dedication to enhancing its capacity to deliver quality education and foster innovation (Mahasarakham University, 2023).

Figure 1. Mahasarakham University

Methodology

This study employs a structured framework to analyze the categories, criteria, and indicators employed in the UI GreenMetric World University Rankings. The methodology encompasses an exploration of the criteria and weighting used in the rankings, as well as the specific data submission processes that universities must follow.

The Criteria

In 2024, the categories and weighting of points were revised to accommodate new questions, ensuring a comprehensive evaluation of sustainability across participating universities. As shown in Table 1 and Figure 2, the rankings are based on six main categories: Setting and Infrastructure (SI), Energy and Climate Change (EC), Waste (WS), Water (WR), Transportation (TR), and Education and Research (ED). These categories are assigned percentages of the total score, reflecting their importance in sustainability assessment (UI GreenMetric, 2024; Phrophayak et al., 2024).

Table 1. Categories Used in the Rankings and Their Weighting

No.	Categories	Percentage of Total Points)%(
1	Setting and Infrastructure (SI)	15
2	Energy and Climate Change (EC)	21
3	Waste (WS)	18
4	Water (WR)	10
5	Transportation (TR)	18
6	Education and Research (ED)	18
	TOTAL	100

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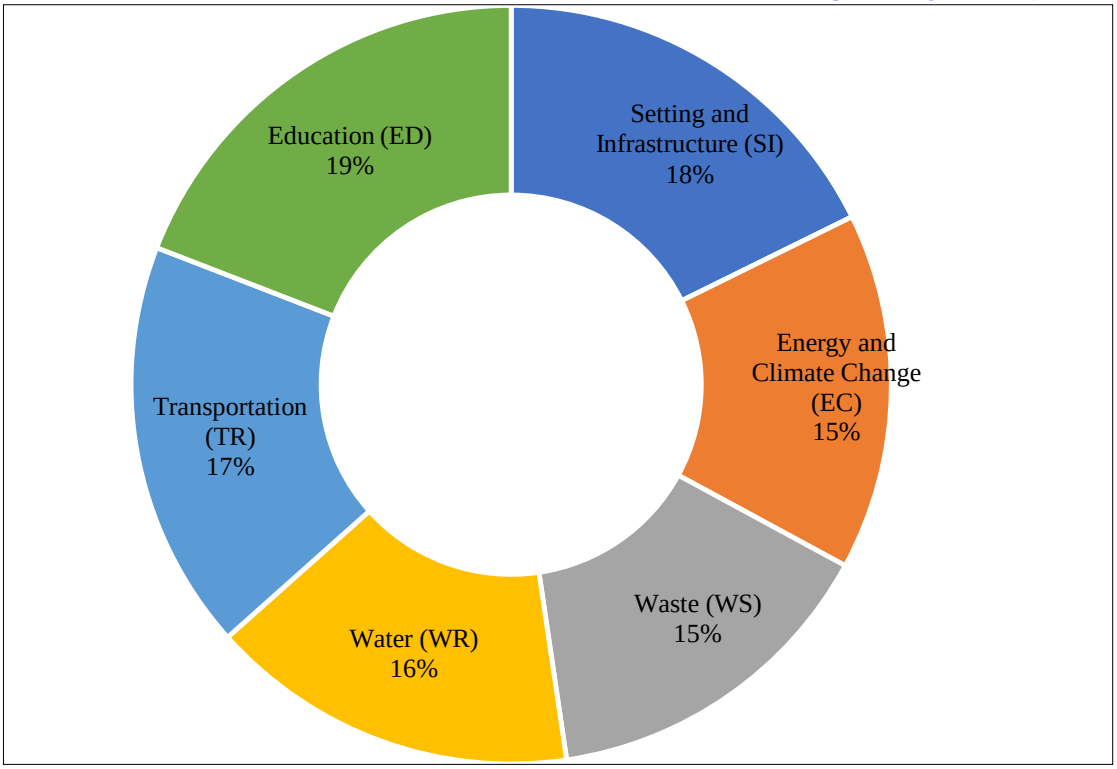

Figure 2. Categories Used in the Rankings and Their Weighting

The detailed criteria and indicators for each category, presented in Tables 2–7, provide insights into the specific evaluation dimensions. For Setting and Infrastructure (SI), indicators such as open space ratio, conservation efforts, and health and safety facilities emphasize eco-friendly campus development, contributing up to 1,500 points (Table 2). The Energy and Climate Change (EC) category, with a total of 2,100 points (Table 3), prioritizes renewable energy adoption, energy efficiency, and carbon footprint reduction, highlighting universities' roles in combating climate change. Waste Management (WS), valued at 1,800 points (Table 4), assesses initiatives like recycling programs and the treatment of various waste types, reinforcing sustainable waste practices. The Water (WR) category (1,000 points, Table 5) focuses on conservation, recycling, and pollution control, ensuring sustainable water use. In Transportation (TR), with a total weight of 1,800 points (Table 6), the criteria evaluate measures to promote low-emission vehicles, enhance pedestrian accessibility, and reduce reliance on private transportation. Finally, Education and Research (ED) (1,800 points, Table 7) underscores the university's academic contributions to sustainability, including the proportion of sustainability courses, related research funding, and student-driven sustainability initiatives. Together, these criteria provide a holistic framework for evaluating and fostering sustainable development within higher education institutions.

Table 2. Criteria and Indicators for Setting and Infrastructure (SI)

No.	Criteria of Setting and Infrastructure (SI)	Point
SI1	The ratio of open space area towards total area	200
SI2	Area on campus covered in forest	100
SI3	Area on campus covered in planted vegetation	200
SI4	Area on campus for water absorption besides the forest and planted vegetation	100
SI5	The ratio of open space area divided campus population	200
SI6	University budget for sustainability effort	200
SI7	Percentage of operation and maintenance activities of building in one year period	100

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No.	Criteria of Setting and Infrastructure (SI)	Point
SI8	Campus facilities for disabled, special needs and or maternity care	100
SI9	Security and safety facilities	100
SI10	Health infrastructure facilities for students, academics and administrative staff's wellbeing	100
SI11	Conservation: plant, animal and wildlife, genetic resources for food and agriculture secured in either medium or long-term conservation facilities	100
Total	15%	1,500

Table 3. Criteria and Indicators for Energy and Climate Change (EC)

No.	Criteria of Energy and Climate Change (EC)	Point
EC1	Energy efficient appliances usage	200
EC2	Smart building implementation	300
EC3	Number of renewable energy sources on campus	300
EC4	Total electricity usage divided by total campus' population (kWh per person)	300
EC5	The ratio of renewable energy production divided by total energy usage per year	200
EC6	Elements of green building implementation as reflected in all construction and renovation policies	200
EC7	Greenhouse gas emission reduction program	200
EC8	Total carbon footprint divided by total campus' population (metric tons per person)	200
EC9	Number of innovative program(s) in energy and climate change	100
EC10	Impactful university program(s) on climate change	100
Total	21%	2,100

Table 4. Criteria and Indicators for Waste (WS)

No.	Waste (WS)	Point
WS1	3R (Reduce, Reuse, Recycling) program for university's waste	300
WS2	Program to reduce the use of paper and plastic on campus	300
WS3	Organic waste treatment	300
WS4	Inorganic waste treatment	300
WS5	Toxic waste treatment	300
WS6	Sewage disposal	300
Total	18%	1,800

Table 5. Criteria and Indicators for Water (WR)

No.	Water (WR)	Point
WR1	Water conservation program & implementation	200
WR2	Water recycling program implementation	200
WR3	Water efficient appliances usage	200
WR4	Consumption of treated water	200
WR5	Water pollution control in the campus area	200
Total	10%	1,000

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Table 6. Criteria and Indicators for Transportation (TR)

No.	Transportation (TR)	Point
TR1	The total number of vehicles (cars and motorcycles) divided by total campus' population	200
TR2	Shuttle services	300
TR3	Zero Emission Vehicles (ZEV) policy on campus	200
TR4	The total number of Zero Emission Vehicles (ZEV) divided by total campus population	200
TR5	Ratio of ground parking area to total campus' area	200
TR6	Program to limit or decrease the parking area on campus for the last 3 years (from 2022 to 2024)	200
TR7	Number of initiatives to decrease private vehicles on campus	200
TR8	Pedestrian path on campus	300
Total	18%	1,800

Table 7. Criteria and Indicators for Education and Research (ED)

No.	Education and Research (ED)	Point
ED1	The ratio of sustainability courses to total courses/subjects	300
ED2	The ratio of sustainability research funding to total research funding	200
ED3	Number of scholarly publications on sustainability	200
ED4	Number of events related to sustainability	200
ED5	Number of activities organized by student organizations related to sustainability per year	200
ED6	University-run sustainability website	200
ED7	Sustainability report	100
ED8	Number of cultural activities on campus	100
ED9	Number of university sustainability program(s) with international collaborations	100
ED10	Number of sustainability community services project organized and/or involving students	100
ED11	Number of sustainability-related startups	100
Total	18%	1,800

The scoring for each indicator is numeric, allowing for statistical analysis. Raw scores are weighted according to the criteria and aggregated to determine the final ranking score. Universities achieving higher scores demonstrate excellence in implementing sustainability practices across these dimensions.

Data Submission

Data submission for the 2024 rankings is conducted through an online platform, with universities required to submit their data between May and October 2024. The validation process occurs between October and November 2024, ensuring the accuracy and reliability of submitted data. The final results are announced in December 2024, reflecting the cumulative efforts of participating universities (UI GreenMetric, 2024).

Results and Discussion

UI Green Metric World University Rankings Results

The UI Green Metric World University Rankings have expanded significantly since their establishment in 2010, marking milestones in sustainability benchmarking for higher education. Table 8 provides a comprehensive summary of the number of participating universities, countries, and Thai institutions,

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alongside annual highlights. Participation increased from 95 universities in 35 countries in 2010 to a record 1,477 universities in 95 countries in 2024. Key developments include the introduction of SDG-aligned indicators in 2015, revisions to scoring metrics in 2018, and a growing emphasis on global collaborations and long-term sustainability in 2024. Thailand's participation has also grown, with the number of universities increasing from 2 in 2010 to 59 in 2024, highlighting the country's strong commitment to sustainability in education.

Table 8. Number Of Participating Universities, Countries, and Thai Universities, Along with The Key Highlights for Each Year

Year	Number of Participating Universities	Number of Participating Countries	Number of Universities from Thailand	Key Highlights
2010	95	35	2	Launch of the inaugural rankings by Universitas Indonesia; pioneering effort in sustainability metrics.
2011	178	42	5	Significant growth in participation; introduction of standardized reporting for sustainability efforts.
2012	215	49	6	Expansion to Latin America and the Middle East; focus on energy, water, and transportation metrics.
2013	301	54	13	Enhanced evaluation methodology; greater diversity in institutional participation worldwide.
2014	360	62	15	Strong focus on waste management and climate change adaptation; increased involvement from Asia.
2015	407	65	19	Introduction of six main categories; integration of SDG-aligned indicators for the first time.
2016	516	74	22	Substantial increase in African university participation; emphasis on renewable energy practices.
2017	619	76	27	Introduction of mobility-focused criteria; rise in participation from South America.
2018	719	81	24	Significant revisions to scoring metrics; major participation from Southeast Asia and Europe.
2019	780	84	37	Record number of participants; introduction of water conservation metrics and digital integration.
2020	912	86	37	Adaptations for data collection during COVID-19; focus on health and resilience initiatives.
2021	956	87	39	Increased alignment with UN SDGs; higher representation from universities in Central Asia.
2022	1050	89	47	Focused on "Sustainability Innovation" and the integration of local cultural practices into rankings.

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2023	1182	91	55	Theme: "Innovation, Impacts, and Future Directions of Sustainable Universities"; growth in Arab region.
2024	1477	95	59	Highest participation to date; emphasis on long-term sustainability policies and global collaborations.

Mahasarakham University (MSU) has actively participated in these rankings since 2011. As shown in Figure 3, the university's global ranking has improved significantly, moving from 140th in 2011 to its best position of 100th in 2024. This consistent improvement underscores MSU's dedication to sustainability practices, which are strategically aligned with the six assessment categories: Setting and Infrastructure (SI), Energy and Climate Change (EC), Waste (WS), Water (WR), Transportation (TR), and Education and Research (ED) (UI Green Metric, 2024).

Figure 4 presents MSU's national ranking history, showing a strong performance among Thai universities. Initially ranked 11th nationally in 2011, MSU climbed to 6th in 2024. This progress reflects the university's ability to adapt and innovate within its sustainability framework, particularly in response to increasing national and global competition in the UI Green Metric rankings.

Figure 5 illustrates MSU's total score growth, which rose from 4,356 in 2011 to 8,475 in 2024. The score increase demonstrates systematic enhancements across all assessment categories. The most notable improvements are in Energy and Climate Change (EC) and Education and Research (ED), which have shown substantial contributions to the university's total score. These improvements highlight the university's focus on renewable energy projects, carbon footprint reduction, and the integration of sustainability principles in academic programs (UI Green Metric, 2023; Sribanasarn et al., 2024).

Figure 6 provides a category-wise breakdown of scores over time. The steady rise in the EC and ED categories is particularly noteworthy. This growth aligns with MSU's initiatives to promote energy efficiency through the adoption of renewable energy technologies and to expand sustainability-related research and education. The university's efforts have included increasing the proportion of sustainability courses and research funding, organizing events and activities focused on sustainability, and fostering international collaborations (Domingos et al., 2024; Phrophayak et al., 2024).

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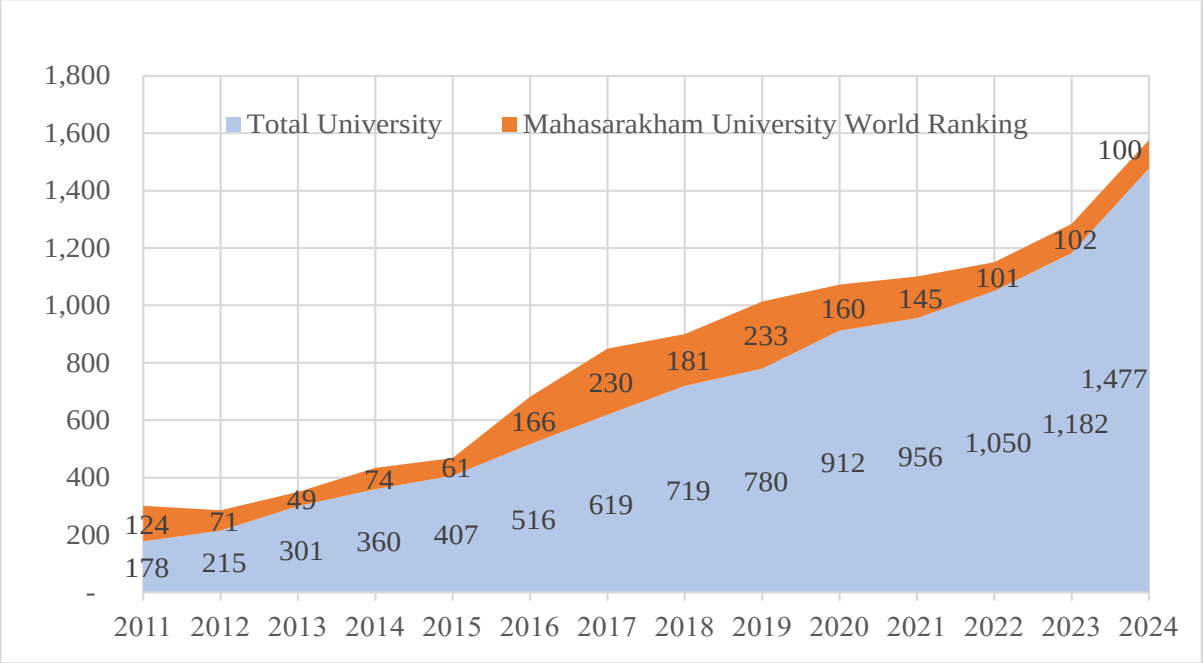

Figure 3. World Ranking History 2011-2024 For Mahasarakham University

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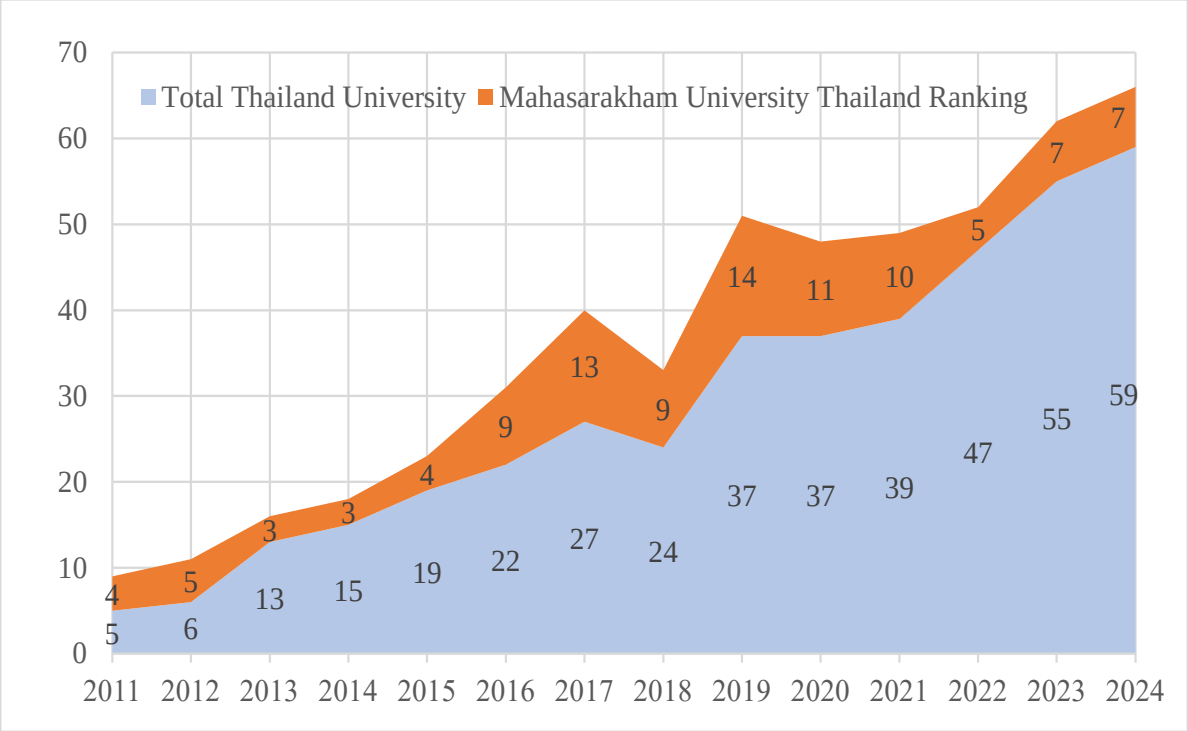

Figure 4. Country ranking history 2011-2024 for Mahasarakham University

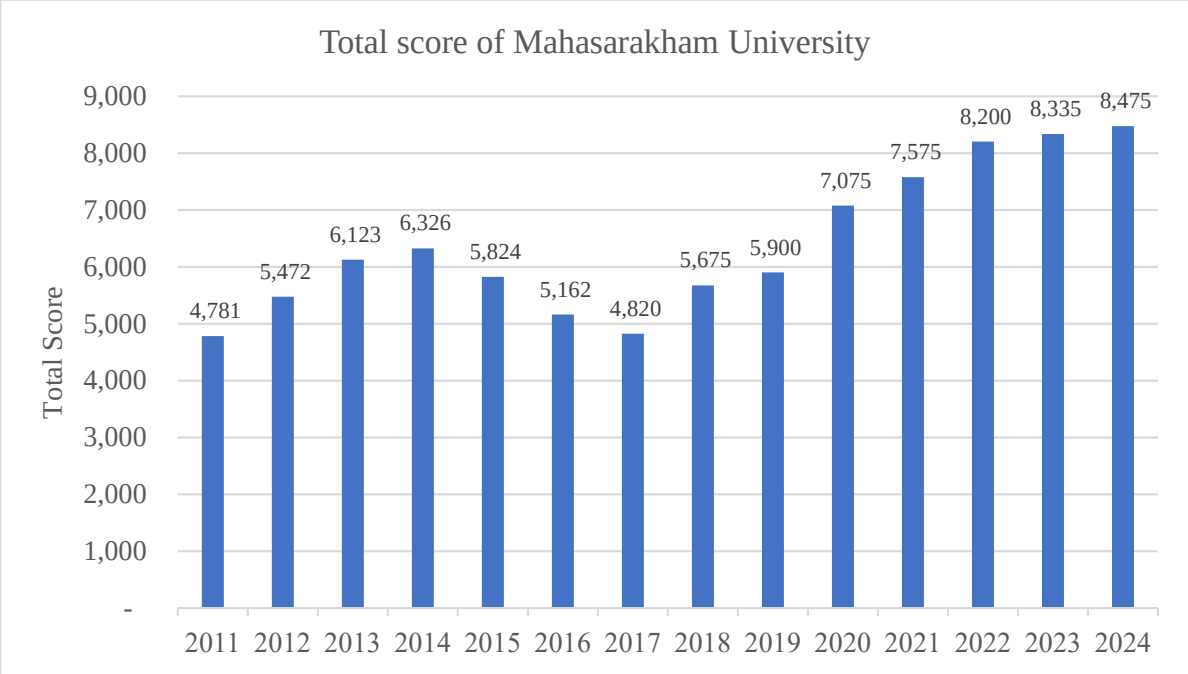

Figure 5. Total Score History Diagram

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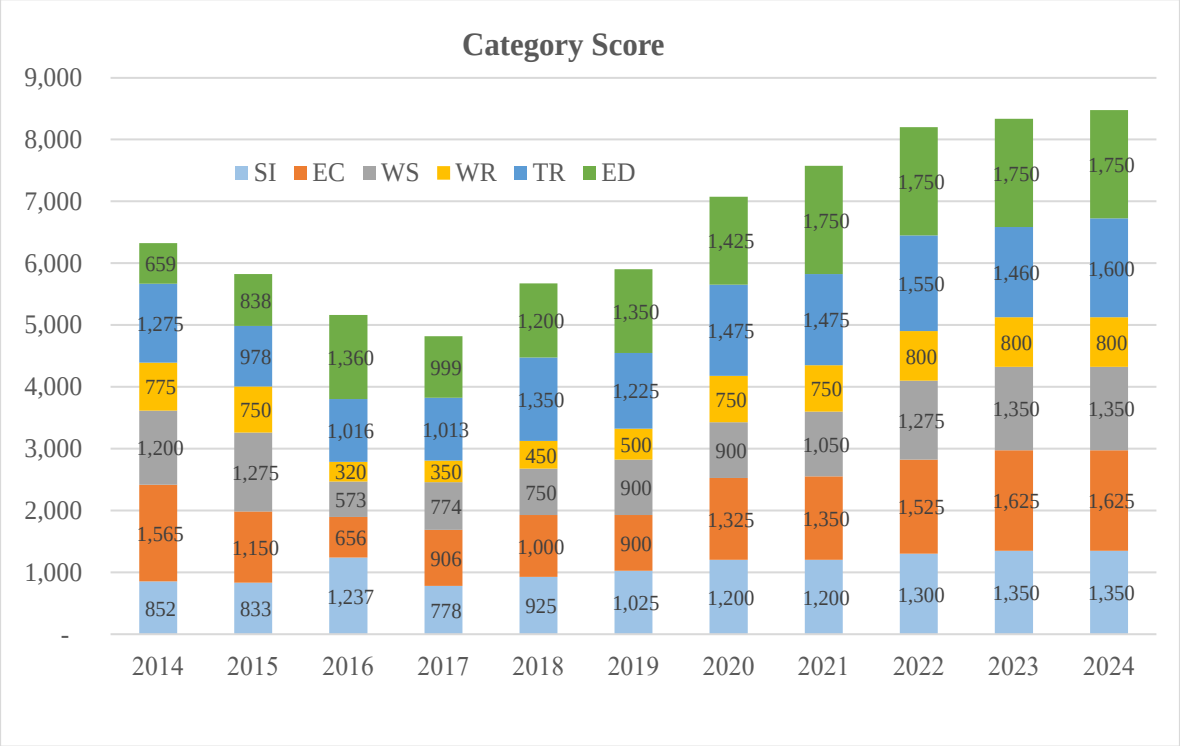

Figure 6. Score Diagram for Each Category

The consistent growth in MSU's global and national rankings reflects its commitment to achieving sustainable development in alignment with UI Green Metric criteria. The steady rise in total scores, as shown in Figure 5, is a testament to the university's strategic focus on all six categories, with particular strength in EC and ED. This progress aligns with broader trends in higher education, where institutions are increasingly integrating sustainability into their operations and academic frameworks (Phrophayak et al., 2024; Sribanasarn et al., 2024).

Thailand's increasing participation in the UI Green Metric rankings, as shown in Table 8, highlights the country's dedication to fostering sustainability in its higher education sector. The rise from 2 participating universities in 2010 to 59 in 2024 demonstrates a nationwide prioritization of sustainability, driven by supportive policies and initiatives that encourage institutions to align with global sustainability goals (Charmondusit and Saingam, 2024).

In conclusion, Mahasarakham University's upward trajectory in both global and national rankings underscores its role as a leader in sustainability within Thailand. By focusing on renewable energy, sustainability education, and impactful research, MSU has set an example for other institutions. These efforts, coupled with Thailand's collective push toward sustainability, indicate a promising future for green university initiatives in the region.

Ui Greenmetric World University Rankings Results 2024

Mahasarakham University achieved significant recognition in the UI Green Metric World University Rankings 2024 by fulfilling the evaluation criteria across six categories: Setting and Infrastructure (SI), Energy and Climate Change (EC), Waste (WS), Water (WR), Transportation (TR), and Education and Research (ED). The university earned a total score of 8,475 out of 10,000, achieving 83.35% of the maximum possible points. The detailed scores for each category are presented in Table 9, while Table 10 summarizes the university's world and national rankings by category.

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Table 9. Total Score 2024

Category	Points	Maximum Points	% Maximum
Setting and Infrastructure (SI)	1,350	1,500	90.00
Energy and Climate Change (EC)	1,625	2,100	77.38
Waste (WS)	1,350	1,800	75.00
Water (WR)	800	1,000	80.00
Transportation (TR)	1,600	1,800	88.88
Education (ED)	1,750	1,800	97.22
Total Score	8,475	10,000	83.35

Table 10. Results Summary World Ranking 2024

Category	World Ranking	Country ranking
Setting and Infrastructure (SI)	55	3
Energy and Climate Change (EC)	198	10
Waste (WS)	323	24
Water (WR)	256	22
Transportation (TR)	100	9
Education (ED)	73	6

Table 9 highlights Mahasarakham University's strength in Education and Research (ED), achieving 97.22% of the maximum score, which reflects the university's consistent investment in sustainability-oriented courses, research publications, and collaborative projects. The Setting and Infrastructure (SI) category also performed strongly, reaching 90.00% of its maximum points, demonstrating effective campus planning and resource management. The Water (WR) and Transportation (TR) categories scored 80.00% and 88.88%, respectively, underscoring the university's initiatives in water conservation, efficient water usage, and sustainable mobility strategies (UI Green Metric, 2024).

Energy and Climate Change (EC) and Waste (WS) categories, while scoring slightly lower at 77.38% and 75.00%, respectively, still reflect substantial progress. These results are indicative of ongoing efforts to implement renewable energy solutions, reduce greenhouse gas emissions, and improve waste management systems on campus (Phrophayak et al., 2024).

Table 10 presents the university's global and national rankings by category. Mahasarakham University achieved its best global ranking in the Setting and Infrastructure (SI) category at 55th, and its highest national ranking in the same category, placing 3rd among Thai universities. These achievements highlight the university's focus on creating sustainable and accessible campus environments. Similarly, the Transportation (TR) category, with a global ranking of 100th and a national ranking of 9th, reflects significant advancements in reducing carbon emissions and promoting eco-friendly commuting options (Charmondusit and Saingam, 2024).

Despite strong performances, there are opportunities for improvement. Categories such as Waste (WS) and Water (WR), with relatively lower rankings (323rd and 256th globally), indicate areas where Mahasarakham University can enhance waste treatment programs and water pollution control efforts to improve sustainability metrics further (Tabucanon et al., 2021; Sribanasarn et al., 2024).

Overall, Mahasarakham University's total score of 8,475 demonstrates its significant progress toward achieving sustainability goals. The university's targeted strategies and initiatives have placed it among the top-performing institutions globally, contributing to Thailand's growing prominence in green university rankings.

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Conclusion

In 2024, Mahasarakham University demonstrated commendable performance in the UI Green Metric World University Rankings, achieving a total score of 8,475 out of a maximum 10,000 points across six evaluation categories. This notable accomplishment underscores the university's ongoing commitment to sustainability in education, research, and operations.

The university excelled in Education and Research (ED), securing 1,750 points (97.22% of the maximum), highlighting its robust efforts in integrating sustainability into academic curricula, research funding, and community service projects. Similarly, Setting and Infrastructure (SI) received 1,350 points (90.00%), reflecting the university's effective management of campus facilities and green spaces. The Transportation (TR) category also showed strong performance, earning 1,600 points (88.88%), indicating successful initiatives in promoting eco-friendly mobility and reducing campus emissions.

Moderate achievements were noted in Water (WR) with 800 points (80.00%) and Energy and Climate Change (EC) with 1,625 points (77.38%), demonstrating steady progress in water conservation, renewable energy adoption, and climate change mitigation programs. However, the Waste (WS) category, with 1,350 points (75.00%), highlights an area where further improvements in waste reduction, recycling, and treatment could bolster the university's sustainability metrics.

Globally, Mahasarakham University was ranked 100th among 1,477 participating universities and achieved the 7th position nationally among 59 Thai universities. These rankings affirm the university's proactive approach to aligning its strategies with international sustainability standards and benchmarks. By consistently enhancing its operations in alignment with the UI Green Metric criteria, Mahasarakham University not only contributes to global academic discourse on sustainability but also sets a benchmark for higher education institutions striving for environmental excellence.

Looking ahead, further focus on underperforming areas, such as waste and water management, coupled with sustained efforts in education, infrastructure, and transportation, can propel Mahasarakham University to higher rankings in future evaluations.

Acknowledgements

This research was financially supported by Mahasarakham University. The authors would like to acknowledge the division of building and ground, Mahasarakham University for supporting research resources.

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"Evaluating the Impact of Community Sustainability Engagement on University Global Reputation"

TITLE	SOURCE
3) Implementing Corporate Social Responsibility for Sustainable Education : A Comprehensive Case Study Analysis (2024)	INTERNATIONAL CONFERENCE ON CYBER RESILENCE (Article From : IEEE)

25th JUNE 2025

SOURCE: PERPUSTAKAAN UTM

Implementing Corporate Social Responsibility for Sustainable Education: A Comprehensive Case Study Analysis

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2024 2nd International Conference on Cyber Resilience (ICCR) | 979-8-3503-9496-2/24/$31.00 ©2024 IEEE | DOI: 10.1109/ICCR61006.2024.10532972

***Abstract* -This article presents an insightful examination of how higher education institutions are increasingly adopting responsible and sustainable practices, driven by the expectations of their communities and stakeholders. It delves into the heightened focus of universities on ethical, social, and environmental accountability, extending beyond their immediate campuses to their global partnerships. This shift is largely influenced by evolving educational policies, the proactive demands of students and faculty, and the imperative to uphold a sterling institutional reputation. The Key external drivers for companies to improve supply chain sustainability ranges from emerging regulations, investor priorities, consumer demand, competitive pressures, advocacy campaigns, and reputational risk management. Implementation is driven by internal commitments aligned with stakeholder values. Benefits include efficiency gains, innovation opportunities, employee engagement, positive social impacts, supporting overall risk mitigation, profitability, and competitive positioning.**

Notably, universities are discovering that their commitment to sustainability is not only ethically sound but also conducive to improving operational efficiency, fostering innovation, and making a tangible difference in society. However, the journey is not without its challenges. Universities are grappling with the need to consistently adhere to these ethical practices, maintain transparency in their dealings, and ensure uniformity in sustainability efforts across various departments and collaborations.
The article concludes by emphasizing the need for further exploration in this domain, particularly in seamlessly integrating corporate social responsibility CSR throughout the academic environment. It underscores the importance of focusing on smaller educational institutions and considering the long-term impacts of these sustainability initiatives. The potential of emerging technologies in solidifying these efforts is also highlighted as a key area for future development.

Keywords - Corporate Social Responsibility (CSR), Sustainability, Supply Chain Sustainability, Higher Education, Jordan, University of Petra (UOP), Sustainable Development Goals (SDGs).

I. INTRODUCTION

CSR has become a subject of business and management research. Beyond profit, CSR covers firms' responsibility to consumers, employees, communities, and the environment in addition to its ability to supply chains' social, ethical, and environmental performance improvements [1] [2]. To maximise long-term economic, social, environmental well-being, sustainable supply chain management coordinates product design, raw material procurement, manufacture, shipping, retail, and end-of-life management, the study of such discipline is highly important [3]. Additionally, customers, regulators, investors, and advocacy groups are urging corporations to increase supply chain transparency ethical, and green practises [4]. Complex worldwide supply chains make CSR and environmental projects challenging to implement.

In a complex globalised economy with rising stakeholder pressures, shrinking ecological buffers, and growing inequality, corporate executives must prioritise sustainability. As climate change, pollution, biodiversity loss, resource depletion, and societal challenges including poverty, conflict, and migration crises grow, companies must manage negative impacts throughout operations and supply networks. This changing landscape is prompting firms to rethink profit-maximizing strategies based on short-term shareholder returns and create longer-term plans that combine environmental, social, and ethical obligations.

Nevertheless, some firm leaders believe ethics, responsibility, and regeneration are essential to succeed as regulators, investors, consumers, employees, and activists increase pressure. Science-based pledges strengthened by system improvements and open cooperation can lead to long-term commercial and societal success. Discussing responsible supply chain management drivers, benefits, and problems. Supplier codes of conduct, sustainability reporting,

circular economy business models, blockchain traceability, and social auditing best practises are examined.

From basic concepts, vocabulary, and theoretical foundations, managers, academics, and advocates can carefully analyse priority areas for converting global supply networks into ethical and ecologically regenerative models.

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2.1 Corporate Social Responsibility (CSR)

The research keywords for CSR are sustainability strategy, performance, stakeholders, developing nations, climate change, and supply chain management. Corporate social responsibility involves socially beneficial corporate activities [5]. A company's CSR programmes demonstrate its commitment to sustainable development by managing environmental, social, governance, and economic impacts [6]. ISO 26000 guides CSR integration into company operations and stakeholder relations [7].

CSR is linked to corporate citizenship, triple-bottom-line accounting (financial, social, and environmental), business ethics, transparency, and stakeholder management [8]. It moves away from the shareholder primacy paradigm that maximises profits to a more comprehensive view of business-society relations [9]. Sustainability reporting, ethical codes of conduct, employee volunteering, philanthropic donations, human rights protections, local community development projects, and environmental conservation are common CSR practices [10].

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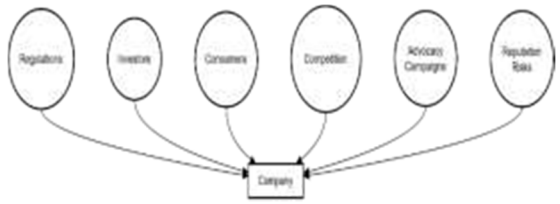

Fig.1 shows the external drivers leading organisations to improve supply chain sustainability

2.2 Corporate Social Responsibility (CSR) Towards Sustainable Education

Supply chain management involves coordinating flows of products, services, finances, information, and decisions among a network of organizations across procurement, manufacturing, logistics, and distribution processes to deliver value to the end consumer. Several interrelated factors are driving increased adoption of ethical, environmental, and social sustainability initiatives across global supply chains. They include regulatory pressures, investor expectations, consumer demand, competitive pressures, advocacy campaigns, and reputational impacts as shown in table 1.

Table 1: Drivers of Supply Chain Sustainability

Driver	Description
Regulatory Pressures	Government regulations related to sustainability reporting, responsible sourcing, etc.
Investor Expectations	Growth of ESG criteria driving investment decisions
Consumer Demand	Surveys show consumers factor sustainability into purchases.
Competitive Pressures	Sustainability is becoming an industry norm across sectors.
Advocacy Campaigns	NGO awareness campaigns pressuring brands on issues
Reputational Impacts	Supply chain scandals can severely damage brand reputations.

According to research, supply chain ethics, social, and environmental sustainability requirements help firms and society [11].

2.2.1 Manage Risk

Enterprise risk management must assess and handle supplier network human rights violations, climate change impacts, resource restrictions, corruption concerns, and pollution hazards to maintain long-term business continuity, stability, and resilience [12].

2.2.2 Efficiency, Operations

Eliminating waste and hazardous materials from manufacturing, conserving energy, water, and materials, recycling, and optimising processes can save operating costs and boost profits [13].

2.2.3 Product Innovation

Brands may become sustainability leaders by designing products and services to promote social good and reduce environmental lifetime impacts, opening new markets and increasing revenue [14].

2.2.4 Worker Engagement

Corporate values and purpose initiatives promote social responsibility and employee participation, attracting, retaining, motivating, and boosting talent [15].

2.2.5 Civic Goodwill

Over time, strategic social engagement, local capacity building, infrastructure improvements, livelihood creation, and microenterprise partnerships create community trust and goodwill, enhancing the social licence to operate [16].

2.2.6 Growth sustainably

Over time, the benefits mentioned improve financial performance, competitive positioning, stakeholder support, and social legitimacy, laying the groundwork for long-term success [17].

3. Major challenges in Sustainable Education Development

The table focuses on what sort of challenges are to be faced and dealt with by universities and educational institutions especially when trying to implement comprehensive

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supply chain sustainability. These initiatives face several pragmatic challenges [18].

Table 2: Challenges of Sustainable Supply Chain Management

Challenge	Description
Supplier Buy-In	Suppliers resistant to adopting costly sustainability changes
Monitoring Complexity	Limited visibility across complex multi-tier supply chains
Uneven Regulations	Varying and limited national sustainability regulations
Consumer Scepticism	Growth in scepticism towards corporate "greenwashing"
Conflicting Priorities	Navigating trade-offs between profits, speed, quality and sustainability
Resource Requirements	Large expertise, data and capital needed for robust initiatives

4. Sustainable Development Solutions

Leading firms use ethical sourcing rules, supplier assessments, sustainability reporting, circular business models, traceability systems, social audits, and corrective action processes to integrate sustainability throughout essential supply chain operations [19]. The 17 SDGs' 169 targets form a widely acknowledged 2030 sustainable development agenda.

4.1 SDGs as a Framework for CSR

Broad and diverse topics are covered by the Sustainable Development Goals SDGs and associated targets. Diverse industries and contexts find different levels of significance in various sustainable development issues. Nowadays knowing that the SDGs offer a thorough framework for determining which of the numerous sustainable development issues should be prioritized. Companies can increase the scope of their measurement efforts while reducing the number of important issues that need to be considered into regard. On the other hand, the SDGs provide an extensive framework that directs CSR measures. Businesses have the potential to make significant contributions to global development by coordinating their initiatives with specific SDGs. The potential benefits of using the SDGs as indicators for businesses in setting up and arranging their CSR initiatives are discussed in this section.

4.1.1 Ethical sourcing codes

Formal supplier codes of conduct explicitly state that all supply chain partners must meet minimal social, environmental, health, safety, and governance criteria to do business [20]. Codes promote self-assessment and awareness.

4.1.2 Supplier Evaluations

Due diligence techniques evaluate risks, standards compliance, performance gaps, root causes, and competence limits across vendors to set a baseline for improvement [21]. Sustainability scorecards are widely used in assessments.

4.1.3 Sustainability Reporting

Supply chain rules, standards, management procedures, impact indicators, targets, and timetables are disclosed in public sustainability reports and online data portals to indicate priorities and track progress [22]. Reporting increases accountability.

4.1.4 Blockchain Tractability

New blockchain-based supply chain traceability technologies may track materials movements, document sustainability attributes, governance transactions, and compliance data in tamper-proof distributed ledgers [23].

4.1.5 Social Audits

Specialised social auditors inspect higher-risk suppliers' working conditions, labour rights, pay and benefits, health and safety, employment rules, management systems, and community impacts to uncover hidden issues [24].

4.1.6 Remedy Plans

Through root cause analysis, capability building, procedural changes, worker engagement, management system improvements, transparency enhancements, and verification, structured corrective action processes responsibly address chronic sustainability issues from assessments, audits, and incidents [25].

5. Conclusion

The paper concludes with a call to action to incorporate sustainability and corporate social responsibility into business goals. The paper within its sections highlighted how educational institutions might deploy CSR and the SDGs. Academia needs to invest further to deepen the sustainable development processes to face the growing global challenges. This study examines how universities may assist CSR programmes that benefit SDGs through research, innovation, and effective education.

Furthermore, CSR revolutionises supply chain management by increasing transparency, traceability, and accountability, enabling businesses to track products from source to destination, and mitigating fraud. Smart contracts automate legal processes, such as real estate transactions, by eliminating intermediaries and building trust among involved parties. Additionally, blockchain implementation reduces costs by eliminating intermediaries, particularly in financial institutions that benefit from efficient cross-border payments through cryptocurrencies like Bitcoin or stablecoins. Notably, blockchain's influence extends to developing countries, where it enables secure asset storage via internet-connected mobile devices, thus fostering financial inclusion on a global scale.

5.1. Suggestions for further Research

5.1.1 In-depth exploration of how CSR became committed to sustainable development and how to influence sustainable development goals would be very helpful.

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Further research might compare, for example, effective strategies for involving various stakeholders such as employees, local communities and educational institutions in CSR initiatives. Research and methodologies could be used to assess the social, economic and environmental impact of CSR initiatives in the education sector, and how collective analysis of successful CSR programs in other industries and regions might identify best practices that applicable and effective in the sustainable education involvement.

5.1.2 Research to develop frameworks for measuring and reporting the tangible outcomes of CSR initiatives in education would be beneficial. Although methodologically challenging, it would be very useful to conduct some longer-term studies of how CSR initiatives on education can be designed to examine the long-term ensuring sustained benefits for communities and the corporate entity

5.1.3 It would also be helpful to explore qualitatively the potential for partnerships between corporations, nonprofit organizations, and governmental bodies to enhance effectiveness of implementing CSR towards sustainable education.

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"Evaluating the Impact of Community Sustainability Engagement on University Global Reputation"

TITLE	SOURCE
4) Nursing and medical students' views on their knowledge related to the Sustainable Development Goals - A mixed methods study at three Swedish Universities (2025)	BMC MEDICAL EDUCATION (Article From : BIOMED CENTRAL LTD)

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BMC Medical Education

RESEARCH

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Nursing and medical students' views on their knowledge related to the Sustainable Development Goals – a mixed methods study at three Swedish universities

Maria Niemi[1*], Helle Mölsted Alvesson[1], Daniel Helldén[1], Olivia Biermann[1], Eva Henje[2], Helena Nordenstedt[1,4], Carl Johan Sundberg[3,5] and Tobias Alfvén[1]

Abstract

Background The challenges that the world faces to ensure good life for future generations are vast and complex. The United Nations Sustainable Development Goals (SDGs) aim to meet these challenges. A growing number of higher education institutions have integrated them within their curricula, but there are indications that health professional education has been lagging behind. Therefore, it is important to better understand the views of students in health professional education on the level and depth of their education on sustainable development.

Methods This sequential exploratory mixed methods study was based on survey responses from $N=294$ nursing ($N=137$) and medical ($N=157$) students of first and last semesters from three Swedish universities. From the full group of survey responders, 21 students participated in 5 focus group discussions (FGDs) and 9 individual interviews. The survey findings were summarized through descriptive statistics and the interviews and FGDs were analyzed by qualitative content analysis.

Results The survey findings showed that most students (63%) perceived that they had not learned enough about the SDGs and Agenda 2030 during their education, or for the purposes of their future career. Most of the students (63%) also thought that Agenda 2030 and the SDGs should be a greater part of their education. The qualitative data gave a more in-depth understanding of the quantitative findings, forming two themes: The first theme revealed that the SDGs may be more relevant for health care practice than what the students initially thought, but that the education they had received was in most places superficial, or not tied to the SDGs. The second theme detailed what and how students wished to learn more about. Here, they called for a more in-depth understanding of how to promote equality, equity, inclusion and psychosocial aspects in health care. They also hoped for more knowledge about how to ensure a sustainable working life for themselves.

Conclusions Nursing and medical students at three Swedish universities experience that they lack the knowledge necessary to face sustainability challenges they encounter in working life and give some suggestions about how this may be improved in future education.

Keywords Sustainable development, Higher education, Medical professionals education, Students

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Introduction

The challenges that the world faces to ensure good life on earth for current and future generations are vast and complex [1], and the UN's Sustainable Development Goals (SDGs) and Agenda 2030 aim to meet these challenges [2]. Ending poverty, improving health, social, and economic inequalities, improving education, and safeguarding a healthy environment are some of the SDGs [2]. Higher Education Institutions (HEIs) play an important role in contributing to these goals [3]. In particular, health professions education plays a role in equipping future health professionals with the competences needed to sustainably promote health and well-being, while also taking sustainable health into account [4]. Sustainable health has been defined as *"a multisectoral area for study, research, and practice towards improving health and well-being for all while staying within planetary boundaries"* [5]. Moreover, higher education should prepare future health professionals to address unresolved and complex social, political, economic and environmental challenges [1].

A Lancet Commission for educating health professionals in the new century [6] has highlighted that medical schools are ill-equipped to prepare students for the complexities they face in working life. The complex challenges of new infectious, environmental, and behavioral risks, as well as rapid demographic and epidemiological transitions, call for new forms of education that can help develop a more relational view of the world [7]. This is a challenge for health professions education, which is still mainly based on traditional medical disciplines, with a strong bias towards cognition, one-way knowledge transmission, and a reductionistic biomedical paradigm [8]. According to some scholars in education for sustainable development, a new form of education is thus called for, which should enable students to become more adept in capabilities like systems thinking, handling uncertainty, changing perspectives, moral reasoning, tapping into diversity, and actively engaging in change and transformation [9, 10]. Moreover, the notion of "students as change agents" has been highlighted as an important focus for medical education [6].

A growing number of HEIs have already integrated sustainable development within their curricula, research, operations, outreach, assessment and reporting [1]. The SDGs can be integrated into higher education across disciplines and in various ways, e.g., through mandatory or elective courses, workshops and lectures [11]. However, there is still a need for an in-depth understanding of the views of health professional students on the education for sustainable development they obtain during their degree programs, as students have been highlighted as important change agents for sustainable development [12–15] and a recent international survey study highlighted that planetary health is poorly incorporated into medical school curricula [16]. Moreover, the authors of a recent scoping review [17] recommend that future research and education development should focus on how to best integrate planetary health medical education. To address these gaps in knowledge, the aim of this study was to explore how medical and nursing students at three Swedish universities experienced their education for sustainable development which was offered as part of their study program and its potential relevance for their future working life. According to the Swedish Higher Educated Act, paragraph 5, "In their operations, higher education institutions shall promote sustainable development, which means that current and future generations are assured of a healthy and good environment, economic and social welfare and justice." [18]. However, to our knowledge the integration of this mandate into health professions education has not yet been studied in the Swedish context.

Methods

Study design

This was a sequential exploratory mixed methods study [19] using a survey, focus groups and individual interviews to collect information about student experiences and views of students in health professional education on the level and depth of their education on sustainable development. The study was approved by the Stockholm Regional Ethical Review Authority with approval number 2021–04960, and complies with the Declaration of Helsinki in its latest version.

Sampling

The inclusion criteria for the study were: Any student of the nursing or medical programs at either the first or final semester of their program respectively (semester six for nursing students, semester eleven for medical students) at Karolinska Institutet (KI), Uppsala University (UU) or Umeå University (UMU) in Sweden. Three different universities were chosen to allow for a broader perspective of how sustainable development is taught and learnt/experienced within nursing and medical education in Sweden.

Recruitment

To recruit students to the study, names and e-mail lists of all students filling the inclusion criteria were requested from the study directories at each of the three universities. The population from which the sample was therefore all listed students in first and final semesters of the two study programs at the three universities, resulting in altogether 945 nursing students and 738 medical students. No power calculation was conducted to guide the

sample size, rather, we sent an invite to participate to all students meeting the inclusion criteria. An e-mail and two follow-up reminders with an invitation to participate in the survey, which was estimated to take approximately 10 min to complete, was sent to all listed students' e-mail addresses. The students were asked for written informed consent before responding to the survey. Two cinema tickets were drawn out randomly to one survey participant in each semester as compensation. At the end of the survey, students were also asked to indicate if they would like to participate in a focus group discussion (FGD), and if so, to provide their e-mail address. All students who had provided their e-mail address were thereafter contacted to schedule a time for a FGD via zoom. However, due to the difficulty of recruiting students at time points that suited several of them, individual interviews were conducted with those students where an FGD was not feasible. All FGD and interview participants we asked for verbal informed consent, which was audio recorded prior to participation in the interview or FGD.

Data collection

The survey was designed to capture whether students had obtained education for sustainable development in their study program and whether the education was perceived as relevant and sufficient. The SDGs were used as a framework for designing the survey, and for priming the survey respondents about what is meant by "sustainable development" for the purposes of the study. Also, demographic data about sex, age, study program, semester and university were collected. The survey was collaboratively developed by the research team, pilot tested with two medical students, and distributed via the KI Survey online platform which is a survey hosted on secure servers at Karolinska Institutet. The responses for each statement were given on 4-point Likert scales ranging from "agree fully" to "don't agree at all", with an additional "I don't know" option for each question. The survey was developed for the purposes of the present study and an English translation can be found in Appendix 1. Anonymized survey results were downloaded from the survey program as excel sheets which were then converted to SPSS for analysis.

The qualitative interview guideline was developed by the research team, including experts in qualitative research, and aimed to capture information about student experiences of their sustainable education (see interview guide in appendix 1). The study design was sequential exploratory mixed methods, implying that the qualitative interview/FGD participants were selected from among the survey participants, and the interviews/FGDs aimed to provide an in-depth understanding of the quantitative findings. The interviews/FGDs focused on overarching questions, which were further explored with relevant probes. FGDs and interviews were conducted in Swedish by the first author of the study. In preparation for the interviews, the students were sent a link to the UN SDG's page [2] and asked to read through the overarching information about each SDG. They were also given the Swedish education Act statement of how universities should include sustainable development [18]. This was to ensure the students had a common understanding of what was meant by education for sustainable development in the interviews. The interviews and focus groups were conducted by the first author who is a public health researcher working with educational development for sustainable development at one of the universities where the study was conducted. The interviewer thus had a broad and in-depth understanding of the relevance of the SDG:s for health care professions education, but had no previous contact with the students being interviewed. While the interviewer herself endorsed an expectation that education for sustainable development is an important endeavor for medical universities, she was aware of this possible bias during the interviews and allowed and encouraged the entire range of possible student views on this matter as equally important and relevant.

The interviews were audio recorded and transcribed verbatim, and the transcribed text was converted to excel worksheets for analysis. Only the quotes that were chosen for the results section were translated to English by a bilingual researcher.

Analysis

Descriptive statistics were used to summarize baseline data of the participants and to assess whether there were differences in the agreement levels of each survey statement between programs (medical/nursing) and universities (KI, UU, UMU). One way ANOVA was conducted, where the response mean value (omitting the "don't know" response option) was the dependent variable and the university semester was the independent variable. All statistical analyses were performed with IBM SPSS Statistics, version 28.0.1.1 [13]. The quantitative analysis was conducted separate from the qualitative analysis, i.e. the data sets were not merged for analyses, but the qualitative results were rather used to provide in-depth understanding of the overall quantitative findings.

The interviews and FGDs were analyzed with qualitative content analysis with an inductive approach where the sub-categories, categories and themes were allowed to emerge from the data [20, 21]. The analysis was conducted by the first author of the study and was validated by the last author and any discrepancies

Table 1 Table of survey participants

Gender N (%)	Female 226 (77); Male 62 (21); Other 4 (1,4); Prefer not to say 2 (0,7)											
Age range (mean)	18–49 (25,6)											
Study program	Medicine						Nursing					
N (%)	157 (53)						137 (47)					
Semester	First			Final			First			Final		
N (%)	86 (55)			71 (45)			85 (62)			52 (38)		
University	KI	UU	UMU	KI	UU	UMU	KI	UU	UMU	KI	UU	UMU
N (%)	41 (48)	25 (29)	20 (23)	24 (34)	20 (28)	27 (38)	31 (37)	34 (40)	20 (24)	22 (42)	10 (19)	20 (39)

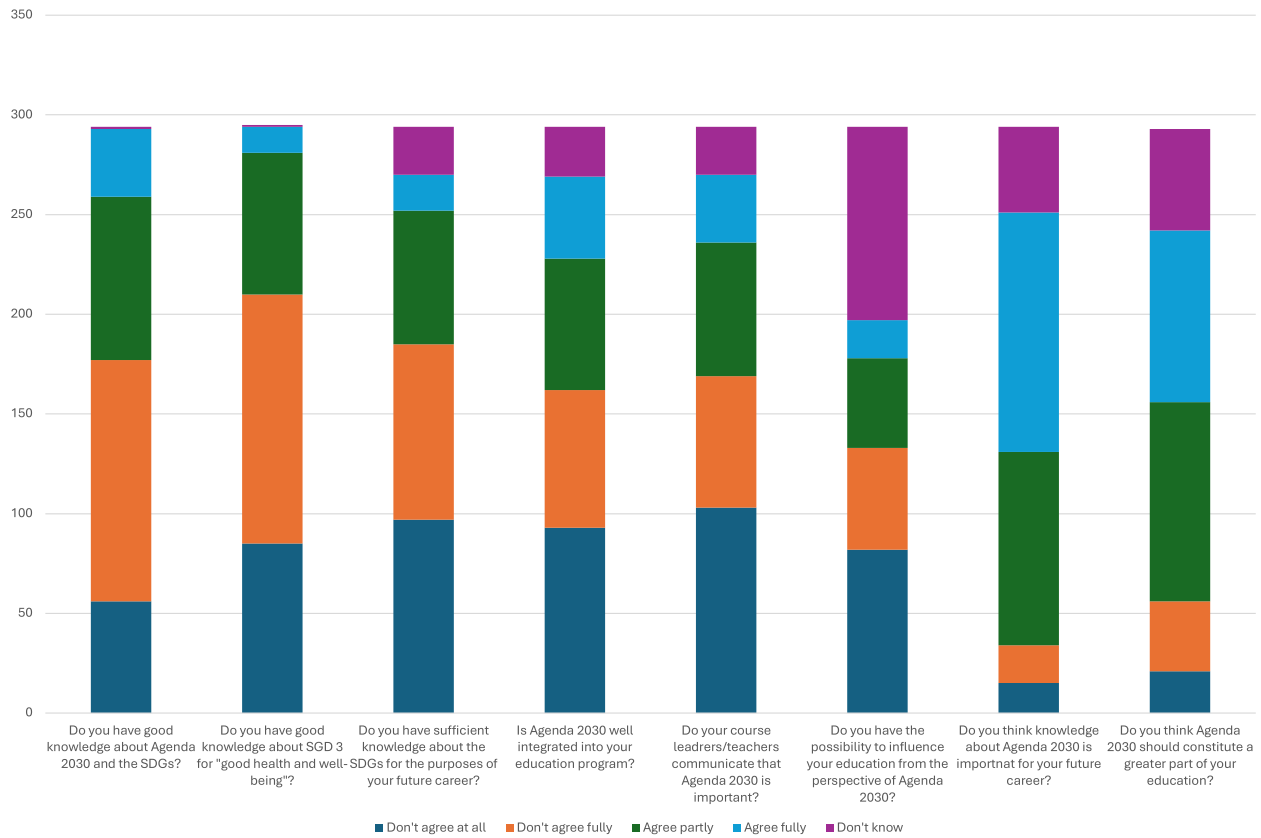

Fig. 1 Survey responses per question and response category

between their interpretations of the data were discussed and resolved. In the analysis, first, any differences in findings between the three universities, the two study programs and the semesters were sought. However, since no obvious differences in findings from the three universities emerged, the qualitative analysis was conducted on all interviews and the FGDs from all the sites merged. Only findings from study semesters (first vs last semester) and education programs (nursing vs medical students) were separated, whenever findings differed between them.

Results

Altogether, $N=294$ students (18%) participated in the survey, and the breakdown of the recruitment variables into universities, programs and semesters are shown in Table 1. The mean age of the participants from all programs was 24 years. Participants from the nursing program were 92% were females and 7% were males, while 0,7% indicated neither sex. Among medical program participants, 64% were females and 33% were males, while 3% indicated neither sex.

Figure 1 presents the responses from the entire participant group, broken down into the different survey

Table 2 Sociodemographic background of participants in qualitative study, and numbers of participants divided by study program and university

Sex/gender		19 females, 2 males											
Age range/mean		19–37/25,8 years											
University		KI				UMU				UU			
Study program		Nurse		Med		Nurse		Med		Nurse		Med	
Semester		First	Final	First	Final	First	Final	First	Final	First	Final	First	Final
N interview	9	1	-	-	2	1	1	-	-	-	2	-	2
N FGD	12		2	4				2		2		2	

KI Karolinska Institutet, *UMU* Umeå University, *UU* Uppsala University, *FGD* Focus Group Discussion

questions and response categories. For the first survey question, "do you have good knowledge about Agenda 2030 and the SDGs?", the majority of students responded either "don't agree at all" (19%) or "don't agree fully" (41%). For the second question "do you have good knowledge about SGD 3?", also the majority responded "don't agree at all" (29%) or "don't agree fully" (43%). In contrast, for the 7th survey question"do you think knowledge about Agenda 2030 is important for your future career?", the vast majority of students responded either "agree partly" (33%) or "agree fully" (41%). This was also true for the eighth question, "do you think Agenda 2030 should constitute a greater part of your education?", where 34% responded "agree partly" and 29% responded "agree fully".

There were no significant differences between study programs (medical or nursing) in the reported levels of knowledge about the SDGs and Agenda 2030 overall or SDG3 in particular, nor in the self-assessed knowledge about the SDGs for the purposes of their future careers. Nursing and medical students did not differ significantly in their responses regarding whether Agenda 2030 was sufficiently integrated into their program, their ability to influence their program content in relation to the SDGs and Agenda 2030, the perceived importance of the SDGs for their future career or reporting that there should be more education on the SDGs in their programs. However, medical students were more likely to report that their course leaders/teachers had emphasized the importance of the SDGs for their education than for their future career ($p=0.004$).

There were no significant differences depending on whether students were in first or last semester regarding the reported levels of knowledge about the SDGs overall, or SDG3 in particular, nor in the perception of having sufficient knowledge about the SDGs. However, students in their first semester were more likely to report that education about the SDGs was included in their programs, compared to the students who were in their final semester ($p=0.017$). Moreover, the communicated importance of the SDGs by course leaders/teachers, the perceived ability to impact the content of their education, or the perceived importance of being educated in the SDGs did not differ depending on how far the students had progressed in their programs.

There were differences between the universities that related to knowledge about SDGs, where students from UU reported higher levels of knowledge of SDG3 than students from UMU ($p=0.038$). Students from KI were more likely than students from UU or UMU to report having sufficient knowledge about the SDGs for the purposes of their future career, and students from UU were also more likely to report higher levels of adequate knowledge about the SDGs for the purposes of their future career than UMU students ($p=0.002$). Also, the same pattern of differences between the three universities emerged in the perception of the communication for course leaders/teachers about the importance of the SDGs ($p=0.012$). On the contrary, regarding the perceived ability to influence their education about SDGs, the perceived importance of the SDGs for their future career and the opinion that there should be more education about the SDGs in their study programs, students from UU agreed most to the statements, whereas KI students agreed second most and UMU students agreed least, with significant differences ($p=0.012$); ($p=0.31$); ($p=0.002$).

Altogether 21 students participated in in the qualitative part of the study; FGDs (12 students) and individual interviews (9 students) – see Table 2. These students did not clearly differ from the overall survey participants in their responses to the survey: A majority of the qualitative study participants (52%) responded either "don't agree at all" or "don't agree fully" to the first survey question, "do you have good knowledge about Agenda 2030 and the SDGs?"; the majority (71%) also responded "don't agree at all" or "don't agree fully" to the second survey question "do you have good knowledge about SGD 3?"; and the majority (76%) responded "agree partly" or "agree fully" to the eighth question,

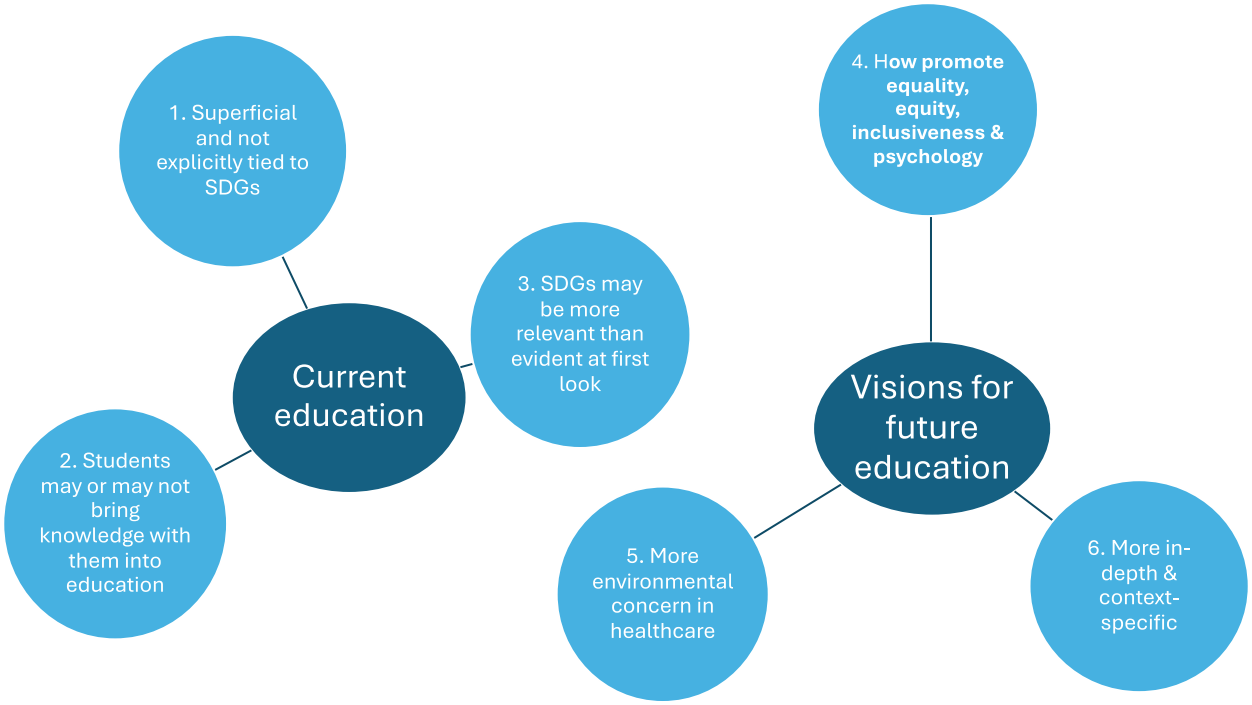

Fig. 2 The themes and categories that emerged form qualitative analysis

"do you think Agenda 2030 should constitute a greater part of your education?". However, they differed from the survey responders in their response pattern to survey question 7"do you think knowledge about Agenda 2030 is important for your future career?", with the most common answer (28%) being "I don't know".

The length of the interviews varied between 20 and 30 min, while the FGDs lasted between 45 and 60 min. The analyses of this data allowed for an in-depth understanding of why students in the survey witnessed to not having sufficient knowledge about the relevance of the SDGs for the purposes of their future profession and why Agenda 2030 should constitute a greater part in their education, as well as how teachers might effectively incorporate this knowledge into the programs. Data saturation did not guide the number of interviews/FGDs, as we included all students in the qualitative study who were willing to participate. However, during the course of the data gathering, we did experience that data saturation was achieved. The analysis resulted in two themes: 1) "current education" and 2) "visions for future education", with altogether six categories, described in the following with quotes that illustrate some of the prominent perspectives more in-depth. The themes and categories are illustrated in Fig. 2. In the text we have provided participant quotes to illustrate the sub-categories, and to denote which participant the quote came from we have indicated the participant sex, study semester, study program and university acronym (KI, UMU or UU).

Current education

The overarching theme "current education" consisted of the following categories, described below.

Superficial and non-explicit education on SDGs

First semester medical students mentioned that they had received some form of education about the SDGs, which ranged from the SDGs having been mentioned at some point, to a whole week addressing sustainable development. The topics thus covered included equity as well as sustainable development in health care. However, some of the medical students felt that this education had been rather superficial.

First semester nursing students also recognized that they had received education on the SDGs, for example in relation to public health work, and focusing on equality and equity in health, as well as in relation to antimicrobial resistance. However, in some instances this education was described as superficial and as having felt like "ticking a box".

Last year medical students described that they had all received education about the SDGs, but to varying degrees: Some said that they had only been mentioned at some particular lectures such as in relation to environmental factors as risk factors for stroke, primary

prevention of chronic illnesses, global child health, water-borne infections, vaccination, the effects of certain medications on the environment and social determinants of health. Others described that they had received more in-depth education on the SDGs, mainly through elective courses in for example "global health", which they described had been inspiring. Moreover, some described that for example aspects relating to gender equality and inclusiveness in health care had been taught in depth, but not clearly tied to the SDGs.

The final year nursing students also described having received more in-depth education on the SDGs if they had chosen an elective course on "global health". Otherwise, the SDGs had seldom been explicitly mentioned, apart from in a few instances. Some mentioned that ecological sustainability had been brought up in their clinical training, regarding sustainable material choices and the effects of medications on the environment. Some also remembered having received an introductory lecture about the SDGs in their first year of study. Equality and equity were also described by these students to have been taught about in-depth, but not related explicitly to the SDGs:

> *"We may have talked about some of these topics more than the other topics. For example, issues of gender equality, they usually come up during education where they talk a lot about healthcare on equal terms, that you must give the right care to everyone regardless of what background they have or other things." (Female, 11th sem. medical, UU)*

Large variety in student knowledge

The first year medical and nursing students had a variety of previous knowledge about the SGD:s, for example some had previous university education where the topics of sustainable development had been brought up, while others had learnt a lot about the SDGs and sustainable development in high school.

> *"My primary school education was quite good, they had a huge focus on it, at least my handicraft teacher, back then there was a huge focus on the global goals, you had to connect your own project to the global goals." (Male, 1st sem. medical, KI)*

Others had heard about sustainable development at their workplaces as well. Further, other participants had no prior knowledge and had never heard about sustainable development prior to their medical or nursing education.

Some of the first semester nursing students described personal engagement in sustainable development issues, such as being motivated by a love for nature and animals, or thoughts about future generations' well-being in case they were to have children of their own.

Some of the final year medical students also described having strong personal engagement in sustainable development issues, for example engagement in student associations for sustainable development as well as labor unions. Others, however described that even if they were interested to engage in these issues, they found that the education program was demanding to the extent that they didn't have much time or energy left for extra-curricular engagements.

SDGs more relevant than initially thought

While some did think it was important to work toward realizing the SDGs they found that it was difficult to understand how they could contribute to this in a positive manner through their medical vocation—also, the education they have received had not helped them understand this:

> *"Most of all, I kind of miss the connection to the medical profession, how you yourself as a doctor can contribute to the goals. And this lecture last week, it was also like more about the bigger picture. Not about how you yourself can influence something." (Female, 1st sem. Medical UU)*

A final year nursing student also described that it was difficult to impact sustainability issues through the nursing practice:

> *"In the hospital, there are certain things like how to dispose of things, throw things away, manufacture things, where you buy things from, it feels like it's sort of a management issue and not something that we nurses on the floor really have any influence on." (Female, 6thsem. Nurse, KI)*

However, at a closer look, some final year medical and nursing students did find that the SDGs were relevant for their clinical practice, for example if they met patients from difficult socio-economic conditions and could thus impact their psychosocial health status in various ways. Overall, some of them also emphasized the importance of medical practice taking environmental aspects into account. Yet others thought that the SDGs had no relevance for their future practice in medicine:

> *"I think [sustainable development] is relevant, but I won't become a better doctor in terms of knowledge through knowing these global goals, but the way I act as a doctor, I won't act based on what the UN says, but I'll act based on what I myself think; I want to promote equality and care on equal terms and so on." (Male, 1st sem. Medical, KI)*

Visions for future education

The overarching theme "visions for future education" consisted of the following categories, described below.

Promoting equality, equity, inclusiveness and psychological aspects

Medical and nursing students in both their first and final years described various subjects related to sustainable development and the SDGs that they thought they could learn more about during medical education. One of these subjects was equality and discrimination. Some described that they found it would be of importance to know how to promote inclusive health care and not to discriminate—they wished for more practical knowledge and skills for how to provide inclusive and non-discriminatory health care. Intercultural knowledge was also called-for, in terms of an increased understanding of the needs of patients with non-Swedish cultural or language backgrounds.

> *"I would still say that these intercultural meetings are important precisely because you know that these people receive lower quality care. And it is very relevant because, according to the law, everyone must be given equal care, regardless of background. But this is like a factor that you cannot influence in the same way: there are no guidelines that facilitate that meeting with those patients, or I am not aware of them." (Female, 6th sem. Nursing, UMU)*

Some topics related to equality and equity that the nursing students thought would be relevant to learn more about included how to communicate with people from a different cultural/educational background. Moreover, some medical and nursing students expressed an interest to learn more about global health problems, as well as the illness panorama that impacts migrant populations. Some medical students wished for more knowledge and practice on how to interpret and meet a patient's non-verbal behavior:

> *"But in the medical program, I think it's important to learn about meeting people like, how to interpret a person's non-verbal signals and the like. If you're going to work with people, it feels very important that you are good with people, both from the point of being able to see people but also from the fact that you yourself are sympathetic." (Female, 1st sem. Medical UMU)*

Many medical as well as nursing students expressed awareness of the stressful nature of their future work, relating to that many young clinicians burn out early in their careers. They thus hoped for more education about how to handle such emotional stressors, and wished to learn more about what organizational support structures exist that they could possibly turn to if needed.

Environmental awareness in health care

Both medical and nursing students mentioned various ecological sustainability issues that they would have liked to learn more about during their education programs. For example, some medical students would have liked to learn more about how pharmaceutical waste impacts the environment, so that they could make informed choices in their medical practice.

Some medical students expressed a personal interest in climate change issues, but thought it was difficult to see how these were connected to human health and wished therefore to learn more about these connections. Some expressed that health care at large seemed to lack appropriate concern for its climate impact—for example by unnecessarily using helicopters or other forms of operation that have large climate impacts. Moreover, medical as well as nursing students wished to learn more about the environmental impact of the materials they use in hospitals, such as single-use items, and to learn about more sustainable options. The impact of chemicals and pollution on health was yet another aspect that medical students wished to learn more about:

> *"I've even heard that fertility is affected by emissions and chemicals and like that there will be more in the future that people will have problems with their fertility and it also feels very relevant to us as doctors. It obviously depends on the specialty, but you want to prevent or be able to remedy anything that people can have problems with." (Female, 1st sem. Medical UMU)*

In-depth and context-specific teaching and learning

Both medical and nursing students had various suggestions about how sustainable development and the SDGs could be taught in their study programs. Some described that they would prefer having it more in-depth in the form of a module of its own, instead of being spread out as small information points here and there throughout the education. The importance of practical examples was emphasized by many.

More specifically, medical students wished for interactive forms of pedagogy to learn about sustainable development, such as group work, work shops and panel debates. Regarding time placements, these topics were suggested to be taught after exams, as those periods were less stressful.

Yet others – both nursing and medical students – would be interested to learn about the connections to

sustainable development and the SDGs throughout their education period, when relevant connections can be made. More specifically, courses in which SDGs could be brought up were suggested, for example courses in professional development towards the end of the program:

> *"Because it is so important and I think that since we live in Sweden and we should be such a well-developed high-income country and then I think we have obligations." (Female, 6th sem. Nursing, KI)*

Moreover, several nursing students mentioned that the bachelor's thesis work would have been a good place for the integration of the SDGs into their education. One nursing student problematized learning too much about sustainable development, if not given practical examples of how to contribute to it through their clinical work:

> *"The global goals would feel too far away if you kept saying "and this is what the UN, those over there in New York, have talked about and decided that we should do with the whole world; you will make sure that it becomes equal and healthy and that the gaps are reduced through your work", while like global political decision-makers don't. Yes, but that's just not an attitude that you go into the [nursing] program with, I think. If you sort of formulate it that way then you feel that "oh now it's up to me to solve this". It becomes a bit more manageable when you can kind of say "okay this is what I'm going to do. I'm going to treat my patients this way or I'm going to make sure that I'm not causing healthcare-associated infections and stuff like that" instead of like, 'I'm going to solve the cholera problem worldwide or something'. It's kind of too big." (Female, 1st sem. Nursing UU)*

While on the other hand, learning about the SDGs more in terms of giving a broader context to their work, was thought of as positive by another nursing student:

> *"I thought it would be nice to have a lecture where they kind of just talked about the global goals and why it's important that we keep them in mind. It would be nice if we got a little more context around what we do. Context around how everything we do is affected by the whole world and vice versa as well." (Female, 6th sem. Nursing, UU)*

Discussion

The findings from this suggest that a majority of medical and nursing students in the three Swedish universities did not perceive that they had learned enough about the SDGs and Agenda 2030 in their program. Further they did not feel that they had sufficient knowledge for their future career, and they would like that the Agenda 2030 and the SDGs should be a greater part of their education.

The qualitative findings formed two themes with altogether six categories and provided a more in-depth understanding. The first theme concerned the student views on the education they have received, where the category *"overall, the education that is in place is superficial or not explicitly tied to the SDGs* " revealed that students, though having heard about the SDGs, did not perceive that they had gained any significant in-depth knowledge about the relevance of the SDGs for their future careers in health care. Indeed, similar findings have been made in other studies and settings, where students witness to superficial education for sustainable development [12, 22]. Students in our study often experienced the education that had been provided by their programs as feeling superficial and more filling the purpose of educators needing to "tick the box".

The category *"Students have a large variety of background knowledge when entering health professional education* ", revealed that many of the students had learned about the SDGs in their prior education or workplaces, and some of them were personally engaged in activities related to promoting sustainable development. This is in line with other findings describing that students may indeed have more knowledge and be more engaged in education for sustainable development than their educators are [23], and that this is a challenge as well as an opportunity for education for sustainable development keeping up-to-date and being relevant for students [23].

The category *"the SDGs are more relevant for health care practice than what students initially thought"* was brought up by those students who described having thought more about the relevance of the SDGs for their professional practice. For example, the use of resources in health care such as transportation, the use of medications and encountering socio-economically disadvantaged groups, were ways in which our participants described that health care indeed carries an impact on sustainable development. Indeed, the main climate impact of health care is indeed incurred by procurement, transport, and medication use [24]. Moreover, a greater focus on preventive health interventions have been found to carry great potential for reducing the environmental impact of health care [24]– a fact that our study participants seemed unaware of. In addition, the SDGs explicitly state that "all learners acquire the knowledge and skills needed to promote sustainable development, including […] through […] human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity" [2]—which is in line with our study participants' descriptions of the ways

in which their work can contribute to the SDGs when encountering socio-economic disadvantage.

The second theme of the qualitative findings was concerned with the ways in which students thought their education for sustainable development could be improved. In this theme, the category *"a call for more in-depth understanding of how to promote equality, equity, inclusiveness and psychological aspects in health care"* revealed that students experienced that they lacked the necessary skills and training to be able to counter inequity in health though their professional practice. Persistent study findings in low-, middle- [25] and high-income country settings [25, 26] have ascertained the patterns of inequity in health care availability and utilization. In high-income country settings in Europe, these differences in health care seeking are found predominantly in the settings of specialist health care; socioeconomic differences are not as pronounced in seeking primary health care, but more advantaged socio-economic groups are more likely to receive specialist care [26, 27]. The reasons behind this are likely due to a combination of differences in illness prevalence, access to care for example due to privatization and unequal distribution, and care-seeking behavior independent of prevalence [27, 28]. Several authors have called for medical curricula to recognize the importance of the complex interrelated socio-ecological root causes of health, well-being, and illness [29–31]. Along the lines of what our study participants described, others have also brought forth that the root causes of many conditions have been neglected in medical education [32], which focuses mainly on siloed and medicalized approaches to health [8].

In the category, *"a call for more environmental awareness in health care "* students also called for more environmental awareness and pro-activism within health care, including a greater understanding both of the environmental impacts on the health of human beings and the impact of healthcare on the environment. These aspects have indeed been described as important interlinks between sustainable development and health [2].

In the light of the present study, focusing on health care professional education, the relevant questions to ask would thus be – what skills do future health care professionals need in order to counter inequities in health? Others have suggested that public health principles, skills and resources need to be integrated into health care education curricula, with clear competency standards to guide practice and ensure impact on public health indicators [33]. Such developments would possibly also meet the call for more in-depth and context-specific teaching and learning, expressed by present study participants in the category *"A call for more in-depth and context-specific teaching and learning"*. Some recommendations that have emerged to meet this need include the development of health care educator empathy, in order to recognize the impact of the socio-ecological determinants of health, particularly regarding inequities [29]. Such an understanding should be based on a broad knowledge of the complex links between individual health and community-level data [29]. Moreover health care professionals should acquire the skills to educate individuals on beneficial health practices such as nutrition, health promotion principles and risk reduction approaches, in addition to a narrow approach on treating symptoms [29]. Indeed, overall, siloed approaches to education have been discussed not to correspond to adequate learning objectives in education for sustainable development [1, 10].

Some participants in the present study also described lacking the knowledge about how to ensure a sustainable working life for themselves, especially with regard to anticipated high levels of stress when working in health care. The calls for more training in resilience and mental health promotion among future health care professionals are indeed many, and emphasize that the lack of such training is a blind spot in much of health care professional education. Healthcare work is associated with a high prevalence of distress, which unfortunately is beginning already during their education. Also, for "transformative learning", which has been recently emphasized by scholars of education for sustainable development, it is essential to take into account individuals' dynamic inner dimensions and transformation [34–36], which have only recently started to receive growing attention in education and practice [36–38]. Contributing to student awareness of interconnectedness is a vital component of transformative learning. This involves a dismantling of power structures and mechanisms at play, intersectional analyses and positionality, psychological flexibility, an increased understanding of the living world including humans as primarily systemic and relational, and a recognition of society as part of nature, and the forces of localization and the globalization [39].

Limitations and strengths

The results of the survey study should be interpreted with caution, as the participation rate of eligible students was low (18%), and there is therefore possible selection bias [40] in which students participated – perhaps those who were more interested in the topic of sustainable development were more likely to participate. Despite multiple attempts to reach eligible students via e-mail, we were not able to secure a higher participation rate. However, for the qualitative study, we may expect to have obtained a broader and more in-depth picture of the Education for Sustainable Development that the students had obtained. Since we had students participating from both targeted

education programs, and almost all study semesters, we can expect that they have been able to give a representative view of their educational programs. Also, in the case of the qualitative study, a selection bias of more interested students may not only have affected the results negatively, but rather provide the views of more interested students who therefore have perhaps given the topic of sustainable development more thought than some of their possibly less interested student colleagues.

Conclusions

Our findings suggest that students in health professional education in three Swedish Universities may lack the knowledge needed to face present and future sustainability challenges. Our findings revealed that the SDGs may be more relevant for health care practice than what is evident at a first look. For example, the use of resources in health care such as transportation and medications and how to meet patients from traumatized or socio-economically disadvantaged groups. Also, a call was made for more in-depth understanding of how to promote equity, diversity and inclusion. Psychological skills training was also asked for. Here, students experienced that they lacked the necessary skills and training to be able to counter inequity in health in their professional practice. Finally, the participants described lacking the knowledge about how to ensure a sustainable working life for themselves, especially with regard to anticipated high levels of stress.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12909-025-06991-5.

Supplementary Material 1.

Acknowledgements
We would like to thank the study participants for their time and engagement. Also, we would like to thank Dr. Hanna Karlsson, Prof. Knut Lönnroth and Dr. Karin Leander for their contributions to the work.

Authors' contributions
T.A. designed the study and obtained funding, D.H. and O.B. contributed to the study design at the planning stage. M.N. recruited participants with the help of E.H., M.N. collected and analyzed the data and wrote the first version of the manuscript. D.H. assisted in the validation of the survey among medical students. H.M.A. gave guidance in the qualitative study design and analysis. All authors provided input in the process and read and approved the final manuscript.

Funding
Open access funding provided by Karolinska Institute. Funding for this study was obtained from the Karolinska Institutet pedagogical research fund, grant number 20200903.

Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.We would like to thank the study participants for their time and engagement. Also, we would like to thank Dr. Hanna Karlsson, Prof. Knut Lönnroth and Dr. Karin Leander for their contributions to the work.

Declarations

Ethics approval and consent to participate
Ethical approval number from the Stockholm Regional Ethical Review Authority: 2021–04960.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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Received: 7 November 2024 Accepted: 11 March 2025
Published online: 25 March 2025

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SOURCE: PERPUSTAKAAN UTM

education sciences

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Article

Academic Third Mission through Community Engagement: An Empirical Study in European Universities

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Abstract: Community engagement is fundamental for tertiary education, as it allows universities to connect with external stakeholders, create social impact, and improve the development of strategies for public engagement. The current study aims to evaluate the level of community engagement in tertiary education, assess the level of sustainable practices, and identify areas for improvement. The research employed a survey method, using a standardized questionnaire to gather data from 44 respondents, representing 35 European universities from nine countries. The survey covered various aspects of community engagement, such as university commitment, documentation, public awareness, investments, incentives, training, and stakeholder engagement. Quantitative analysis was employed using ANOVA and AHP to analyze the data collected from 20 questions. The results revealed that universities have a clear commitment to public engagement and have well-documented policies in place. However, there were areas identified for improvement, such as increasing investments to encourage public engagement and offering more training activities to support it. Additionally, the universities were found to have a limited target group for their community engagement activities and insufficient communication of the results of impact assessments. The findings of this study will be used to improve the development of strategies and enhance public engagement in tertiary education through the Academic Third Mission.

Keywords: third mission; tertiary education; community engagement; participatory and deliberative processes

Citation: Spânu, P.; Ulmeanu, M.-E.; Doicin, C.-V. Academic Third Mission through Community Engagement: An Empirical Study in European Universities. *Educ. Sci.* **2024**, *14*, 141. https://doi.org/10.3390/educsci14020141

Academic Editor: Andrew Holliman

Received: 30 November 2023
Revised: 13 January 2024
Accepted: 25 January 2024
Published: 30 January 2024

1. Introduction

Academic Third Mission is a priority on universities' agendas, focusing on the role of higher education institutions in contributing to the socio-economic development of their regions and communities through activities such as technology transfer, community outreach, and applied research [1,2]. This mission is in addition to the traditional roles of teaching and research, which are often referred to as the "first" and "second" missions, respectively [3–5]. The concept of the Academic Third Mission is intended to encourage universities to engage more actively with their local communities and to contribute to the development of a knowledge-based society. The European Union (EU) has recognized the importance of the Academic Third Mission and has made it a priority to support the engagement of universities with their local communities and regions [6,7]. The EU has implemented several initiatives and programs aimed at promoting the Third Mission, such as the Horizon 2020 program and the European Regional Development Fund [8,9]. These initiatives provide funding and resources for universities to conduct applied research and engage in technology transfer and community outreach activities.

There are several policy instruments that have been designed to support, monitor, and evaluate the engagement of universities in the community in relation to the Third Mission and can include funding programs, performance indicators, impact assessments, regional development strategies, public-private partnerships, and community engagement [10–13]. Worldwide governments and organizations, including the EU, provide funding for universities to engage in activities that support the Third Mission, such as applied research

and technology transfer. Universities are often required to report on their engagement in Third Mission activities and are evaluated on their performance in these areas [14,15]. This can include measures such as the number of patents filed, the number of startups created, and the number of community outreach programs [16,17]. Studies and evaluations are conducted worldwide to assess the impact of universities' Third Mission activities on the community and society [18]. Universities are encouraged to engage with regional development strategies and to align their Third Mission activities with regional priorities [19,20]. Governments and organizations often support universities to form partnerships with businesses and industry to boost progress and prosperity [21]. Of all the policy instruments, community engagement is particularly important.

Community engagement is a key aspect of the Third Mission, as it is through engagement with the local community that universities can truly understand the needs and priorities of the region and tailor their activities to have the most impact [3,22]. Community engagement allows universities to identify the needs of the community through direct engagement and communication with residents, organizations, and local leaders [23]. This helps universities develop programs and services that are responsive to local needs and priorities. It also helps build trust between the universities and the community by demonstrating their commitment to addressing local issues and by involving community members in the planning and implementation of Third Mission activities. By engaging with the community, universities can better understand the social, economic and environmental issues that affect the community and design their programs and services to have the greatest positive impact [24]. Community engagement can provide opportunities for students and faculty to gain real-world experience, which can enhance the educational experience and prepare graduates for careers that impact the community positively. Also, it promotes collaboration between universities, businesses, and organizations to address local issues and create new opportunities [25–28].

Due to all the benefits of community engagement within the Academic Third Mission, the authors proposed a study on the participatory and deliberative processes of several European universities, with the final goal of designing a general framework for academic community-led innovation. Participatory practices refer to the involvement of 'the public' in the decision-making processes of universities [29]. These processes entail actively involving community members in the planning and implementation of Third Mission activities to ensure that they are responsive to local needs and priorities [30]. This can include involving community members in the design and implementation of research projects, technology transfer initiatives, community outreach programs, co-creation and co-design of curriculum, and public engagement [31–33]. Participatory processes ensure that community members have a say in the activities that affect them and that their perspectives and experiences are taken into account.

Deliberative processes are aimed at making decisions upon an issue involving the weighing of reasons for and against a course of action [34]. Participation focuses on empowering citizens to take action. Deliberation focuses on discussion and debate between citizens and other stakeholders [35,36]. The process involves community members in a structured and informed discussion to identify and evaluate options and make collective decisions [25,37]. These processes allow community members to express their views, consider different perspectives, and make informed decisions. Deliberative processes can include public meetings, community forums, and other forms of consultation and dialogue [22,24,38].

Given the importance of participatory and deliberative processes within the global scope of the Academic Third Mission through community engagement the current research provides valuable insights into the current practices and challenges of European universities. The study involves a research methodology that uses quantitative tools, focusing on specific practices and strategies that universities use to engage with their communities and the impact of these practices on the community. It also examines the barriers and challenges that universities face in engaging with their communities and the strategies they use to

overcome these barriers. Additionally, it assesses the effectiveness of participatory and deliberative processes in promoting community engagement and the alignment of Third Mission activities with community needs and priorities.

2. Research Methodology

The current study was carried out under the TENACITY European project funded by Erasmus Plus through grant agreement no. 2021-1-IT02-KA220-HED-000032042. The project focuses on the Academic Third Mission and, specifically, on supporting universities to develop participatory and deliberative practices. In this context, the main objective of the research was to detect the needs, gaps and opportunities for designing a framework for the Higher Education Third Mission by collecting information from nine different European countries. This was conducted by applying an online questionnaire aimed at investigating universities' commitment to public engagement activities. Specifically, the investigation focused on the university experience with participatory and deliberative processes. The questionnaire was targeted at university staff/professors/researchers involved in managing/delivering relevant activities.

The research was conducted on a sample of 44 respondents from 35 universities in 9 different European countries (Table 1).

Table 1. European universities which participated in the conducted study.

Country	No. of Universities	Universities
Germany	4	University of Stuttgart; Münster University of Applied Sciences—FH Münster; Deggendorf Institute of Technology; Martin Luther University Halle-Wittenberg
Greece	7	University of Thessaly; Harokopio University; Panteion University; Aristotle University of Thessaloniki; University of the Aegean; University of Patras; National Technical University of Athens.
Italy	2	University of Bolzano; University of Firenze
Lithuania	3	Vilnius University, Faculty of Communication; SMK University of Applied Sciences; Kazimieras Simonavičius University
Malta	1	University of Malta
Portugal	1	University of Minho, Institute of Education
Romania	7	University of Bucharest, Faculty of Foreign Languages and Literatures; Carol Davila University of Medicine and Pharmacy, Faculty of Dentistry; Transylvania University of Brașov, Faculty of Materials Science and Engineering; Bucharest University of Economic Studies, Faculty of Management; Ferdinand I Military Technical Academy; Craiova University, Faculty of Engineering and Management of Technological Systems; University of Targu Jiu, Faculty of Engineering, Constantin Brancusi
Spain	6	Santiago de Compostela University; University of Jaen; University of Valladolid; Universidad Autónoma de Madrid; University of Seville, Department of Developmental and Educational Psychology; Pablo de Olavide University
Sweden	4	Södertörn University; KTH Royal Institute of Technology; University West; Umeå University

The 35 universities were selected randomly amongst European institutions. The sample consisted of 31 professors, 4 researchers, 4 doctoral students, and 5 administrative staff members (1 rector, 1 chancellor, 1 public engagement officer, and 2 other administrative staff). This distribution of the positions held in the institutions by the survey participants is not a limitation for the research and is not significantly influencing the research results. Within the TENACITY project, a letter of consent was created at the consortium level, outlining the purpose and ethical considerations of the research, including issues such as anonymity, voluntary participation, and confidentiality. The initial version of the questionnaire was specifically designed to target the university experience in participatory and deliberative processes, taking into account the characteristics of the target audience.

The research process was carried out in two stages. The first stage involved the completion and validation of the questionnaire. The initial English version of the questionnaire was reviewed by experts from each partner institution to ensure that the questions

were clear and easily understood by survey participants. The final English version of the questionnaire was implemented in Google Sheets and distributed by e-mail to the target group for participation in the research. The data collection process was carried out in approximately two months. Quantitative analysis was used to assess public engagement using a 7-point Likert scale, where value 1 corresponds to "totally disagree" and value 7 corresponds to "totally agree". The scale provided two moderate opinions along with two extremes, two intermediate, and one neutral opinion to the respondents. This scale provides better accuracy of results and more data points to run statistical information. The survey was constructed with 20 items (Table 2) that used the same response scale in order to allow the application of an Analysis of Variance (ANOVA) to the data set. This approach was preferred in order to improve the consistency of information from a large number of participants, such as university staff, community members, and researchers, on their perceptions and experiences of participatory processes of public engagement, as well as facilitate the use of statistical analysis on the numerical data.

Table 2. Question set used for survey in public engagement.

ID	Question
Q1	Is the university's commitment to public engagement clearly defined?
Q2	Is the commitment to public engagement well documented?
Q3	Does the university ensure that the documented commitment to public engagement is also publicly known and understood?
Q4	Are people at different levels of the university responsible for implementing the public engagement agenda?
Q5	Does the university currently make adequate investments to encourage public engagement?
Q6	Does the university offer incentives and rewards to promote public engagement?
Q7	Does the university offer training activities to support public engagement?
Q8	Does the university integrate external services into its portfolio of services to promote public engagement?
Q9	Does the university have clearly defined target groups for its (community) public engagement activities?
Q10	Does the university use up to date (e.g., didactic) methods and approaches to develop public engagement skills among students?
Q11	Does the university integrate public engagement practices into degree programs?
Q12	Does the university promote interdisciplinary educational paths?
Q13	Does the university compare and identify the needs of its external stakeholders?
Q14	Does the university use indicators to measure its activities and public engagement results (of the community)?
Q15	Does the university ensure that the results of the impact assessment of public engagement activities are used for future planning and organizational development?
Q16	Does the university communicate the results of the assessment on the impact of its public engagement activities inside and outside the institution?
Q17	Does the university influence (community) engagement at local and regional levels?
Q18	Does the university create a social impact from public engagement activities?
Q19	Has the university defined the kind of impact it aims to create through public engagement?
Q20	Does the university integrate (community) stakeholders into the institution's leadership?

ANOVA was selected as an appropriate validation method due to the overall goal of the study and the necessary prerequisites being met. The main goal of the research was to detect the needs, gaps, and opportunities for designing a framework for the Higher Education Third Mission by collecting information from different HEIs in European countries. ANOVA was a useful tool in this research context for comparing responses across different target groups and analyzing aggregated scores from the Likert scale survey. The method helped in assessing whether perceptions and needs vary significantly from one European country to another. The survey was constructed to investigate different aspects of the

Third Mission of Higher Education (commitment, implementation, investments, incentives, training, educational paths, and community engagement). ANOVA was used to analyze these aspects simultaneously, providing insights into which aspects differ significantly across different groups. Although in line with the research's main goal, ANOVA was deployed only after validation of its prerequisites.

The first prerequisite, independence of observations, was ensured through the distribution channel and application of the questionnaire. The final English version of the questionnaire was distributed by e-mail, individually to each member of the target group. Members of the target group were selected randomly from information available online. After selection, the consortium members validated the final 44 participants, verifying that they did not have any prior collaboration and were not in contact for the completion of the survey. The questionnaire was completed without revealing personal information like name, surname, age, or gender and involved completing a Google survey on their personal computers.

Normality was the second prerequisite of ANOVA, which was analyzed before applying the method. This prerequisite entails that the data in each group should be approximately normally distributed, which is particularly important for small sample sizes (which is the case). The Shapiro–Wilk test (best for small to moderate sample sizes) was used to calculate a statistic (W) and a *p*-value for each of the 20 questions in each country except Italy, Malta, and Portugal, which had less than 3 respondents. The test showed that the majority of questions have a normal distribution (Tables A1 and A2, shown in Appendix B of the manuscript). To validate even further the normality of the data, a Q-Q plot was put together (Figure A2, Appendix B), and the normally distributed data appears as roughly a straight line. Considering the aforementioned, the normality prerequisite was considered met.

Homogeneity of variances is the third important ANOVA prerequisite and was verified using Levene's test. This checks for homogeneity of variances and is less sensitive to deviations from normality, making it suitable for Likert scale data. It is performed by comparing the variance within each group (country) to the overall variance. Homogeneity of variances was considered met if Levene's Test *p*-value was over 0.05. Calculations conducted in Table A3, and Appendix C validates this prerequisite.

The fourth prerequisite is related to the *level of measurement*. This is met due to the structure of the survey. The 1 to 7 scores represent ratings, where differences are consistent and meaningful across the entire scale, for all 20 questions.

Random sampling, the fifth prerequisite, has been ensured since the early stages of the experiment design. The request for involvement in the study was sent randomly to HEIs around Europe with a timeframe of one month for receipt upon initial acceptance. With 44 respondents from 35 universities giving a positive reply in this timeframe, they were further verified for having no prior connection and validated for taking the study individually. The e-mail instructions highlighted the importance of independent responses. The responses were collected independently, ensuring anonymity and avoiding situations where participants from the same country and university discuss their responses before completing the survey.

Group independence of observations is the sixth prerequisite of ANOVA and is critical for its validity. The experiment design phase ensured group independence based on the premise that each country's data was selected and collected independently of the others. Moreover, the Durbin-Watson test was conducted on the residuals of ANOVA to check for autocorrelation as a proxy for independence. A value of 2.42 was obtained, suggesting a small degree of negative autocorrelation. However, this value is close enough to 2 to generally not be a cause for concern regarding the independence of observations. This result is a good indicator of the independence of the responses.

The seventh prerequisite of applying ANOVA, related to an *appropriate sample size*, is the main determinant in selecting this method, as it does not impose a minimum value. Nevertheless, a very small sample size can lead to a lack of statistical power, making it difficult to detect a real effect if it exists. To counteract this limitation, Cronbach's Alpha

was used to measure the internal consistency and reliability of the set of scales used and test items.

Based on all prerequisites being met and alignment with the study goal, ANOVA was the appropriate method to use in the conducted research.

3. Results Interpretation and Discussion

3.1. Quantitative Analysis

Quantitative analysis involved an Analysis of Variance (ANOVA) on the collected data set for items Q1 ÷ Q20 (Table 3). The statistical analysis was conducted to examine the differences between groups on a particular measure. The groups in the data set were the different questions (Q1, Q2, Q3, etc.), and the measures being analyzed were the responses given to each question. These responses were given in numbers, where each number represented an option on a 1–7 Likert scale (Appendix A—Figure A1). The items for public engagement must show a common variant, correlate with each other, and, at the same time, correlate each item with the score that reflects this attribute.

Table 3. ANOVA on public engagement data set.

Source of Variation	*SS*	*df*	*MS*	*F*	*p-Value*	*F Crit*
Rows	2102.727	43	48.90063	23.51994	3.6×10^{-114}	1.394538
Columns	113.1636	19	5.955981	2.864672	4.31×10^{-05}	1.599272
Error	1698.636	817	2.079114			
Total	3914.527	879				
Cronbach's Alpha = 0.957483						

After conducting the ANOVA with Two-Factor Without Replication the results include the source of variation, the sum of squares (*SS*), the degrees of freedom (*df*), the mean squares (*MS*), the *F*-ratio, the *p*-value, and the *F* critical value. These indicate that there is a significant difference between the means of the groups on the measure being analyzed (*p*-value is less than 0.05), and the source of variation was broken down into three main parts: Rows, Columns, and Error.

The Rows source of variation demonstrates that there is a significant difference between the means of the groups that were formed by rows. The Rows source of variation in the ANOVA results refers to the variation in the responses between the different questions. The calculated value of SS of 2102.727, *df* of 43, *MS* of 48.90063, *F* of 23.51994, *p*-value of $3.6 \cdot 10^{-114}$, and *F crit* of 1.394538 are all indicators of the statistical significance of the variation between the questions. The results suggest that there is a significant difference in the responses given to the 20 questions, with a large *F*-ratio and a very small *p*-value. Thus, all values are significant, indicating that there is a difference in means among the groups. The relevance of these values is that they can be used to identify which questions are most important to the participants, which questions are not well understood, and which questions are measuring different aspects of public engagement. The Columns source of variation shows that there is a significant difference between the means of the groups that were formed by columns. The *SS* is 113.1636, *df* is 19, *MS* is 5.955981, *F* is 2.864672, *p*-value is 4.31·10-05, and *F crit* is 1.599272. The calculated values are significant, indicating again that there is a difference in means among the groups. The Columns source of variation in this analysis refers to the variation in responses between the different questions. The relevance of the calculated values in terms of the questions can be determined by looking at the *p*-value and the F-value for each question. A low *p*-value (typically below 0.05) and a high *F*-value represent that there is a significant difference in the responses between the different questions, indicating that the question is measuring a different aspect of public engagement. For example, if we analyze the question "Does the university offer incentives and rewards to promote public engagement?" (Q6), the *p*-value and *F*-value are both low, indicating that there is a significant difference in responses between this question

and the other questions. Thus, offering incentives and rewards is an important factor in promoting public engagement [12,39]. On the other hand, if we look at the question "Does the university integrate external services into its portfolio of services to promote public engagement?" (Q8), the *p*-value and F-value are both relatively high, indicating that there is not a significant difference in responses between this question and the other questions. This shows that integrating external services may not be a major factor in promoting public engagement [15,18,19]. The Error Source of Variation is the variability that is not explained by the other sources of variation. It represents the random variation or noise in the data set. In terms of the questions, it represents the degree to which the responses to each question vary from the overall mean of the sample. A lower error variance corresponds to more consistent and less random responses for a given question, while more variable and less consistent responses have a higher error variance.

Focusing on the need to assess the consistency and reliability of the scale used, Cronbach's Alpha was used to assess the reliability and internal consistency in the development and validation stages. The ANOVA undertaken for public engagement has a Cronbach's Alpha of 0.957483, which is a strong indicator of the internal consistency of the questionnaire, which means that the items on the scale or questionnaire are measuring the same underlying construct and the results are reliable. Results show that there is a significant difference between the means of the groups or conditions on the measure being analyzed, and the source of variation in the difference is coming from both Rows and Columns. Moreover, the Cronbach's Alpha coefficient was used in the analysis of the results as the main indicator of the measurement accuracy of the test. Since F > F crit (23.51994 > 1.394538), the null hypothesis will be rejected. Population means are not all equal. Which means that at least one of the means is different. Because $p < 0.001$, it means that at least two means differ highly significantly from each other.

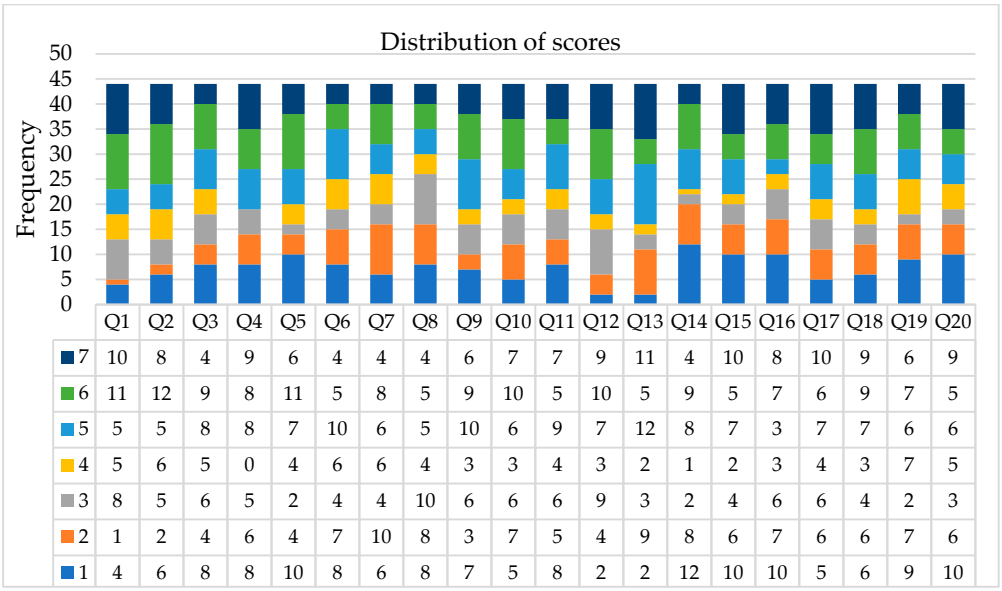
To further analyze the significance of each question, Table 4 was put together, containing information about the number of respondents (Count), the sum of scores (Sum), the average of scores, and the variance and standard deviation (Std. Dev.) for each item (Q1 ÷ Q20). The results show that there is a range of averages and variances among the questions. The average ranges from 3.477 to 4.795, and the variance ranges from 3.469 to 5.465, indicating that there is a significant difference between the means of the questions and the measure being analyzed. It is also worth noting that the variance is an indicator of the spread of the data; the larger the variance, the more spread out the data is, and it could involve the presence of outliers.

A low standard deviation means that most of the scores are near the mean, and a high value means that the scores are more dispersed. To identify which questions are considered more significant by the participants, the average scores were evaluated and contrasted among the questions. Questions with higher average scores are considered more significant by the participants. Furthermore, questions with a lower standard deviation imply that the responses are more consistent; hence, it is more likely that the question is considered more important by the participants. Based on the results from Table 4, in hierarchical order, starting with the most important, questions Q1, Q12, Q13, Q9, and Q10 are the most significant for the participants in terms of importance and consistency.

To determine which questions are not well understood, apart from the standard deviation, the distribution of responses was calculated and analyzed. The distribution of scores is a measure of how the scores are distributed across the range for each question. It can be visualized for all 20 questions using the histogram and the frequency distribution presented in Figure 1.

Table 4. Standard deviation and variance for the 20-question data set regarding public engagement.

Question ID	Count	Sum	Average	Variance	Std. Dev.
Q1	44	211	4.795	3.701	1.924
Q2	44	202	4.591	4.108	2.027
Q3	44	176	4.000	4.047	2.012
Q4	44	186	4.227	5.110	2.261
Q5	44	183	4.159	4.928	2.220
Q6	44	166	3.773	3.901	1.975
Q7	44	168	3.818	3.966	1.992
Q8	44	153	3.477	3.790	1.947
Q9	44	189	4.295	4.120	2.030
Q10	44	188	4.273	4.296	2.073
Q11	44	176	4.000	4.419	2.102
Q12	44	207	4.705	3.469	1.862
Q13	44	204	4.636	3.958	1.989
Q14	44	160	3.636	5.027	2.242
Q15	44	177	4.023	5.465	2.338
Q16	44	167	3.795	5.236	2.288
Q17	44	192	4.364	4.423	2.103
Q18	44	194	4.409	4.619	2.149
Q19	44	171	3.886	4.615	2.148
Q20	44	174	3.955	5.207	2.282



	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
7	10	8	4	9	6	4	4	4	6	7	7	9	11	4	10	8	10	9	6	9
6	11	12	9	8	11	5	8	5	9	10	5	10	5	9	5	7	6	9	7	5
5	5	5	8	8	7	10	6	5	10	6	9	7	12	8	7	3	7	7	6	6
4	5	6	5	0	4	6	6	4	3	3	4	3	2	1	2	3	4	3	7	5
3	8	5	6	5	2	4	4	10	6	6	6	9	3	2	4	6	6	4	2	3
2	1	2	4	6	4	7	10	8	3	7	5	4	9	8	6	7	6	6	7	6
1	4	6	8	8	10	8	6	8	7	5	8	2	2	12	10	10	5	6	9	10

Figure 1. Distributions of scores for the public engagement data set.

For example, for question Q1, the frequency of scores is given by {1:4, 2:1, 3:8, 4:5, 5:5, 6:11, 7:10}. Four respondents gave a score of 1, one respondent gave a score of 2, eight respondents gave a score of 3, and so on. Questions with a wide range of responses and a high standard deviation are generally not well understood. For all 20 questions, the calculated range was 6. Although the standard deviation for all questions is low, the study requires further clarifications for question Q15. The average values for the question range from 3.477 to 4.795, with Q1 having the highest average value of 4.795. The participants generally agreed that the universities' commitment to public engagement is clearly defined. However, it is worth noting that the average for Q1 is only slightly above the midpoint of the scale (4.5), which means that the results are not overwhelmingly in favor of the statement. There were some participants who disagreed or were uncertain about the statement; thus; there is a need for further investigation [18].

Regarding the documentation of public commitment (Q2), the lowest results were recorded in Greece (with an average of 3.85) and the best results were recorded in Germany with an average of 6.33, indicating that German universities have the best practices for documentation of public engagement activities. The results suggest that the commitment to public engagement is well documented, but there may be room for improvement in terms of clarity and dissemination of information. As other research shows, confusion on the subject can be due to a lack of consistency in the channels of information and the diversity of tools [11,34]. In order to further investigate this issue, Q3 was analyzed.

According to the respondents, most universities make efforts so that their documented commitment to public engagement is known and understood; there are no significant differences between the partner countries. The conclusion aligns with several other findings at a European level and can be explained mainly due to cultural and societal similarities but also due to strategic collaboration paths between institutions [6,7,9,22,24]. Based on the results, it can be inferred that the universities may need to improve their efforts to ensure that their documented commitment to public engagement is also publicly known and understood. Such strategies are implemented and actively promoted by universities and institutions worldwide, but with notable differences in the effectiveness of the tools [26,33]. Depending on the cultural approach, universities need to establish the most effective methods for undertaking public engagement documentation.

When asked if people from different levels of the university are responsible for the implementation of the public involvement agenda (Q4), the respondents appreciated the efforts of the university staff, suggesting that there is a fair level of responsibility among people at different levels of the university for implementing the public engagement agenda. European universities tend to assume a high level of responsibility in undertaking academic third-mission actions, endeavors sustained by a variety of common efforts and initiatives [6,7,12,22]. However, there is still room for improvement as the mean score is not the highest, indicating that there may be some lack of clarity or understanding of the responsibilities related to public engagement across different levels of the university. Several studies found that lack of clarity can be due to improper communication throughout the universities' management and organizational hierarchies [17,19].

Surveyed universities are concerned with investments to encourage public involvement (average = 4.159 for Q5), but they are less involved in offering incentives and rewards to promote audience involvement (average = 3.773 for Q6). Some universities have been known to strongly encourage public engagement through student involvement, which has proven beneficial in the long-term development of third mission strategies [37]. The EU has promoted continuous development of public engagement through the academic third mission of universities [6], so as to counteract the gap between academia and entrepreneurs. The average score for Q6 is 3.773, which is relatively low compared to the other questions. For this question, the respondents generally disagree with or are neutral in their opinion that their universities offer incentives and rewards to promote public engagement. The standard deviation of 1.975 also infers that there is a significant amount of variation in the responses, indicating that some respondents may strongly disagree while others may be more neutral or slightly disagree. There is definitely room for improvement in this area for the universities in terms of offering incentives and rewards to promote public engagement. This is mainly performed through structural funds [8,9], but also through local initiatives [13,15].

The results for questions Q7, Q8, and Q9 were very close to the central tendency (average: Q7 = 3.818, Q8 = 3.477, Q9 = 4.295). Training activities to support public involvement are not sufficient, and services to promote public involvement are less satisfactory in surveyed universities. A fair interpretation of the obtained results could be that the respondents do not believe that the university is effectively integrating external services into its portfolio to promote public engagement. This was also the case for several other institutions outside of the study [15,20,21,30]. Thus, this is a clear area for improvement

for the university in terms of its public engagement efforts and is in correlation with other literature findings [32,39].

For questions Q10 and Q11 there are no significant differences between the results collected from different countries. These results reflect, in the opinion of the respondents, the satisfactory preoccupation of universities in using updated methods and approaches to develop public engagement skills among students and in the integration of public engagement practices in study programs [23]. The general opinion of the respondents is that they do not believe that the university is effectively integrating public engagement practices into its degree programs. For this question respondents stated that there are universities where the public is involved to some extent in the study programs. The justification for this statement is based, in the opinion of the respondents, on the fact that the universities consider the opinion of the public based on the feedback received from them, especially formulated during internships, and volunteering. It could be beneficial to follow up with strategies that have proven successful over one common framework [18,22,24].

By identifying the needs of external stakeholders (Q13 = 4.636), the universities are involved in the promotion of interdisciplinary educational paths (Q12 = 4.705), as the surveyed professors claim. Most of the participants think that their university is effectively promoting interdisciplinary educational paths. The results show that universities effectively promote interdisciplinary educational paths, and this is something that is positively perceived by the respondents, a result that aligns with most literature research [20,21,32].

Regarding the evaluation of the activities and results of public commitment (Q15 = 4.023) and indicators used (Q14 = 3.636), the best results were recorded in the universities of Romania and Lithuania, and lower results were obtained in Greece. These results could be explained by the fact that the respondents from Romania are teaching staff directly involved in the evaluation activity, compared to Greece, where doctoral students were involved in the survey. This context also explains the average obtained for question Q16 = 3.795 regarding the communication of the evaluation results on the impact of the institutions' activities. This issue is of particular importance in the process of standardization, and universities should address their challenges based on proven strategies [16]. Results suggest that the respondents feel that the universities are not effectively using indicators to measure their activities and public engagement results, and it may be beneficial for universities to review and improve their methods for measuring and evaluating the effectiveness of public engagement activities. Insight into these processes is given by literature and professionals [11,14,20]. The low average score and large variation in responses suggest that this may be an area where the university could improve in terms of public engagement efforts [2]. This set of data shows that there is a need for the universities to improve in integrating the results of their public engagement activities into future planning and organizational development [2,4]. The standard deviation of 2.103 for Q17 means that the responses to this question are relatively spread out. This is also supported by the distribution of scores. In the ANOVA table, the values reveal that there is a significant difference between the means of the different rows, inferring that the responses to this question vary between different groups. Regarding the influence of universities at the local and regional level in Q17, the lowest average was obtained for universities in Greece; for the other countries, the results were approximately equal.

Social impact from public involvement activities and the definition at the university level are not fully satisfactory for respondents from all countries (Q18, Q19), with the averages obtained being close to the recorded central tendency. This satisfactory result was also recorded for question Q20 regarding the integration of interested parties in the management of the institution. Based on the obtained results, it can be concluded that the universities are generally successful in setting and communicating the goals and objectives of their public engagement activities and have a clear sense of direction in terms of how they want to create impact. This is a positive indication and hints at the fact that the universities effectively communicate their purpose and objectives with regard to public engagement with their communities and stakeholders [13,15]. Relationships with various stakeholders are crucial for universities in order to train students for real-life case scenarios

and offer a smooth transition to the job market. Integration initiatives include joint labs, entrepreneurship accelerators, spin-off communities, and many others, for the mutual benefit of universities and companies alike [13,20,21,36,39].

In order to avoid the dependence between two quantitative variables in the sample of data collected by applying the questionnaire, Pearson's correlation coefficient (r) was determined. The obtained coefficients had values between –1 (perfectly negative correlation) and 1 (perfectly positive correlation). The sign of the coefficient represents the meaning of the correlation, namely: the positive value corresponds to the variations of the same meaning and the negative one to those of the opposite direction. The absolute values of the correlation coefficients, presented in Table 5, express the intensity of the association between the items. Thus, for $\alpha < 0.05$, values of the correlation coefficient from −0.25 to 0.25 were obtained, representing a weak or zero correlation, from 0.25 to 0.50 (or from −0.25 to −0.50) acceptable degree of association, from 0.50 to 0.75 (or from −0.50 to −0.75) moderate to good correlation, and from 0.75 to 1 (or from −0.75 to −1) very good correlation.

Table 5. Correlation of coefficients.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q1	1.00																			
Q2	0.73	1.00																		
Q3	0.77	0.84	1.00																	
Q4	0.39	0.46	0.42	1.00																
Q5	0.49	0.55	0.61	0.66	1.00															
Q6	0.47	0.53	0.64	0.65	0.74	1.00														
Q7	0.46	0.53	0.56	0.53	0.56	0.66	1.00													
Q8	0.43	0.50	0.49	0.61	0.54	0.56	0.36	1.00												
Q9	0.46	0.50	0.59	0.48	0.67	0.72	0.55	0.62	1.00											
Q10	0.46	0.53	0.63	0.55	0.59	0.62	0.46	0.49	0.71	1.00										
Q11	0.43	0.57	0.60	0.60	0.47	0.61	0.69	0.38	0.47	0.54	1.00									
Q12	0.12	0.24	0.17	0.27	0.13	0.35	0.33	0.31	0.37	0.35	0.52	1.00								
Q13	0.22	0.37	0.30	0.40	0.46	0.56	0.57	0.36	0.56	0.37	0.59	0.65	1.00							
Q14	0.31	0.54	0.44	0.51	0.49	0.55	0.52	0.51	0.47	0.35	0.62	0.60	0.67	1.00						
Q15	0.32	0.55	0.52	0.51	0.58	0.54	0.66	0.37	0.54	0.55	0.66	0.52	0.70	0.85	1.00					
Q16	0.47	0.55	0.61	0.53	0.58	0.64	0.66	0.47	0.53	0.46	0.72	0.45	0.67	0.74	0.77	1.00				
Q17	0.48	0.35	0.40	0.44	0.50	0.61	0.57	0.41	0.47	0.35	0.41	0.26	0.48	0.40	0.48	0.53	1.00			
Q18	0.59	0.51	0.60	0.53	0.64	0.64	0.71	0.41	0.58	0.58	0.64	0.34	0.54	0.62	0.76	0.74	0.69	1.00		
Q19	0.52	0.55	0.62	0.63	0.61	0.69	0.76	0.54	0.64	0.64	0.72	0.46	0.56	0.70	0.80	0.74	0.57	0.87	1.00	
Q20	0.41	0.29	0.36	0.45	0.54	0.63	0.41	0.37	0.42	0.31	0.45	0.37	0.55	0.51	0.50	0.59	0.50	0.61	0.54	1.00

Among all the survey items in the first part of the questionnaire, only positive values were recorded that corresponded to variations of the same meaning. There are some moderate-to-strong positive relationships between the different questions. For example, Q2 and Q3 have a correlation coefficient of 0.84, indicating a strong positive relationship between the two questions.

Q4 and Q5 have a correlation coefficient of 0.66, indicating a moderately positive relationship between the two questions. Similarly, Q5 and Q6 have a correlation coefficient of 0.74, indicating a moderately positive relationship between the two questions. The highest association was recorded between items Q18 and Q19 (0.87), Q2 and Q3 (0.84), and Q15 and Q19 (0.80). However, it can also be seen that there are some weaker or no relationships between certain questions. For example, Q10 and Q14 have a correlation coefficient of 0.35, indicating a weak relationship between the two questions, and Q8 and Q17 have a correlation coefficient of 0.41, indicating a moderate relationship between the two questions.

The weakest correlation between items was recorded between items Q12 and Q1 (0.12), Q12 and Q5 (0.13), and Q12 and Q3 (0.17). These results suggest that there are moderate to strong positive relationships between some of the questions, indicating that the answers to

these questions may be related to one another. However, there are also some weaker or no relationships between certain questions, indicating that the answers to these questions may not be as related to one another. It is important to keep in mind that correlation does not imply causation, and further analysis would be needed to understand the underlying relationships between the variables.

3.2. Relative Importance of Community Engagement

The questionnaire was put together so that the answers reflect a different facet of community engagement in European universities. Questions do not overlap in information but rather offer a complementary vision on how universities integrate community engagement practice into their academic third missions. Thus, each question is viewed both as a separate entity, with its own value in the setting of the overall objective of the questionnaire, and as a puzzle piece in the development of transformative actions.

In this context, results obtained by ANOVA and Pearson's correlation showed that further analysis is necessary to substantiate the construction of a cohesive framework that could impact the decision-making process regarding community engagement in European universities.

Given the complexity of the analyzed issue, the Analytic Hierarchy Process (AHP) was applied to define the importance of each one of the 20 questions, respectively, as an underlying component of community engagement. The authors identified AHP as the most suitable method, attributing its effectiveness to its ability to minimize biases in the results of the decision-making process [40,41]. This approach necessitated a total of 190 pairwise comparisons among all 20 questions. In AHP, a consistency ratio below 10% is considered acceptable for maintaining result accuracy [42]. Goepel's AHP Online System facilitated the analysis [43].

A decision matrix needs to be put together, evaluating the importance of each question in relation to all others and the degree of that importance. The used AHP scale was: 1—Equal Importance, 3—Moderate Importance, 5—Strong Importance, 7—Very Strong Importance, 9—Extreme Importance (2, 4, 6, 8 values in-between). To set the values for each pair of questions, the calculated standard deviation (Table 4) was used.

There are two important steps in putting together the matrix, as follows: 1. Which question is more important than the other; 2. How much more important is one question than the other based on the AHP scale. The first step is straight-forward as the question with the lowest standard deviation is the most important of the two being compared.

The second step involves weighing the differences in standard deviation and spreading them across the 9-point scale. A square matrix is used to calculate the standard deviation differences (1).

$$\begin{array}{c} \\ Q_1 \\ Q_2 \\ Q_3 \\ \cdots \\ Q_i \\ \cdots \\ Q_{20} \end{array} \begin{array}{c} \begin{array}{ccccccc} Q_1 & Q_2 & Q_3 & \cdots & Q_j & \cdots & Q_{20} \end{array} \\ \begin{pmatrix} x_{11} & x_{12} & x_{13} & \cdots & x_{1j} & \cdots & x_{120} \\ x_{21} & x_{22} & x_{23} & \cdots & x_{2j} & \cdots & x_{220} \\ x_{31} & x_{32} & x_{33} & \cdots & x_{3j} & \cdots & x_{320} \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ x_{i1} & x_{i2} & x_{i3} & \cdots & x_{ij} & \cdots & x_{i20} \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ x_{201} & x_{202} & x_{203} & \cdots & x_{20j} & \cdots & x_{2020} \end{pmatrix} \end{array} \quad (1)$$

where x_{ij} is the difference between the standard deviation of question Q_i and the standard deviation of question Q_j. If x_{ij} has a negative value, then Question Q_i is more important than question Q_j. Based on the maximum absolute value amongst these differences, each question gets assigned a point on the AHP scale, according to the procedure shown in Table 6.

Table 6. Criteria to assign points on the AHP scale for each pairwise comparison.

Points on the AHP Scale	Interval Range for $\left\|x_{ij}\right\|$ When Assigning Points on the AHP Scale *
1	0
2	$\left(0\ ,\ \frac{max\left\|x_{ij}\right\|}{n-1}\left((n-8)+\frac{1}{2}\right)\right]$
3	$\left(\frac{max\left\|x_{ij}\right\|}{n-1}\left(1+\frac{1}{2}\right)\ ,\ \frac{max\left\|x_{ij}\right\|}{n-1}\left((n-7)+\frac{1}{2}\right)\right]$
4	$\left(\frac{max\left\|x_{ij}\right\|}{n-1}\left(1+\frac{1}{2}\right)\ ,\ \frac{max\left\|x_{ij}\right\|}{n-1}\left((n-6)+\frac{1}{2}\right)\right]$
5	$\left(\frac{max\left\|x_{ij}\right\|}{n-1}\left(1+\frac{1}{2}\right)\ ,\ \frac{max\left\|x_{ij}\right\|}{n-1}\left((n-5)+\frac{1}{2}\right)\right]$
6	$\left(\frac{max\left\|x_{ij}\right\|}{n-1}\left(1+\frac{1}{2}\right)\ ,\ \frac{max\left\|x_{ij}\right\|}{n-1}\left((n-4)+\frac{1}{2}\right)\right]$
7	$\left(\frac{max\left\|x_{ij}\right\|}{n-1}\left(1+\frac{1}{2}\right)\ ,\ \frac{max\left\|x_{ij}\right\|}{n-1}\left((n-3)+\frac{1}{2}\right)\right]$
8	$\left(\frac{max\left\|x_{ij}\right\|}{n-1}\left(1+\frac{1}{2}\right)\ ,\ \frac{max\left\|x_{ij}\right\|}{n-1}\left((n-2)+\frac{1}{2}\right)\right]$
9	$\left(\frac{max\left\|x_{ij}\right\|}{n-1}\left(1+\frac{1}{2}\right)\ ,\ \frac{max\left\|x_{ij}\right\|}{n-1}\left((n-1)+\frac{1}{2}\right)\right]$

* $n = 9$, the maximum value on the AHP scale.

Using the criteria given in Table 6, 190 comparisons were made in pairs and an AHP decision matrix was put together (Figure 2a). The relative importance of each question was calculated based on the decision matrix, using the principal eigenvector solution with five iterations and a delta value of 4.7×10^{-8}. Each question's weight was assigned based on the priority in the AHP Ranking, as shown in Figure 2b.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	3.00	2.00	7.00	6.00	2.00	2.00	2.00	3.00	4.00	4.00	0.50	2.00	6.00	8.00	7.00	4.00	5.00	5.00	7.00
2	0.33	1	0.50	5.00	4.00	0.50	0.50	0.50	2.00	2.00	2.00	0.25	0.50	5.00	6.00	5.00	2.00	3.00	3.00	5.00
3	0.50	2.00	1	5.00	4.00	0.50	0.50	0.50	2.00	2.00	3.00	0.25	0.50	5.00	6.00	6.00	3.00	3.00	3.00	6.00
4	0.14	0.20	0.20	1	0.50	0.17	0.17	0.17	0.20	0.25	0.25	0.12	0.17	0.50	2.00	2.00	0.25	0.33	0.33	2.00
5	0.17	0.25	0.25	2.00	1	0.20	0.20	0.17	0.25	0.33	0.33	0.14	0.20	2.00	3.00	2.00	0.33	0.50	0.50	2.00
6	0.50	2.00	2.00	6.00	5.00	1	2.00	0.50	2.00	3.00	3.00	0.33	2.00	5.00	7.00	6.00	3.00	4.00	4.00	6.00
7	0.50	2.00	2.00	6.00	5.00	0.50	1	0.50	2.00	2.00	3.00	0.33	0.50	5.00	7.00	6.00	3.00	4.00	4.00	6.00
8	0.50	2.00	2.00	6.00	6.00	2.00	2.00	1	2.00	3.00	4.00	0.50	2.00	6.00	8.00	7.00	4.00	4.00	4.00	7.00
9	0.33	0.50	0.50	5.00	4.00	0.50	0.50	0.50	1	2.00	2.00	0.25	0.50	5.00	6.00	5.00	2.00	3.00	3.00	5.00
10	0.25	0.50	0.50	4.00	3.00	0.33	0.50	0.33	0.50	1	2.00	0.20	0.50	4.00	5.00	5.00	2.00	2.00	2.00	5.00
11	0.25	0.50	0.33	4.00	3.00	0.33	0.33	0.25	0.50	0.50	1	0.20	0.33	3.00	5.00	4.00	2.00	2.00	2.00	4.00
12	2.00	4.00	4.00	8.00	7.00	3.00	3.00	2.00	4.00	5.00	5.00	1	3.00	7.00	9.00	8.00	5.00	6.00	6.00	8.00
13	0.50	2.00	2.00	6.00	5.00	0.50	2.00	0.50	2.00	2.00	3.00	0.33	1	5.00	7.00	6.00	3.00	4.00	4.00	6.00
14	0.17	0.20	0.20	2.00	0.50	0.20	0.20	0.17	0.20	0.25	0.33	0.14	0.20	1	3.00	2.00	0.33	0.33	0.33	2.00
15	0.12	0.17	0.17	0.50	0.33	0.14	0.14	0.12	0.17	0.20	0.20	0.11	0.14	0.33	1	0.50	0.20	0.25	0.25	0.50
16	0.14	0.20	0.17	0.50	0.50	0.17	0.17	0.14	0.20	0.20	0.25	0.12	0.17	0.50	2.00	1	0.25	0.33	0.33	0.50
17	0.25	0.50	0.33	4.00	3.00	0.33	0.33	0.25	0.50	0.50	0.50	0.20	0.33	3.00	5.00	4.00	1	2.00	2.00	4.00
18	0.20	0.33	0.33	3.00	2.00	0.25	0.25	0.25	0.33	0.50	0.50	0.17	0.25	3.00	4.00	3.00	0.50	1	0.50	3.00
19	0.20	0.33	0.33	3.00	2.00	0.25	0.25	0.25	0.33	0.50	0.50	0.17	0.25	3.00	4.00	3.00	0.50	2.00	1	3.00
20	0.14	0.20	0.17	0.50	0.50	0.17	0.17	0.14	0.20	0.20	0.25	0.12	0.17	0.50	2.00	2.00	0.25	0.33	0.33	1

(**a**)

Cat		Priority	Rank	(+)	(-)
1	Q1	11.6%	2	3.6%	3.6%
2	Q2	5.4%	8	1.6%	1.6%
3	Q3	6.3%	7	2.1%	2.1%
4	Q4	1.2%	17	0.4%	0.4%
5	Q5	1.6%	15	0.5%	0.5%
6	Q6	8.5%	4	2.9%	2.9%
7	Q7	7.2%	6	2.3%	2.3%
8	Q8	9.9%	3	3.0%	3.0%
9	Q9	5.0%	9	1.5%	1.5%
10	Q10	4.0%	10	1.2%	1.2%
11	Q11	3.4%	11	1.1%	1.1%
12	Q12	15.8%	1	5.7%	5.7%
13	Q13	7.8%	5	2.5%	2.5%
14	Q14	1.4%	16	0.5%	0.5%
15	Q15	0.8%	20	0.3%	0.3%
16	Q16	1.0%	19	0.4%	0.4%
17	Q17	3.2%	12	1.0%	1.0%
18	Q18	2.3%	14	0.8%	0.8%
19	Q19	2.5%	13	0.8%	0.8%
20	Q20	1.1%	18	0.4%	0.4%

(**b**)

Figure 2. AHP for 20 questions on community engagement in European universities: (**a**) AHP Decision matrix; (**b**) AHP Ranking.

The consolidated results of the AHP reveal a consistency ratio of 3.5% (Figure 3), significantly lower than the predetermined threshold. Consequently, the model's inconsistencies

are within an acceptable range, allowing the derived importance coefficients to be reliably utilized in subsequent decisions.

Number of comparisons = 190
Consistency Ratio CR = 3.5%
Principal eigen value = 21.077
Eigenvector solution: 5 iterations, delta = 4.7E-8

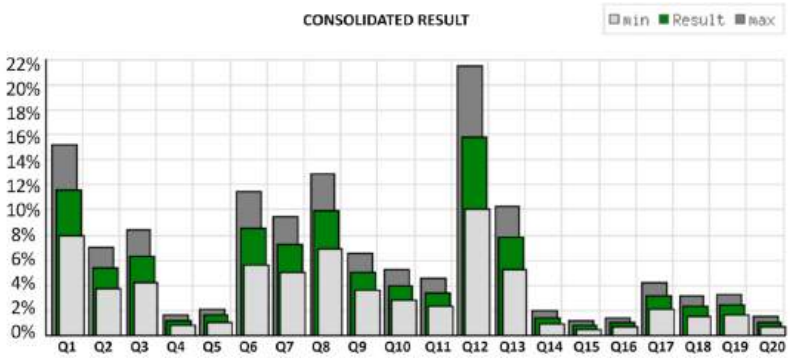


Figure 3. AHP consolidated result for all 20 questions on community engagement in European universities.

AHP shows that the most important questions relate to the promotion of interdisciplinary educational paths (Q12), the clarity of the public engagement definition (Q1), the integration of external services into universities' portfolios of services to promote public engagement (Q8), and the offer of incentives and rewards to promote public engagement (Q6). Q12, although the most important for the survey participant universities, has the lowest correlation coefficient of all questions, implying that this is a mandatory area of improvement and further investigation for all universities.

It is interesting to note that ANOVA identified Q1 as having the highest average value amongst the group, and according to AHP, it is the second most important component for universities. In this regard, there is a balance between value and importance, and further steps might involve improving functionality rather than value.

The ANOVA on Q8 showed that European universities do not effectively integrate external services into their portfolio to promote public engagement. This result corroborated its' importance. AHP shows that universities should implement a more efficient framework targeting practical solutions to external service integration. Q6 has strong positive values, with all other questions showing the grounded connection in research, making its' importance valuable for further analysis and improvement. Based on the AHP and ANOVA results the authors put together a set of recommendations and limitations fort the current study.

3.3. Recommendations and Study Limitations

The Academic Third Mission refers to the engagement of universities with their local communities through activities such as research, education, and services [5,23]. Public engagement, or the involvement of citizens in these activities, is crucial for the success of the Third Mission [35]. However, the results of the current study indicate that there are a number of challenges to effective public engagement in tertiary education. These challenges include a lack of awareness and understanding of the Third Mission among citizens, difficulty in involving citizens in decision-making processes, and conflicts of interest that arise in the participatory process. In light of these challenges, it is essential to develop strategies for improving public engagement in tertiary education through the Academic Third Mission [18,19,22]. Some possible strategies include increasing awareness and understanding of the Third Mission among citizens, involving citizens in decision-making processes and providing them with the tools and resources to participate effectively,

and addressing conflicts of interest in the participatory process. Based on the obtained results, the authors propose nine different strategies (S1 ÷ S9) for further development.

Improving public engagement in tertiary education requires a multifaceted approach, emphasizing transparency, early involvement, and a culture of participation. A key strategy is enhancing transparency and communication between universities and the community (S1). This can be effectively achieved by regularly publishing the results of participatory activities on the university's website and establishing a dedicated online channel to listen to and implement citizens' recommendations. Involvement of citizens should begin at the initial stages (S2), including the collection and processing of context data, identification of priorities, and planning and programming of interventions. Such early engagement ensures that their needs and perspectives are integral to decision-making processes. Additionally, fostering a culture of participation within the university is crucial (S3). This involves providing training and support to staff and students in participatory methods and encouraging active participation in decision-making processes. The formation of interest groups and coalitions during debates ensures diverse perspectives in decision-making (S4). Equally important is the regular evaluation and monitoring of the participation process (S5) to identify areas for improvement, ensuring inclusivity and fairness. Diverse participatory methods, such as town meetings, deliberative surveys, and design workshops, are essential to represent varied viewpoints (S6). Collaboration with other organizations and experts is another key aspect (S7), providing access to a broad range of perspectives and expertise in decision-making. It is also important to consider the available resources and the level of conflict (S8) related to the intervention area and the local community before implementing any strategy. Finally, supporting citizens to understand their needs and make informed decisions is paramount (S9). This includes informing them of the outcomes of the participatory process, the work conducted by researchers and experts, and collecting feedback for potential interventions and improvements. A specific online channel for listening to and implementing citizens' recommendations further supports this strategy, making for a more robust and inclusive approach to public engagement in tertiary education.

In order to facilitate the implementation of the above strategies, the study showed that there are still several areas in which universities can improve their engagement with citizens through the Academic Third Mission [1,4]. In order to effectively involve citizens in the decision-making process and ensure that their needs are being met, universities should consider implementing a variety of good practices. First, universities should prioritize transparency and communication throughout the participatory process. This includes clearly communicating the goals and objectives of the participatory process to citizens, as well as providing regular updates on the progress of the process and the outcomes achieved [2]. Universities should also make an effort to ensure that the results of the participatory process are widely shared and easily accessible to citizens, such as through a dedicated section on the university website. Second, universities should actively involve citizens in the planning and implementation of the Third Mission activities. This can be achieved through a variety of methods, such as working groups, town meetings, and participatory budgeting [20]. By involving citizens in the planning process, universities can ensure that their needs and priorities are taken into account and that the resulting interventions are more effective. Third, universities should consider providing support to citizens to understand their needs and make informed decisions. This can be achieved through a variety of methods, such as information desks, listening points, and providing information about the final result produced by the participatory process and the work conducted by researchers and experts [21,23,30]. Fourth, in order to prevent conflicts of interest, universities should have a clear policy in place to identify and address such situations. This can include the establishment of a conflict-of-interest committee, the implementation of a code of conduct, and the provision of training to staff and stakeholders on how to handle conflicts of interest [33,35]. Finally, universities should conduct regular evaluations of the participatory process to identify areas for improvement and ensure that the needs and priorities of citizens are being met. This can include conducting surveys or

focus groups to gather feedback from citizens, as well as conducting internal evaluations of the process [37].

The study revealed the main areas of improvement for the involved European universities and some important recommendations were proposed for further development. Based on these an initial framework is proposed in Figure 4.

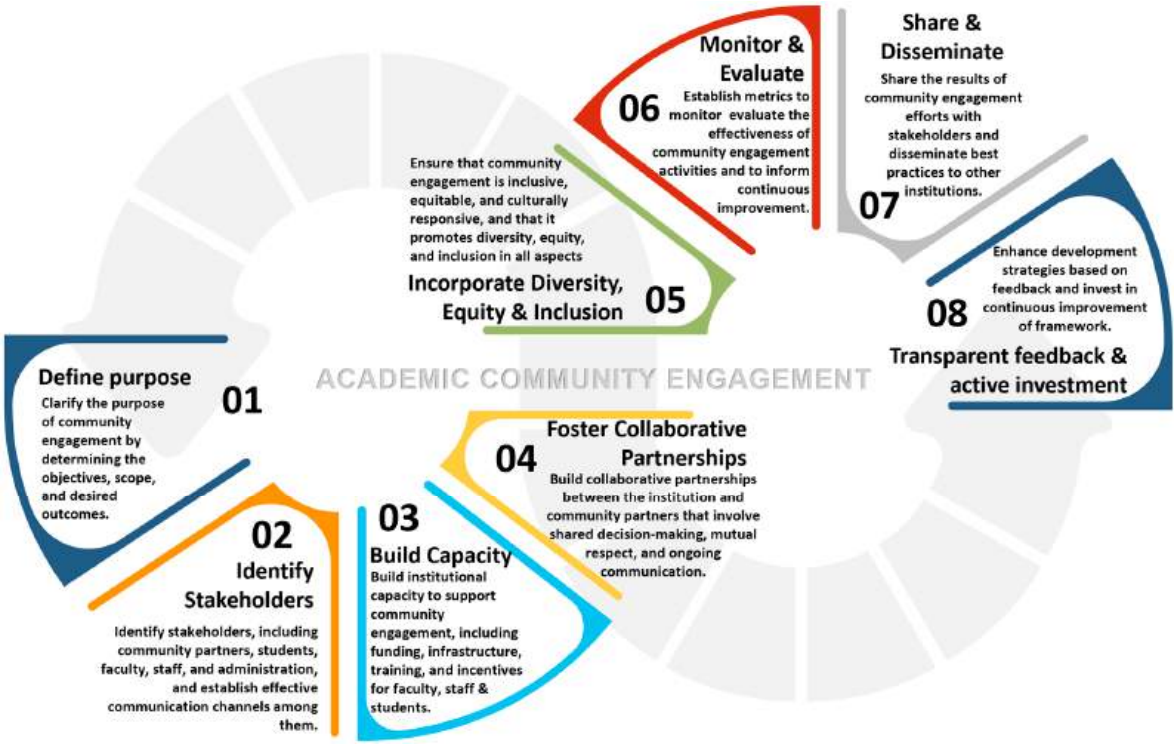


Figure 4. General framework for promoting academic community engagement.

To substantiate the framework and apply the identified sustainable strategies, the project consortium developed an online platform which enables stakeholders to get involved, participate and decide on sustainable academic contexts. The platform is available at www.tenacityplatform.com (accessed on 15 November 2023) and allows sustainable implementation of academic deliberative arenas for open science and innovation, and the delivery of an e-learning platform for academic deliberative practitioners. In accordance with study findings, the platform allows six main categories of stakeholders to participate in the creation of sustainable academic practices, namely: citizen, policy maker, professor, researcher student and teacher.

An important feature of this interactive tool is the iterative feedback loop which allows participants to the deliberative process to improve on any subroutine, enhancing the overall sustainability and probability of use for future applications. This approach also lowers the impact of identified limitations, all the way to potentially eliminating some of them. Multifunctionality was also promoted, and organic development of novel avenues was permitted, all leading to sustainable product development in academic settings.

Nevertheless, the study brings with it limitations which should be considered when assimilating the presented information and conclusions. One potential limitation of this study is the small sample size of the survey participants. With only 44 participants, it is difficult to generalize the findings to the larger population of citizens and universities. Small samples may have limited representativeness and statistical power, and assumptions such as normality can be more challenging to meet. Nonetheless, even a small quantitative study can establish baseline data on a topic, providing a starting point for future research and comparisons.

Additionally, the survey responses were self-reported and may not accurately reflect the true experiences and perspectives of the participants. The study also relies on the assumption that the participants have a clear understanding of the term "participatory practices" and have had similar experiences in their participation in university activities. There could also be a bias in the survey responses, as the participants may have had a vested interest in presenting their experiences in a certain way. Another limitation is that the study does not consider other factors that may influence the implementation of participatory practices in universities. For example, the survey does not take into account the specific political, economic, and cultural context of each university or the level of resources available to support participatory practices.

One mentionable limitation is that the study does not consider how the COVID-19 pandemic may have affected the ability of citizens and universities to participate in participatory practices, such as the shift to online engagement or the reduced availability of resources. The small sample size and self-reported nature of the survey responses, along with the assumptions made about the participants' understanding and experiences, may limit the generalizability of the findings. Also, the study does not take into account other factors that may influence the implementation of participatory practices in universities. To overcome the study limitations, it is recommended to conduct quantitative analysis and further research on larger studies. Future actions include the use of the current study as a pilot to inform a larger, more comprehensive research project. Additional qualitative methods, such as focus groups or case studies, will also supplement the survey data to provide a richer, more nuanced understanding of the third mission in different European HEIs, further developing the proposed framework.

The advantages of using ANOVA in our design analysis also counteract some of the study limitations. It allowed us to quantify trends and patterns for community engagement, even with the small sample size. This provided initial insights and identified potential areas of interest for further qualitative analysis. The quantitative data collection involved standardized instruments; the survey used Likert scales, allowing for consistency in data collection and facilitating comparisons across respondents and institutions.

4. Conclusions

The current study provides valuable insights into the current state of public engagement in tertiary education through the Academic Third Mission in European universities. The results of this survey can be used to identify gaps and areas for improvement in the development of strategies for promoting public engagement. Additionally, the study leads to the conclusion that European universities need a general framework for promoting and improving public engagement in tertiary education through the Academic Third Mission. Furthermore, the study's findings can be used to enrich a repository of good practices in Europe, which will be showcased in a handbook and on the TENACITY project website. This can serve as a valuable resource for universities looking to improve their public engagement strategies. The obtained results can be used to help identify the needs of universities in order to improve their deliberative practices. A survey was designed and applied to collect the data from 44 respondents, representing 35 universities from nine European countries. Quantitative (ANOVA) and qualitative analysis was undertaken to analyze various aspects of public engagement, such as university commitment, documentation, public awareness, investments, incentives, training, and stakeholder engagement.

The ANOVA results showed that while the respondents generally have a neutral opinion on the statements regarding public engagement at the university, there are some areas where they feel more positively or negatively. For example, the higher scores for Q1, Q2, and Q9 suggest that the respondents feel that the university's commitment to public engagement is clearly defined, well documented, and has well-structured target groups for its community public engagement activities. Lower scores for Q3, Q4, and Q5 show that the respondents feel that the university does not ensure that the documented commitment to public engagement is also publicly known and understood, people at different levels

of the university are not responsible for implementing the public engagement agenda, and the university does not currently make adequate investments to encourage public engagement. Similarly, higher scores for Q6 and Q7 imply that the respondents feel that the university offers incentives and rewards to promote public engagement and offers training activities to support public engagement. The smaller values obtained for Q8, Q10 and Q11 showcase the situation where the respondents feel that the university does not integrate external services into its portfolio of services to promote public engagement, does not use up-to-date methods and approaches to develop public engagement skills among students, and does not integrate public engagement practices into degree programs. Results for Q12, Q13 and Q19 were registered in the upper part of the evaluation scale and signify that the respondents think that the university promotes interdisciplinary educational paths, compares and identifies the needs of its external stakeholders, and has defined the kind of impact it aims to create through public engagement. On the other hand, lower scores for Q14, Q15 and Q16 suggest that the respondents feel that the university does not use indicators to measure its activities and public engagement results, does not ensure that the results of the impact assessment of public engagement activities are used for future planning and organizational development, and does not communicate the results of the assessment on the impact of its public engagement activities inside and outside the institution. Higher scores for Q17, Q18, and Q20 entail that the university influences community engagement at local and regional levels, creates a social impact from public engagement activities, and integrates community stakeholders into the institution's leadership.

AHP was used to add value to the current study by prioritizing the questions based on their relative importance, thus offering a comprehensive view that is beneficial for both analytical and decision-making purposes. The analysis identified four key survey areas: promoting interdisciplinary paths (Q12), defining public engagement (Q1), integrating external services (Q8), and incentivizing public engagement (Q6). Q12, crucial but with the lowest correlation, highlighted a significant improvement area. Q1's high average in ANOVA aligned with its AHP importance, suggesting a need to focus on functionality. Q8's poor integration of external services in universities, as per ANOVA, combined with its AHP significance, called for more efficient external service integration strategies. Q6's strong correlations indicated its vital role in research and improvement.

The current study is an important contribution to the field of public engagement in tertiary education through the Academic Third Mission by providing valuable insights and recommendations that can be used to improve the development of strategies and enhance public engagement in European universities.

Author Contributions: Conceptualization: M.-E.U. and C.-V.D.; Methodology: P.S.; Validation: C.-V.D., P.S. and M.-E.U.; Formal analysis: C.-V.D.; Investigation: M.-E.U.; Resources: P.S.; Data curation: P.S., M.-E.U. and C.-V.D.; Writing—original draft preparation: M.-E.U.; Writing—review and editing: P.S. and C.-V.D.; Visualization: M.-E.U.; Supervision: C.-V.D.; Project administration: P.S.; Funding acquisition: P.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the European Community's ERASMUS+ PROGRAMME under grant agreement no. 2021-1-IT02-KA220-HED-000032042—ACADEMIC THIRD MISSION: comuniTy Engagement for a kNowledge bAsed soCIeTY (TENACITY). This work was supported by a grant from the National Program for Research of the National Association of Technical Universities—GNAC ARUT 2023, Grant No. 14/06.10.2023.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available in Appendix A.

Acknowledgments: Authors would like to acknowledge the contribution of University POLITEHNICA of Bucharest for the support given in the form of infrastructure and other resources not covered through the funded projects.

Conflicts of Interest: The authors declare no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data, in the writing of the manuscript, or in the decision to publish the results.

Appendix A

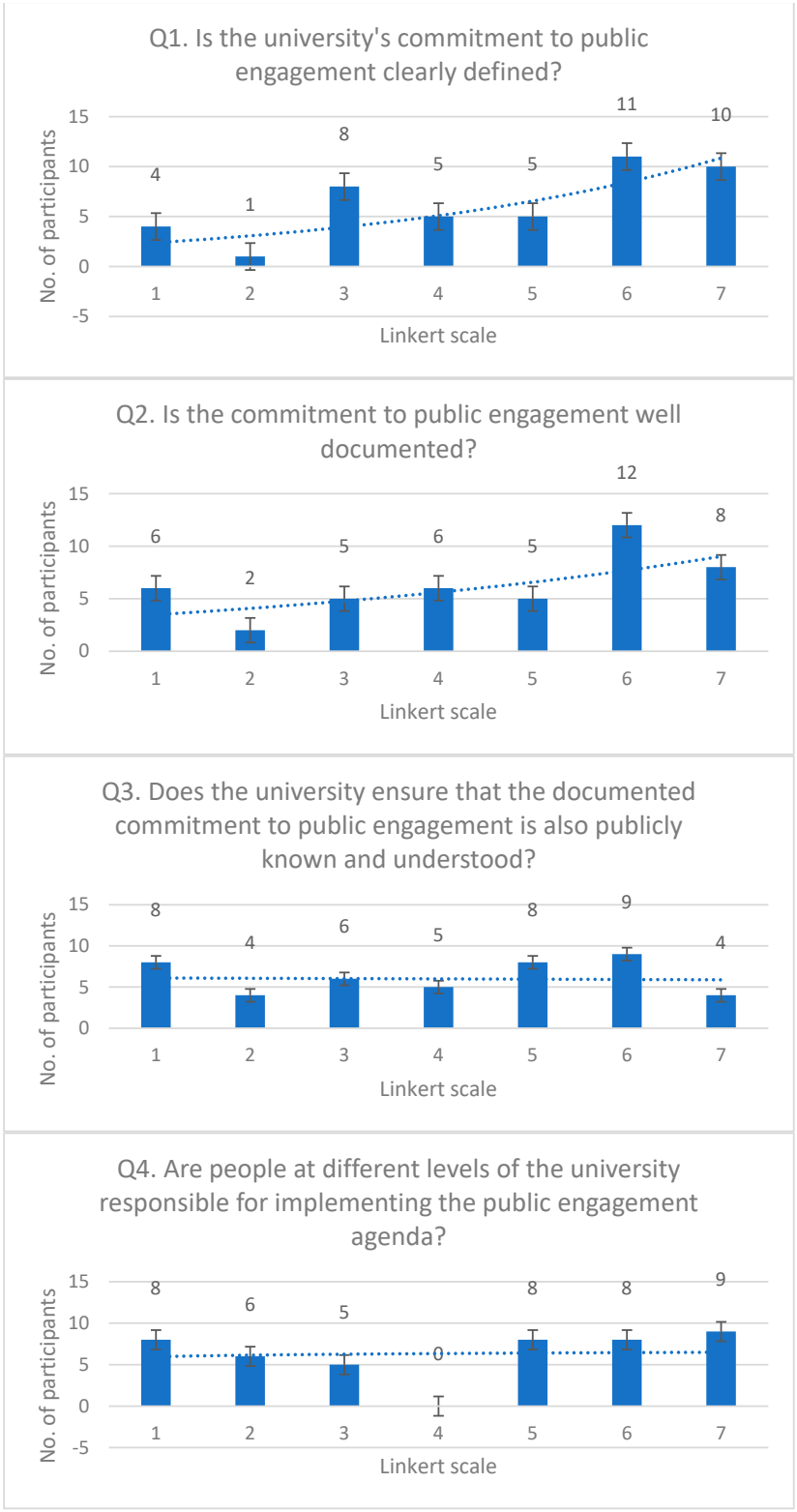
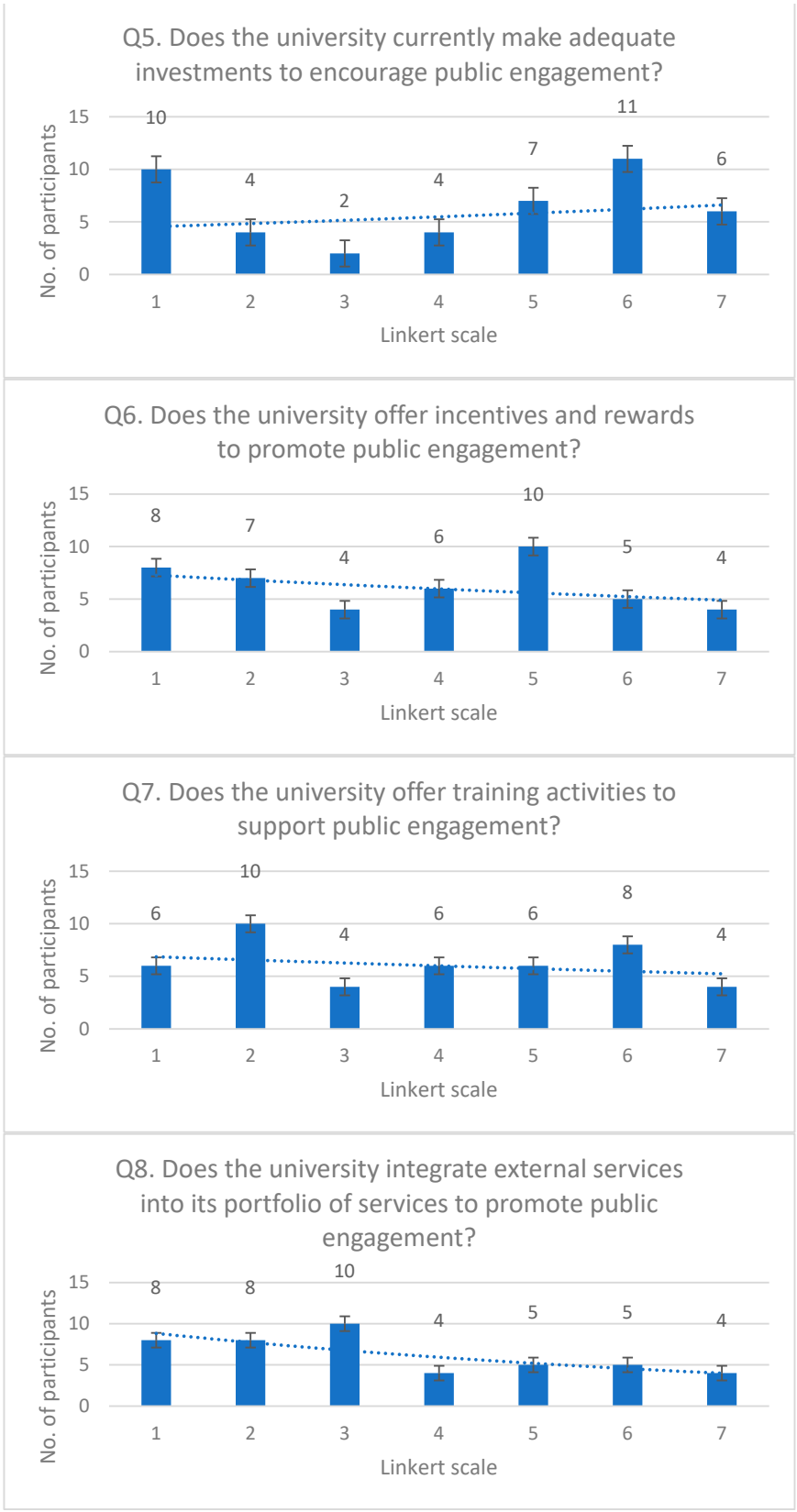


Figure A1. *Cont.*



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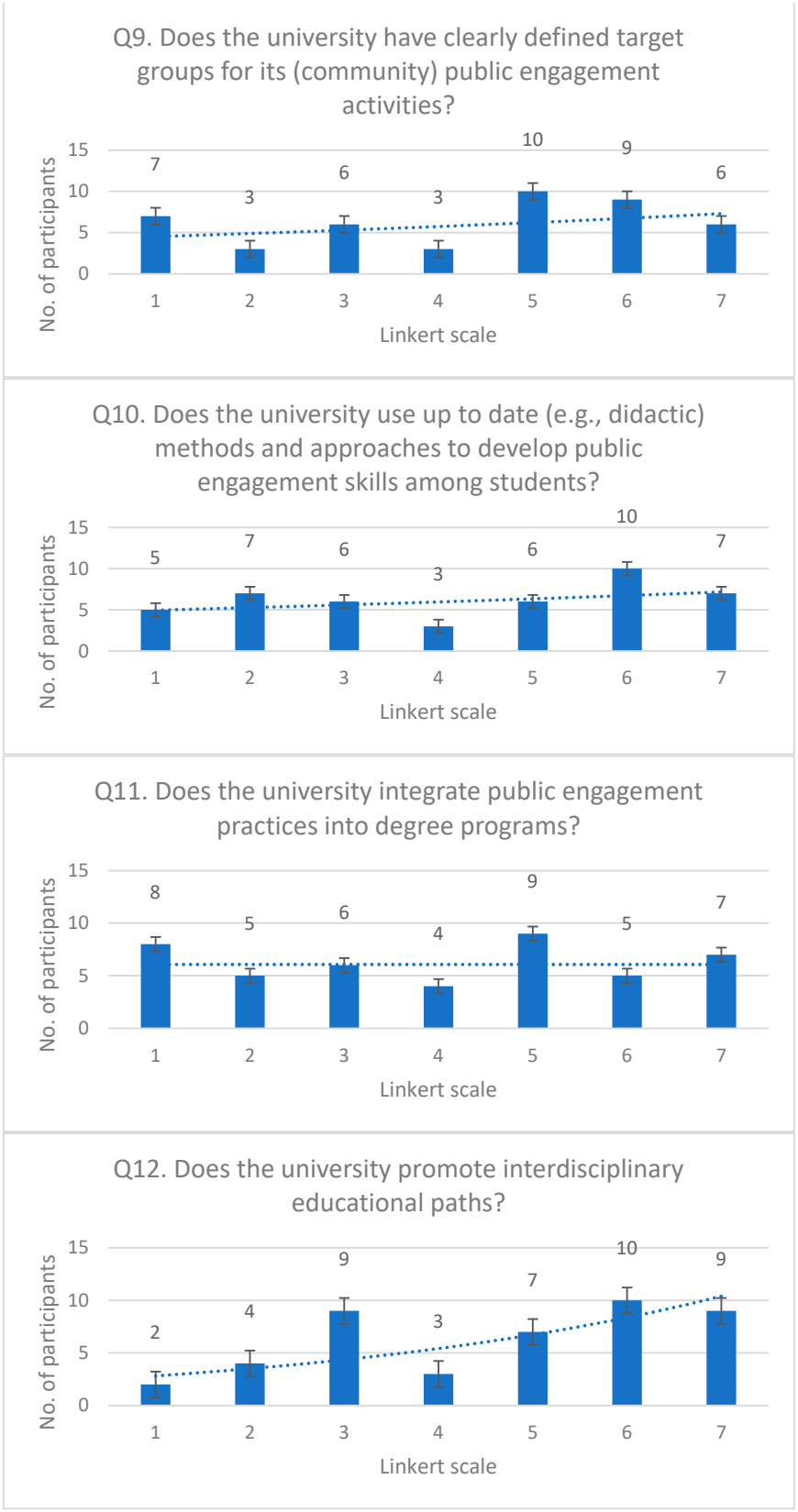

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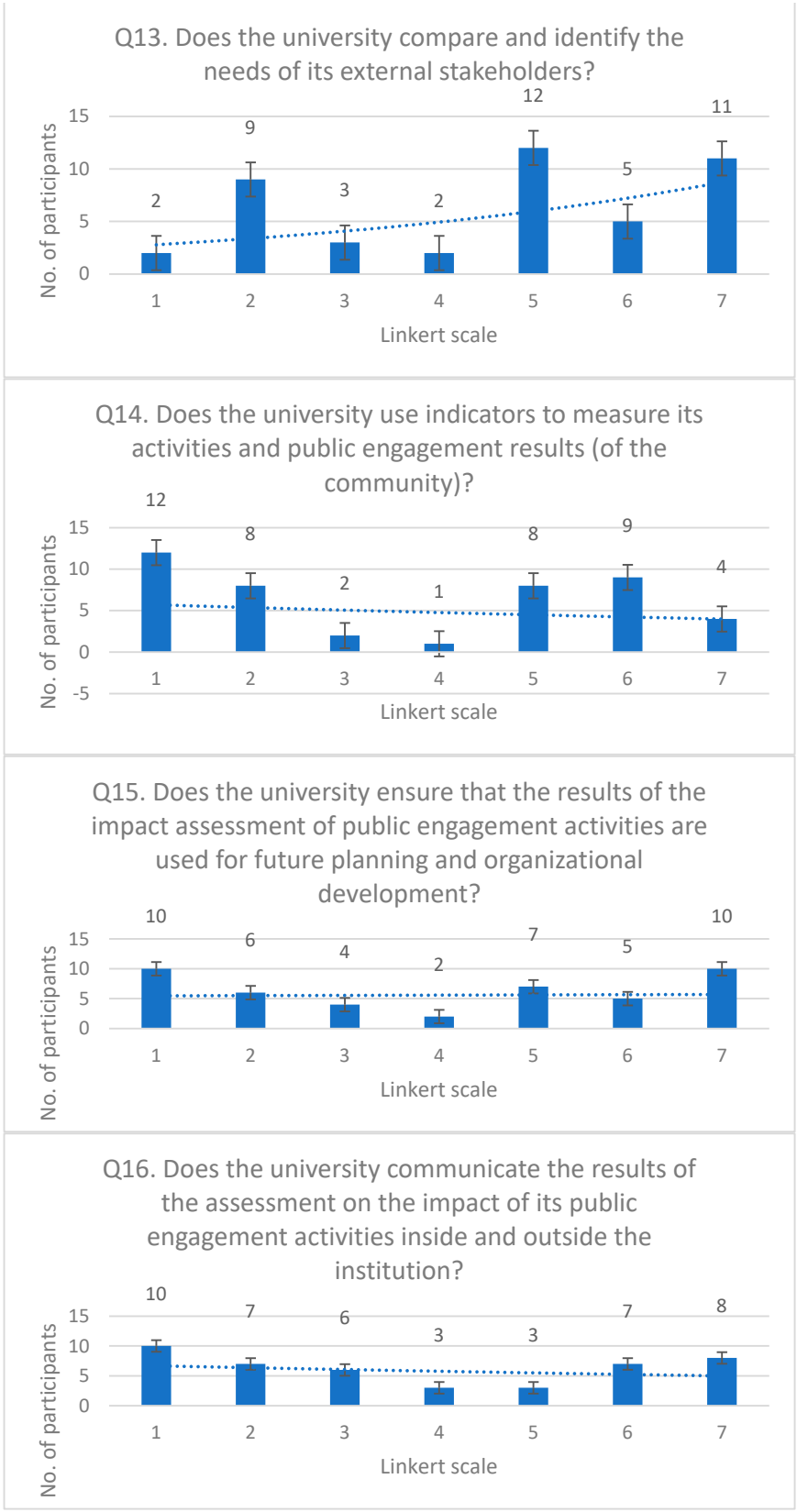

Figure A1. *Cont.*

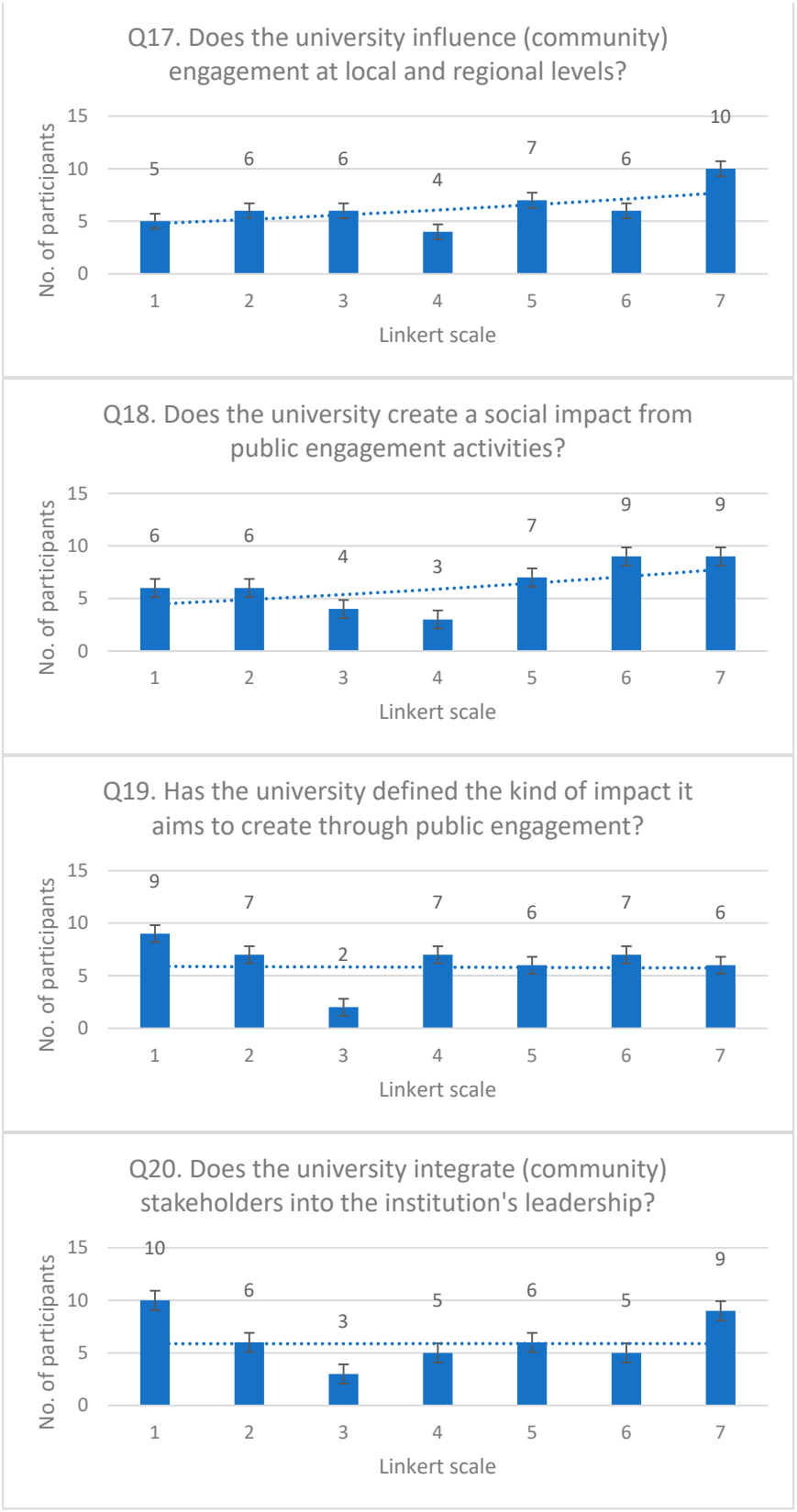

Figure A1. Results for the 20 items within TENACITY project.

Appendix B

Table A1. Shapiro–Wilk test applied to calculate the statistic (W) and the *p*-value for each of the 20 questions from the survey in Germany, Greece and Lithuania.

Question	Germany			Greece			Lithuania		
	W	***p*-Value**	**Normality**	**W**	***p*-Value**	**Normality**	**W**	***p*-Value**	**Normality**
Q1	0.629776	0.001241	No	0.94817	0.532673	Yes	0.860379	0.261574	Yes
Q2	0.944664	0.682961	Yes	0.958862	0.704304	Yes	0.91099	0.487663	Yes
Q3	0.849402	0.224231	Yes	0.899812	0.112078	Yes	0.971374	0.849971	Yes
Q4	0.790653	0.086487	Yes	0.881089	0.060231	Yes	0.848079	0.219999	Yes
Q5	0.944664	0.682961	Yes	0.819258	0.008724	No	0.894945	0.406387	Yes
Q6	0.91099	0.487662	Yes	0.881597	0.061244	Yes	0.839702	0.194534	Yes
Q7	0.863369	0.272453	Yes	0.859002	0.029495	No	0.963072	0.798227	Yes
Q8	0.849402	0.224231	Yes	0.909098	0.152901	Yes	0.839702	0.194534	Yes
Q9	0.992912	0.971877	Yes	0.845529	0.019323	No	0.992912	0.971878	Yes
Q10	0.827427	0.161191	Yes	0.876281	0.051458	Yes	0.743573	0.033567	No
Q11	0.629776	0.001241	No	0.934432	0.35164	Yes	0.863369	0.272453	Yes
Q12	0.800563	0.103233	Yes	0.760175	0.001673	No	0.629776	0.001241	No
Q13	0.93927	0.649878	Yes	0.904935	0.133024	Yes	0.848079	0.219999	Yes
Q14	0.949706	0.714281	Yes	0.844588	0.018768	No	0.772907	0.061847	Yes
Q15	0.827427	0.161191	Yes	0.857627	0.028237	No	0.763479	0.051229	Yes
Q16	0.998396	0.995064	Yes	0.832679	0.013032	No	0.886912	0.369	Yes
Q17	0.863369	0.272453	Yes	0.853856	0.025066	No	0.949706	0.714281	Yes
Q18	0.944664	0.682961	Yes	0.900759	0.11568	Yes	0.949706	0.714281	Yes
Q19	0.894945	0.406388	Yes	0.877539	0.053617	Yes	0.927082	0.577355	Yes
Q20	0.927082	0.577355	Yes	0.856535	0.027278	No	0.629776	0.001241	No

Table A2. Shapiro–Wilk test applied to calculate the statistic (W) and the *p*-value for each of the 20 questions from the survey in Romania, Spain, Sweden.

Question	Romania			Spain			Sweden		
	W	***p*-Value**	**Normality**	**W**	***p*-Value**	**Normality**	**W**	***p*-Value**	**Normality**
Q1	0.858486	0.146728	Yes	0.774708	0.022823	No	0.971374	0.849971	Yes
Q2	0.858486	0.146728	Yes	0.813434	0.055481	Yes	0.949706	0.714281	Yes
Q3	0.867412	0.176171	Yes	0.932528	0.572603	Yes	0.91099	0.487662	Yes
Q4	0.846302	0.113659	Yes	0.784353	0.028585	No	0.894945	0.406387	Yes
Q5	0.853883	0.133334	Yes	0.909711	0.393876	Yes	0.763479	0.051229	Yes
Q6	0.929357	0.545445	Yes	0.926057	0.517886	Yes	0.949706	0.714281	Yes
Q7	0.921579	0.481756	Yes	0.83571	0.090587	Yes	0.800563	0.103233	Yes
Q8	0.910662	0.400475	Yes	0.879977	0.226348	Yes	0.728634	0.023857	No
Q9	0.670536	0.001752	No	0.911128	0.403738	Yes	0.971374	0.849971	Yes
Q10	0.719758	0.006067	No	0.955536	0.77965	Yes	0.882072	0.34756	Yes
Q11	0.863961	0.164219	Yes	0.846302	0.113659	Yes	0.963072	0.798227	Yes

Table A2. *Cont.*

Question	Romania			Spain			Sweden		
	W	***p*-Value**	**Normality**	**W**	***p*-Value**	**Normality**	**W**	***p*-Value**	**Normality**
Q12	0.840044	0.099451	Yes	0.907051	0.375833	Yes	0.882072	0.34756	Yes
Q13	0.856091	0.139616	Yes	0.862486	0.159333	Yes	0.827427	0.16119	Yes
Q14	0.871193	0.190135	Yes	0.874451	0.202933	Yes	0.743573	0.033567	No
Q15	0.870328	0.186858	Yes	0.863961	0.164219	Yes	0.798526	0.099603	Yes
Q16	0.863225	0.161763	Yes	0.812736	0.054621	Yes	0.882072	0.34756	Yes
Q17	0.934584	0.590524	Yes	0.90903	0.389195	Yes	0.963072	0.798227	Yes
Q18	0.834969	0.089147	Yes	0.945253	0.686389	Yes	0.882072	0.34756	Yes
Q19	0.824948	0.071632	Yes	0.931918	0.567328	Yes	0.863369	0.272453	Yes
Q20	0.791718	0.033888	No	0.965365	0.863218	Yes	0.839702	0.194534	Yes

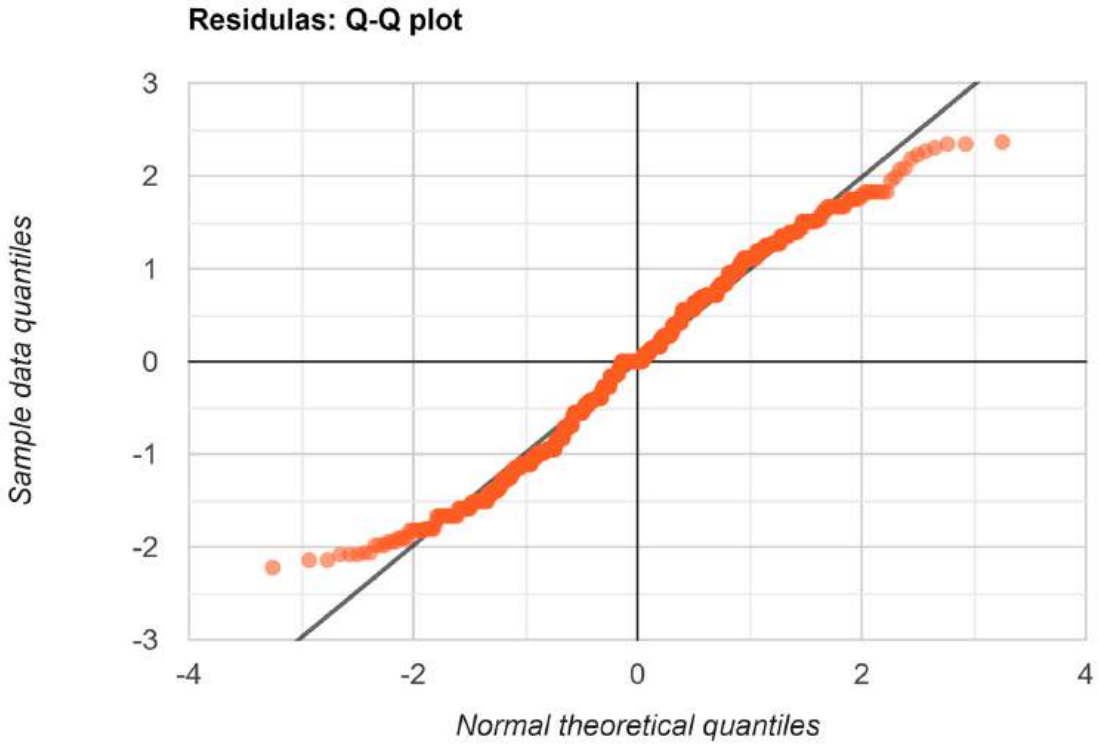

Figure A2. Q-Q plot of residuals.

Appendix C

Table A3. Levene's test for validation of homogeneity of variances for 20 questions of the survey (*p*-value > 0.05).

	Spain	**Romania**	**Italy**	**Sweden**	**Greece**	**Germany**	**Lithuania**	**Overall**	**Levene's Test Statistic**	**Levene's Test *p*-Value**	**Homogeneity**
Q1	2.952381	6.619048	0.500000	2.916667	2.131868	0.250000	6.000000	3.721254	1.640097	0.165415	Yes
Q2	2.571429	6.619048	0.000000	3.333333	3.362637	0.666667	5.666667	3.942509	1.725253	0.144158	Yes
Q3	2.666667	6.238095	0.000000	5.666667	3.412088	2.250000	2.916667	3.997677	1.058790	0.405442	Yes

Table A3. *Cont.*

	Spain	Romania	Italy	Sweden	Greece	Germany	Lithuania	Overall	Levene's Test Statistic	Levene's Test *p*-Value	Homogeneity
Q4	8.333333	6.666667	0.500000	6.333333	3.494505	3.583333	5.583333	5.027294	0.754531	0.610160	Yes
Q5	5.904762	4.476190	0.500000	5.666667	3.758242	0.666667	1.583333	4.840883	0.829477	0.555211	Yes
Q6	5.238095	2.904762	0.500000	3.333333	2.835165	5.666667	3.000000	3.865273	0.768821	0.599509	Yes
Q7	4.238095	4.952381	2.000000	4.916667	2.527473	0.916667	4.916667	3.930314	0.367364	0.894622	Yes
Q8	4.571429	5.285714	2.000000	8.333333	1.346154	2.250000	3.000000	3.816492	2.286003	0.057563	Yes
Q9	3.619048	2.904762	0.000000	2.916667	3.609890	1.666667	6.666667	3.983740	1.494975	0.208598	Yes
Q10	4.000000	1.810000	0.500000	8.667000	2.951000	2.000000	8.250000	4.063000	1.023930	0.426171	Yes
Q11	6.670000	5.570000	0.500000	4.920000	3.450000	4.000000	8.250000	4.320000	0.614851	0.716864	Yes
Q12	3.905000	1.905000	0.500000	8.667000	2.374000	4.917000	6.250000	3.503000	0.533000	0.884000	Yes
Q13	3.619000	2.905000	2.000000	2.000000	3.346000	7.583000	5.583000	4.007000	0.604000	0.725000	Yes
Q14	6.238000	6.952000	0.000000	4.667000	6.527000	2.333000	8.333000	5.928000	0.559000	0.784000	Yes
Q15	5.571429	5.285714	0.500000	10.250000	4.686813	2.000000	5.666667	5.292102	0.781004	0.590487	Yes
Q16	5.238100	6.904800	8.000000	8.666700	4.131900	4.333300	6.916700	5.356600	0.403400	0.871700	Yes
Q17	5.619048	2.238095	2.000000	4.916667	3.456044	0.916667	3.333333	4.192799	0.622752	0.710774	Yes
Q18	4.570000	5.810000	2.000000	8.670000	4.070000	0.670000	3.330000	4.670000	0.864975	0.530078	Yes
Q19	3.571429	5.238095	2.000000	8.250000	3.719780	1.583333	4.666667	4.527294	0.395607	0.876791	Yes
Q20	4.476190	7.476190	0.000000	3.000000	3.719780	4.666667	2.250000	4.987224	1.096671	0.383788	Yes

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25th JUNE 2025

SOURCE: PERPUSTAKAAN UTM

Multidisciplinary Reviews

MINI REVIEW
Published Online: November 22, 2024
https://doi.org/10.31893/multirev.2025124

Influence of global university rankings on strategic decisions at Ho Chi Minh City university of education in balancing global competitiveness and local educational goals

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Abstract University rankings serve as crucial tools for evaluating and comparing the quality of higher education institutions worldwide. This study examines the impact of global university rankings on the strategic choices made by higher education institutions, with a focus on developing countries such as Vietnam. This study investigates rankings, including QS, Times Higher Education (THE), and Webometrics, and analyzes their emphasis on research output, internationalization, and reputation, frequently at the expense of teaching quality and community engagement. The reviewed literature comprises peer-reviewed articles and studies published from 2010--2023, emphasizing Vietnamese universities such as Ho Chi Minh City University of Education, which encounter difficulties in reconciling global competitiveness with local educational objectives. The findings demonstrate that global rankings tend to favor universities with robust research infrastructures and extensive international networks, resulting in disparities between well-funded institutions and those with limited resources. While emerging trends such as contributions to the United Nations Sustainable Development Goals (SDGs) are becoming more prominent, research metrics continue to be the primary determinants. The study concludes that existing ranking systems fail to adequately represent the broader objectives of universities in developing countries, especially those emphasizing local impact.

Keywords: university rankings, developing countries, teaching quality, social impact

1. Introduction

University rankings have emerged as a significant instrument for assessing and comparing the character of higher education institutions on a global scale. These rankings are a source of reference for a variety of stakeholders, such as students, faculty, governments, and employers, and they are used to inform decisions regarding university funding, collaboration, and student enrollment (Hazelkorn, 2015; Kayyali, 2023; Sarrico & Godonoga, 2021). In the last two decades, rankings such as QS World University Rankings, Times Higher Education (THE) Rankings, and Webometrics have gained significant prominence, establishing them as crucial indicators of institutional performance (Chen & Chan, 2021). Although these rankings provide a method for assessing and benchmarking universities on a global scale, they also present obstacles, particularly in terms of conforming their criteria to the diverse missions of institutions, particularly those in developing countries (Dill & Soo, 2005; Serafini et al., 2022).

Rankings are employed by higher education institutions worldwide to establish themselves in competitive international academic environments. Rankings enhance the reputation of universities by attracting top talent, including students, academics, and research funding, and providing visibility and prestige (Marginson, 2007; Salmi, 2021; Soysal et al., 2024). Many universities have adopted this as a strategic objective, prioritizing their performance in global rankings. Nevertheless, classification systems are not without criticism in terms of their methodologies. Numerous rankings prioritize research output, citation counts, and international reputation, frequently disregarding other critical components of a university's mission, including teaching quality, community engagement, and contributions to societal development (Galleli et al., 2022; Hauptman Komotar, 2019).

The dependence on global rankings can be both a constraint and an opportunity for universities in developing countries, such as Vietnam. Rankings can provide opportunities for institutional funding, global visibility, and increased international collaboration. However, numerous universities in these regions may lack the resources to compete with established institutions in Europe or North America, which could result in a potential disparity between the ranking criteria and the institution's local or national priorities (Hazelkorn, 2009; Jöns & Hoyler, 2013; Marginson, 2006). The primary mission of Ho Chi Minh City

University of Education (HCMUE) is to provide quality education, foster pedagogical excellence, and address local educational needs. Therefore, the pursuit of international recognition through rankings must be balanced with this principle.

The relevance of university rankings in Vietnam is on the rise as the country further integrates into the global education market. The Vietnamese government has established ambitious objectives for higher education, such as promoting the participation of universities in international evaluations to improve their global reputation (Harman et al., 2010; Hoang et al., 2018). Nevertheless, this procedure presents unique obstacles for numerous Vietnamese universities, including HCMUE. These encompass challenges in adhering to the publication standards established by ranking agencies that prioritize English-language journals, inadequate international collaborations, and inadequate financial resources for research infrastructure (Truong & Cuong, 2019; Vuong & Tran, 2019). Additionally, there are ongoing discussions regarding the extent to which global ranking systems accurately represent the distinctive contributions of universities in emerging economies, particularly in the areas of social impact, teaching quality, and community service (Hazelkorn, 2015).

The primary goal of this literature review is to evaluate the impact of university rankings on the strategic objectives of HCMUE, with a particular emphasis on their function and significance. This review analyzes the historical evolution of university rankings, discusses the current trends and challenges they present, and investigates the key theoretical frameworks that underpin them. In doing so, the objective of this study is to offer a more comprehensive comprehension of the methods by which HCMUE can navigate the global ranking landscape while still adhering to its mission of educational and social development.

2. Theoretical Framework

University rankings are founded on a variety of fundamental theories regarding competition, reputation, and performance measurement in higher education. These frameworks assist in elucidating the reasons why institutions prioritize rankings and the implications of these rankings for their strategies, objectives, and global academic positioning.

Hazelkorn (2011) claimed that the theory of global competition is a foundational theory in this domain. It argues that rankings are a means for universities to demonstrate their global competitiveness. Hazelkorn stated that universities are no longer merely national institutions in a world that are becoming more interconnected; rather, they are a component of a global knowledge economy. Rankings function as a criterion in this context, enabling universities to assess their performance in comparison to their international counterparts (Adam, 2020; Marginson, 2007). Institutions that succeed in these evaluations are perceived as having superior quality, which can have a beneficial impact on their capacity to attract international students, faculty, and research funding (Dill & Soo, 2005; Mazzarol, 1998). This theory is inextricably linked to the concept of global reputation management, in which universities employ rankings as a signaling mechanism to increase their visibility and prestige on a global scale (Wedlin, 2011). The competitive race for talent and resources is significantly influenced by the perception of excellence, which is further bolstered by strong ranking positions.

The RBV of institutions, as articulated by Barney (1991), is another pertinent theory. The performance of a university in rankings is a reflection of its internal resources and capabilities, as per RBV. These resources encompass infrastructure, international collaboration, research output, and faculty expertise. Universities that possess and effectively employ these resources are more likely to achieve success in global rankings. For example, indexes such as QS and Times Higher Education (THE), which prioritize these criteria, tend to favor institutions with a greater number of research publications and international partnerships. Universities can further improve their competitive advantage by achieving high rankings, which in turn attract additional resources in a positive feedback loop (Lee et al., 2020; Mahdi et al., 2019). Nevertheless, this perspective also underscores the disparities between universities with substantial financial or academic assets and those with fewer. According to Hazelkorn (2011), the resources of universities vary, resulting in unequal competition and an environment in which fewer or less-funded institutions are unable to maintain their ranking performance in comparison to well-established institutions.

Furthermore, the institutional theory of isomorphism is instrumental in comprehending university rankings. Isomorphism is the process by which organizations, and institutions in particular, become more similar over time as a result of external pressures, such as ranking metrics (DiMaggio & Powell, 1983; Hersberger-Langloh et al., 2021; Wedlin, 2007). Rankings impose a form of coercive pressure on institutions to adhere to specific standards, such as increased research output or internationalization efforts, to increase their ranking position. Consequently, universities may adjust their strategies to more closely align with the criteria established by ranking agencies, potentially at the expense of their local missions or other distinctive aspects of their identity (King, 2009; Morphew & Swanson, 2011). For example, institutions may prioritize international student recruitment or English-language publications to increase their ranking scores, although these areas are not fundamental to their original mission.

Legitimacy theory is another critical theory that posits that universities seek validation and legitimacy from external stakeholders, such as governments, donors, and potential students (Circa et al., 2021; Deephouse & Carter, 2005; Parker, 2011). Rankings serve as a means for universities to establish credibility by illustrating their compliance with international standards of excellence. An institution's reputation can be improved by strong performance in rankings, which indicates to stakeholders that it meets or exceeds international quality standards. However, this pursuit of legitimacy can occasionally result in mission

drift, in which universities prioritize activities that enhance their ranking position over those that are consistent with their primary mission, such as community engagement or teaching quality (Hazelkorn, 2015).

Additionally, signaling theory provides a perspective on the manner in which universities employ rankings as a means of communicating their status and value to external audiences. Universities with high rankings convey a positive signal to prospective students, faculty, and partners, indicating that they are high-quality institutions (Al Hassani & Wilkins, 2022; Dicker et al., 2019). This signal can create a self-reinforcing cycle in which highly ranked universities attract more talented students and faculty, resulting in improved outcomes and higher rankings. Nevertheless, this theory also elucidates why universities that do not perform well in rankings may face difficulty in gaining entry into the elite group. Although they provide a higher quality of education or research, they are perceived as inferior institutions (Lynch & O'riordan, 1998).

Finally, the marketization of higher education is a theoretical framework that is expanding and is associated with university rankings. Universities have become increasingly competitive in their pursuit of students and resources, notably on a global scale, as a result of the transition to viewing education as a market commodity (Connell, 2013; Soysal & Baltaru, 2021). In this marketized environment, rankings are essential, as they provide an ostensibly objective measure of the quality of universities. Institutions that are highly ranked are perceived as providing a superior “product”, which in turn stimulates demand from students and other stakeholders (Abina et al., 2020). This theory asserts that higher education is becoming more commercialized, with evaluations serving both as a marketing tool and a benchmark for institutional performance.

University rankings are not merely a reflection of performance; they also affect the strategic behaviors and decisions of higher education institutions. A comprehensive framework for comprehending the significance of rankings and the ways in which they influence the actions and priorities of universities is provided by theories such as global competition, the resource-based view, institutional isomorphism, signaling theory, and the marketization of higher education (Tayar, 2015). These theories emphasize the complexity of the ranking system and the diverse effects it has on institutions, particularly those in developing countries, which may encounter difficulty in reconciling local educational objectives with the requirements of global competitiveness.

3. Methods

3.1. Search strategy

The literature reviewed for this study was selected through a thorough search of numerous academic databases, such as Google Scholar, JSTOR, and ScienceDirect. These databases were selected because of their extensive access to peer-reviewed journal articles, books, and conference papers. The primary search terms were as follows: “university rankings”, “higher education rankings”, “impact of rankings on universities”, “QS World University Rankings”, “Times Higher Education (THE) Rankings”, “Webometrics”, “developing countries”, “Vietnamese higher education”, “HCMUE” and “ĐHSP TP.HCM”. To encompass a wide range of literature regarding the role of rankings in higher education, with a particular emphasis on their influence in developing countries and on Ho Chi Minh City University of Education (HCMUE), these terms were chosen.

To guarantee relevance, the search was restricted to articles published between 2010 and 2023, as this time frame encompasses the most recent advancements in global ranking systems and their increasing impact on university policies and strategies. Foundational texts, including those of Hazelkorn (2011), which offer critical theoretical insights into global competition in higher education, were granted exceptions.

3.2. Process of selection

The literature review was selected on the basis of thorough inclusion and exclusion criteria. Articles were incorporated if they were peer reviewed, published in reputable academic journals, or authored by credible researchers in the field of higher education. Furthermore, articles were required to explicitly address the impact of university rankings on institutional strategies or in the context of developing countries or Vietnamese universities. The methodologies of prominent ranking systems, including QS, Times Higher Education (THE), and Webometrics, were the focus of specific literature.

Articles were excluded if they were deemed outmoded or irrelevant to the current state of global university rankings or if they focused on unrelated topics, such as primary or secondary education. Conference papers and non-peer-reviewed materials were also excluded unless they offered distinctive perspectives on the specific obstacles encountered by developing countries in higher education rankings.

A total of 40 documents were chosen for in-depth review after these criteria were applied. This selection guaranteed a harmonious balance between empirical studies on the impact of university rankings, theoretical discussions on the subject, and case studies that concentrated on Vietnam and other developing regions.

3.3. Categorization

Categorization refers to the process of classifying or grouping items on the basis of shared characteristics or criteria. It is a fundamental cognitive process that aids in organizing information and facilitating understanding.

The literature review was categorized into three primary sections: (1) Historical evolution of university rankings, (2) theoretical perspectives on rankings and their impact, and (3) practical implications for developing countries and Vietnamese universities. The categories facilitated a systematic examination of the literature, emphasizing the evolution of ranking systems and their strategic implications for institutions.

Historical Evolution of University Rankings: This section encompasses research that examines the origins and progression of prominent ranking systems such as QS, THE, and Webometrics. This study examines adaptations in the methodologies of these systems in response to the evolving global higher education landscape.

This category examines the theoretical frameworks present in the literature, including *Hazelkorn's theory of global competition and the resource-based view (RBV)* (Barney, 1991; Hazelkorn, 2011). This section examines the reasons behind the significant influence of rankings on university strategies.

Implications for Development in Emerging Economies and Vietnamese Higher Education Institutions: This section examines the particular challenges encountered by universities in Vietnam and other developing nations in enhancing their rankings. This study examines Vietnamese universities, specifically HCMUE, and analyzes the impact of global ranking pressure on their decision-making and internationalization strategies.

The literature was categorized to facilitate a comprehensive analysis that incorporates global perspectives on university rankings alongside the specific context of HCMUE.

4. Review of the Literature

4.1. Historical perspective

University ranking systems have significantly evolved since their inception. Initial rankings, demonstrated by the Shanghai Academic Ranking of World Universities (ARWU) established in 2003, emphasized research output, specifically metrics such as publication numbers, citation rates, and faculty honors such as Nobel Prizes (Aithal & Kumar, 2020; Alaşehir, 2010; Irungu et al., 2020). These metrics predominantly favor English-speaking countries, particularly in the fields of science and technology, owing to the prevalence of high-impact journals published in English. This prompted criticism that the rankings failed to reflect the complete diversity of institutional strengths, especially in fields such as the social sciences and humanities (Welsh, 2019). The ARWU ranking prioritizes scientific output, thereby excluding universities that excel in teaching or community engagement (Dmitrishin, 2013).

In response to these critiques, more equitable ranking systems emerged, including the QS World University Rankings established in 2004 and the Times Higher Education (THE) Rankings introduced in 2010. The rankings incorporated supplementary criteria such as academic reputation, employer reputation, and teaching quality, with the objective of achieving a more thorough assessment of universities (Liu & Cheng, 2005). Despite these advancements, research outputs and internationalization metrics, including the ratio of international students and staff, continue to be pivotal to these rankings. Webometrics, established in 2004, introduced an alternative methodology by emphasizing the digital presence and visibility of universities, utilizing data from institutional websites as the foundation for their rankings (Khamala et al., 2018; Thelwall et al., 2005). This approach highlights the significance of universities' online presence in a progressively digital landscape.

4.2. Current trends in university rankings

Recent trends in university rankings indicate an increasing focus on internationalization and sustainability, highlighting changes in the priorities of higher education. The Times Higher Education (THE) Impact Rankings evaluate universities according to their contributions to the United Nations Sustainable Development Goals (SDGs), emphasizing aspects such as quality education, gender equality, and climate action (Perović & Kosor, 2020; Serafini et al., 2022). This change in ranking metrics underscores the growing significance of universities' social impact, extending beyond conventional indicators such as academic performance and research output (Adler & Harzing, 2009). This comprehensive evaluation framework prompts institutions to prioritize both academic excellence and their contributions to advancing global sustainability objectives (Hazelkorn, 2015; Yarime et al., 2012).

The QS World University Rankings have integrated additional criteria that acknowledge the increasing significance of cross-border partnerships in higher education. The emphasis on international research network collaboration highlights the importance of global cooperation in enhancing academic research and institutional prestige (Atta-Owusu et al., 2021; Chen et al., 2019). The rankings prioritize employer reputation, a crucial element in assessing the alignment of university programs with job market demands. Employer reputation indicators assist prospective students in assessing the career prospects and market value of a university's degrees, rendering this a critical criterion for numerous global ranking systems (Marginson, 2007, 2014).

Despite these advancements, numerous ranking systems continue to prioritize research output and citations as fundamental metrics for evaluation. For example, THE Rankings assign as much as 30% of their score to research influence, quantified by citation impact (Kanellos et al., 2019). The persistent emphasis on research excellence prompts concerns regarding the potential neglect of other critical dimensions of higher education, including teaching quality and community engagement. This is especially pertinent for institutions such as Ho Chi Minh City University of Education (HCMUE), where the

main focus may prioritize teaching and local educational requirements over research output (Harman et al., 2010; Nguyen, 2014).

4.3. Analysis of the major ranking systems

University ranking systems serve as valuable tools for assessing institutional performance; however, each system possesses inherent limitations and has been subject to criticism regarding particular methodological aspects. The QS World University Rankings have faced criticism due to their dependence on subjective measures, including academic reputation surveys (Marginson, 2014). These surveys gather responses from scholars globally, asking them to evaluate institutions according to their perceived reputation. Goddard and Puukka (2008) noted that these surveys often favor well-established institutions with extensive global networks, which can disadvantage smaller or newer universities lacking comparable visibility. Consequently, newer universities or those located in developing countries may find it challenging to attain high rankings, despite their actual performance and contributions to education and research (Anowar et al., 2015).

Furthermore, the QS methodology places significant emphasis on employer reputation, which, although critical, may be subject to similar biases (Huang, 2012). Institutions with established relationships with multinational corporations or those situated in economically robust countries may obtain higher evaluations from employers, thereby distorting the rankings in favor of these institutions. The dependence on subjective measures has led to critiques that QS rankings may not consistently reflect an accurate or comprehensive assessment of a university's quality (Adler & Harzing, 2009; Dill & Soo, 2005).

The Times Higher Education (THE) Rankings are criticized for their excessive focus on research metrics, especially their significant dependence on citation impact and research output. Although these metrics serve as significant indicators of academic influence, they often obscure other essential functions of a university, including teaching quality and community service. Strand et al. (2003) argues that an emphasis on research may result in a limited perspective on university performance, disadvantaging institutions that prioritize teaching or community engagement. Universities such as Ho Chi Minh City University of Education (HCMUE), which prioritizes pedagogical excellence and community development, may receive rankings that do not accurately reflect their true strengths (Hazelkorn, 2009; Kayyali, 2023).

Webometrics adopts an alternative methodology by evaluating universities according to their digital presence and online visibility (Khamala et al., 2018). This approach, despite its innovation, has limitations in accurately evaluating academic excellence. Webometrics primarily emphasizes quantitative metrics, such as the number of webpages and the visibility of universities on search engines, rather than assessing the quality of publications or the impact of research. Critics argue that Webometrics rankings prioritize universities with robust digital infrastructures over those with significant academic accomplishments (Govender & Nel, 2021; Thuranira & Diki, 2023). Universities that significantly invest in their online platforms may achieve higher rankings, regardless of whether their research output and academic quality align with their digital presence.

Despite these limitations, Webometrics provides a distinct perspective by assessing a university's influence in the digital realm, which is increasingly significant in today's interconnected environment. The increasing importance of online learning and open access research indicates that a university's digital presence is essential for its global influence. Hazelkorn (2015) observes that universities with a strong online presence are more effectively able to connect with a global audience, thereby positioning Webometrics as a valuable instrument for assessing dimensions of university performance that may be neglected by other rankings.

Each ranking system offers valuable insights; however, their methodologies may introduce biases that favor specific types of institutions. Universities, particularly in developing countries, face the challenge of excelling in diverse ranking criteria while remaining aligned with their mission and values (Montesinos et al., 2008).

4.4. Gaps in the literature

Despite comprehensive studies on university rankings, notable gaps remain. There is a paucity of research regarding the alignment of global ranking systems with national education policies and the institutional missions of universities in developing countries. Many global ranking systems are structured for international competition, frequently emphasizing metrics that may not adequately reflect the local priorities of universities in developing countries. Universities such as HCMUE, which focus on teaching excellence and community engagement, may struggle to achieve high rankings that prioritize research output and internationalization (Hazelkorn, 2009).

Moreover, existing rankings frequently neglect nonresearch contributions, including policy consultation, community engagement, and various forms of public service (Moore & Ward, 2010). These contributions are essential for universities, especially in developing countries, where institutions significantly influence societal development. The literature indicates the need for contextualized ranking systems that more accurately reflect the distinct missions and contributions of universities across various regions.

The identified gaps underscore the necessity for future research to concentrate on the creation of more inclusive ranking systems that acknowledge the varied roles of universities, especially in emerging economies. Addressing these gaps will enable

future research to create more equitable and meaningful metrics for university performance that correspond with global standards and local priorities.

5. Synthesis and Discussion

5.1. Integration of findings

The literature on university rankings offers important insights into their substantial impact on institutional strategies, especially in developing countries such as Vietnam. The findings indicate that rankings significantly influence universities' international visibility and global competitiveness. Rankings such as QS, Times Higher Education (THE), and Webometrics are essential tools for assessing university performance, influencing important decisions regarding student recruitment, faculty appointments, and research funding (Hazelkorn, 2015; Taylor et al., 2014). These systems depend significantly on metrics, including research output, internationalization, and reputation, frequently favoring universities with superior financial and academic resources (Reddy et al., 2016). This advantage enables well-established institutions to enhance their global status, placing smaller, resource-limited universities at a comparative disadvantage.

The literature consistently highlights the growing importance of internationalization in university rankings, which has emerged as a critical element in the competitiveness of global higher education. Systems such as the THE Impact Rankings illustrate this trend by evaluating universities' contributions to the United Nations Sustainable Development Goals (SDGs), emphasizing the significance of both academic performance and social impact (Beynaghi et al., 2016). This expands university evaluations to encompass global contributions to critical issues such as climate action, gender equality, and quality education, thus prompting institutions to align their strategies with global development goals. The integration of cross-border partnerships and international research collaborations has become increasingly important, as rankings acknowledge the role of global academic networks in enhancing knowledge exchange and research impact (Gui et al., 2019; Hazelkorn & Gibson, 2017).

Nonetheless, the literature indicates a prevalent critique that numerous ranking systems, notably QS and THE, often place excessive emphasis on research metrics, particularly citation impact. The excessive focus on research outcomes frequently results in the oversight of other essential aspects of a university's mission, including teaching quality, community engagement, and contributions to society (Strand et al., 2003). Universities such as Ho Chi Minh City University of Education (HCMUE), which emphasize teaching quality and local educational requirements, may face challenges in achieving high rankings because the evaluation criteria predominantly favor research-intensive institutions (Hazelkorn, 2009; Kayyali, 2023). Consequently, there is increasing apprehension that existing ranking methodologies fail to offer a thorough assessment of university performance, especially for institutions in developing countries, whose objectives encompass not only research but also substantial contributions to regional development and community service.

The emphasis on research intensifies the disparity between universities in developed and developing countries, as those with strong research infrastructure and global partnerships are more likely to occupy the highest positions. Universities that excel in pedagogy and community-focused initiatives often struggle to achieve recognition in global rankings, despite their essential contributions to local educational advancements and social change. The literature emphasizes the necessity for balanced ranking systems that incorporate various dimensions of university contributions, such as educational quality, social impact, and community engagement, alongside research performance (Marginson, 2007).

5.2. Connections

The analyzed studies collectively emphasize the role of research metrics in influencing university rankings across different systems, notably in QS and Times Higher Education (THE) rankings. Both systems highlight the significance of research output and international reputation, resulting in similar pressures on universities to dedicate considerable resources to publication and global recognition. This has created a competitive landscape in which universities are driven to improve their research output and visibility to attain higher rankings (Adler & Harzing, 2009; Marginson & Van der Wende, 2007). The focus on citation impact and global ranking influences institutional strategies and funding decisions, as universities with higher rankings tend to attract greater investment in research and international collaboration. Consequently, universities in developing countries are compelled to prioritize research metrics, frequently to the detriment of other essential functions such as teaching and community engagement.

Webometrics emphasizes digital visibility, reflecting a broader trend that encourages universities to improve their global presence in an increasingly digitized environment (Khamala et al., 2018). Webometrics assesses universities by measuring their online impact and digital presence, thereby promoting the development of strong online infrastructures and outreach initiatives among institutions (Rafique et al., 2024). This indicates a common goal among ranking systems to establish universities as global entities that are accessible and influential beyond national boundaries.

The studies focus on the increasing importance of internationalization in university rankings, as demonstrated by the incorporation of indicators such as international students, staff, and research collaborations. These measures are integral to QS and THE methodologies, illustrating the growing global character of higher education. Universities are incentivized to

enhance their international presence via student exchange programs, joint research initiatives, and cross-border collaborations to increase their ranking positions (Deb, 2020). The Impact Rankings have implemented a more comprehensive framework by incorporating universities' contributions to the United Nations Sustainable Development Goals (SDGs), thereby broadening the evaluation criteria beyond academic performance and research output (De la Poza et al., 2021). This includes recognizing the social responsibilities of universities and prompting institutions to address global challenges, including climate change, gender equality, and sustainable education. The increasing focus on social impact in rankings such as THE Impact presents a comprehensive perspective on university performance, enabling institutions in developing countries, which may demonstrate strength in local and regional engagement, to enhance their global standing.

Despite these innovations, the prevalence of research metrics continues to be a consistent feature across all ranking systems, leading to ongoing discussions regarding the sufficiency of these criteria in representing a university's broader mission. Institutions primarily dedicated to teaching or emphasizing community service may be at a disadvantage in rankings that prioritize research output as the main indicator of academic success (Hazelkorn, 2009). This results in a disconnection for institutions such as Ho Chi Minh City University of Education (HCMUE), which focuses on educational quality and regional development. Universities must balance the pursuit of global recognition with their local responsibilities and educational objectives as they navigate ranking systems.

5.3. Contradictions

While there is general agreement on the significance of research and internationalization, discrepancies exist in the weighting of these factors across various ranking systems. For example, QS and THE emphasize research output, whereas Webometrics focuses on online visibility, which does not directly reflect the quality or impact of research (Khamala et al., 2018). This prompts an examination of the equity of ranking universities predominantly on the basis of metrics that may inadequately represent their comprehensive contributions, especially in teaching and community service.

A further contradiction exists in the evaluation of teaching quality among various rankings. Although THE asserts the integration of teaching excellence within its framework, research suggests that this component is frequently eclipsed by the emphasis placed on research metrics (Eynon & Iuzzini, 2020). Consequently, universities that emphasize teaching or community involvement may struggle to achieve favorable rankings, resulting in discrepancies in how these rankings represent the varied missions of higher education institutions.

5.4. Implications

These findings have significant implications for universities, especially in developing countries such as Vietnam. The persistent focus on research output and internationalization in rankings exerts pressure on universities to dedicate substantial resources to these domains, frequently compromising their fundamental missions in teaching and community engagement. Universities such as Ho Chi Minh City University of Education (HCMUE) face a strategic dilemma in balancing the pursuit of higher rankings with their commitment to pedagogical excellence and local educational needs.

The increasing dependence on rankings to assess university quality may intensify disparities between well-resourced institutions and those with limited resources. Smaller universities or those located in developing regions may find it challenging to compete in global rankings, as these systems typically favor institutions with well-established international networks and substantial research output. This can result in mission drift, wherein universities prioritize ranking metrics over their core objectives, including teaching quality and local impact (Hazelkorn, 2015).

University rankings serve as important benchmarks; however, they pose challenges for institutions that do not conform to the conventional model of research-intensive, globally oriented universities. Universities in developing countries require ranking systems that are contextualized to reflect their distinct missions and contributions to local and national development.

6. Research Directions and Recommendations

6.1. Future research

The literature identifies multiple gaps that present opportunities for future research, especially concerning the alignment of global university rankings with the missions of universities in developing countries. Future research should concentrate on creating contextualized ranking systems that more effectively consider local priorities and institutional missions in countries such as Vietnam. Research could examine the potential for rankings to integrate metrics that prioritize teaching quality, community engagement, and policy contributions, which are frequently neglected by current ranking systems.

A potential area for future research is the examination of the long-term effects of rankings on university strategies. Research may investigate the extent to which the pressure to excel in global rankings contributes to mission drift, wherein universities divert their attention from local obligations to pursue broader global objectives. This is particularly pertinent for institutions such as Ho Chi Minh City University of Education (HCMUE), which may encounter difficulties in balancing their primary emphasis on pedagogical excellence with the necessity of enhancing their research output and international visibility.

Furthermore, research may explore the equity implications of global rankings, specifically examining how smaller or less resourced institutions can compete in a landscape dominated by universities with extensive international networks and substantial research funding. The development of strategies to equalize opportunities for resource-limited universities may mitigate the biases inherent in existing ranking systems.

6.2. Recommendations

Enhancing university ranking methodologies requires the development of more balanced metrics that accurately represent the varied missions of higher education institutions. For example, QS and THE could incorporate supplementary indicators that evaluate a university's influence on local communities or its educational outcomes in conjunction with current research and internationalization metrics. This approach would yield a more comprehensive assessment of university performance, especially for institutions focused on education and community engagement (Ćulum, 2018).

Furthermore, Webometrics could enhance its framework by incorporating metrics that evaluate research quality in addition to digital presence. Webometrics has innovatively emphasized online visibility; however, integrating metrics of academic excellence and research impact would improve the ranking's credibility and relevance for universities pursuing academic prestige (Sanchez, 2012). This would also mitigate the risk of excessive dependence on web presence, which may not consistently reflect institutional quality.

It is advisable to establish regional or national ranking systems that are customized to the specific local context. This approach may assist universities in developing countries in evaluating their performance relative to peers with comparable missions and resources rather than competing with globally recognized institutions that prevail in conventional rankings. These systems may prioritize regional concerns, including educational quality, local impact, and policy influence, thereby providing a more equitable and pertinent comparison for institutions such as HCMUE.

Improving the transparency of ranking methodologies is essential. Numerous rankings, especially QS, have faced criticism for lacking transparency regarding the weighting and analysis of subjective indicators, such as reputation surveys (Marginson, 2014). Enhancing methodological transparency would foster trust in ranking outcomes and assist universities in identifying strategies to improve their positions while maintaining their fundamental missions.

7. Conclusion

This literature review analyzed the evolution and impact of global university ranking systems, including QS, Times Higher Education (THE), and Webometrics, emphasizing their effects on higher education institutions, especially in developing countries such as Vietnam. These systems, although valuable for assessing global performance, have faced criticism in prioritizing research output and internationalization. This focus tends to advantage well-resourced institutions while neglecting universities that emphasize teaching excellence and community engagement. Recent trends, such as the incorporation of sustainability and social impact in the impact rankings, indicate a transition toward more comprehensive evaluations of university success, although research metrics continue to prevail in numerous rankings. The review highlighted deficiencies in the literature, specifically the necessity for contextualized rankings that more accurately represent the missions of institutions in developing regions, underscoring the significance of teaching and local contributions. This analysis enhances the understanding of the influence of rankings on university strategies and highlights the need for more inclusive and balanced ranking systems that consider the varied roles of universities in local and global contexts.

Ethical Considerations

Not applicable.

Conflict of Interest

The authors declare no conflicts of interest.

Funding

This research is funded by the Ho Chi Minh City University of Education Foundation for Science and Technology under grant number CS.2023.19.13ĐH.

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ARTICLES FOR UTM SENATE MEMBERS

"Evaluating the Impact of Community Sustainability Engagement on University Global Reputation"

TITLE	SOURCE
7) Transforming universities Mobilizing research and education for sustainability transitions at Erasmus University Rotterdam, The Netherlands (2024)	**SUSTAINABILITY SCIENCE (Article From : SPRINGER)**

25th JUNE 2025

SOURCE: PERPUSTAKAAN UTM

Sustainability Science (2024) 19:19–33
https://doi.org/10.1007/s11625-023-01335-y

SPECIAL FEATURE: ORIGINAL ARTICLE

Accelerating Actions for Leveraging a Climate-Neutral, Sustainable Society

Transforming universities

Mobilizing research and education for sustainability transitions at Erasmus University Rotterdam, The Netherlands

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Received: 3 February 2023 / Accepted: 16 April 2023 / Published online: 23 June 2023

Abstract
The dominant model of universities, especially in the social sciences, is often based upon academic disciplines, objectivity, and a linear knowledge-transfer model. It facilitates competition between academics, educating students for specific professions from an objective, descriptive, and neutral position. This paper argues that this institutional model of universities is inadequate to contribute effectively to societal transitions towards just and sustainable futures. Taking the Erasmus University Rotterdam (EUR), the Netherlands, as an example, this paper illustrates the problems with the dominant (twentieth century) model of universities in the social sciences and explores what strategies universities can develop to transform. It introduces the notions of transformative research and transformative education: transdisciplinary, collaborative, and action-oriented academic work that explicitly aims to support societal transitions. It presents the design impact transition (DIT) platform as an 'institutional experiment' at the EUR and a concerted and strategic effort that lays bare current lock-ins of the dominant university model and the kind of institutional work needed to transform universities.

Keywords Transition · Sustainability · Transformative research · Transformative education · University

Introduction

Science is clear: our current economic development pathways based on fossil resources and linear growth leads to increasing global ecological destruction and socio-economic inequalities and is, therefore, unsustainable. This is hardly a new insight on the long term, but we are increasingly confronted with the impacts of this unsustainable development in the short term: ecological crises, geopolitical tensions, financial instabilities, and socio-economic tensions and protests. Against this backdrop, the failure of policy and business to provide concrete actions rather than ambitions and plans is striking. While economic and social progress has been achieved in terms of reducing global poverty, offering access to electricity, education, and health care, this progress has also led to increasing emissions, accelerated biodiversity loss, displaced communities, and conflicts over resources as recent reports by the Intergovernmental panels on climate change (IPCC[1]) and biodiversity (IPBES[2]) have identified.

The scientific understanding of these existential problems and the political consensus built around it has triggered academics to take a critical perspective upon dominant assumptions and approaches within their disciplines and to start

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[1] https://www.ipcc.ch/sr15/chapter/spm/.

[2] https://ipbes.net/global-assessment-report-biodiversity-ecosystem-services.

exploring new ideas across disciplines (interdisciplinarity) as well as between science and practice (transdisciplinarity). In this process, it becomes increasingly clear that traditional, disciplinary academic structures are often unfit to accommodate such new forms of research and education (Trencher et al. 2014; Horan et al. 2019) and at worst are actually working against forms of research and education that support sustainability transitions (Fazey et al. 2021).

Dominant discourses, especially in fields such as economics, public administration, business or law, are fundamentally challenged by persistent and complex sustainability problems. They have developed in a context of economic growth, societal progress and their mainstream applications are based on the idea that research needs to be objective, disciplinary and focused on academic output (Donaldson et al. 2010). This is also the kind of science that is supported by current institutional structures which organize research and education in disciplinary ways. Since the social sciences have, thus, contributed largely to how society and our (developed) economies are organized (Kläy et al. 2015), it also becomes necessary to rethink the role of disciplines, academia, and academic institutions in addressing the consequences thereof. We, thus, accept the broad thesis already articulated by many that universities are currently incapable of addressing the scale and urgency of challenges like climate change (Rubens et al. 2017; Fazey et al. 2021).

Yet most universities in developed economies are still largely disciplinary and centered around academic knowledge that played such a central role in the historic build-up of the welfare society. Directly linked to it are the educational programs and the transfer of knowledge through education. Achieving socio-economic transitions to sustainable futures within planetary boundaries while meeting the basic needs of all in a just and inclusive manner requires to equip young people with completely new types of knowledge and competences, to provide them with a different education (Maxwell 2007; Bien and Sassen 2020; O'Riordan et al. 2020). While the ecological boundary conditions in terms of limiting climate change to 1.5 degrees and stopping the loss of biodiversity seem clear, the ways to get there are deeply contested, uncertain and far from evident. A transformation of energy, food, or health-care systems, to just name a few, is inevitable, but how to deal with such systemic changes is a process full of uncertainties, tensions, barriers, and ambiguities (Loorbach et al. 2017).

This explains the emergence of alternative approaches to science, be it reparative, engaged, transformative, or sustainability research (Kates et al. 2001; Van de Ven 2018; Hölscher et al. 2021), or to education, such as transformative learning, or competence-based education rather than focusing on reproducing (disciplinary) knowledge (Jasanoff 2004a; Scholz 2017). These different concepts and terms are witness of a search for new roles and forms of academic work and ways to produce knowledge of and for sustainability transitions. In general, it refers to academic practices that are reflexive and critical towards business as usual, and explorative and experimental with regards to the development and diffusion of knowledge. We, thus, consider the problem of reproduction of the existing through established structures and the search for new forms and practices to be relevant for both academic education and research (cf. Fazey et al. 2021).

In this paper, we explore the implications of the need for alternative types of research and education on the institutional design of universities: what are these alternative types of research and education, and which institutional changes are necessary for universities to support accelerating societal transitions? We answer this question through providing a synthesis of relevant literature and by using our home base, the Erasmus University Rotterdam (EUR), the Netherlands, as an illustration. Both authors are involved in action researching the Design Impact Transition (DIT) platform, a strategic initiative of EUR to drive the university transition towards a new institutional design. That is, we are employed as DIT academic and DIT academic lead to shape the platform and in so doing learn about how universities can transform to become a driver for just sustainability transitions, what the institutional work involved is and where the current lock-ins are. We systematically collect and analyze data throughout based on an approach inspired by reflexive monitoring (Van Mierlo et al. 2010). This paper is structured as follows: we first describe the currently dominant institutional design and its limitations "The 20th century university in transition?" and then introduce transformative research and education as a future orientation "Transformative research" and "Transformative education". Building on that, we describe the approach and activities of the DIT platform to drive the university transition towards a new institutional design "Transforming a university". We close by reflecting upon the need to proactively help guide and accelerate transforming universities "Reflection and discussion".

The twentieth century university in transition?

Impact through knowledge production and transfer

Universities and academic research have always been relevant and have had enormous impact on the development of society and its economic systems (Jasanoff 2004b). In the decades after World War II, universities have supported economic and human progress through technological and institutional advances. The social sciences (e.g., sociology, political sciences, economics, law, business, and innovation) co-evolved with the rise of the modern welfare state, its

bureaucracy and economic models. Through their research, universities developed knowledge, models, concepts, insight and observations, and formulated recommendations that would further progress. In this linear process of knowledge transfer, it is then up to policy and practice to take that knowledge and use or implement (or disregard) it. This conception is aided through sharp boundaries being drawn between academic and applied, or between pure and applied activities (Flyvbjerg 2001).

Over time, universities developed into an institutional environment that facilitated this highly successful model of academic impact through knowledge transfer and further optimized it. Much aligned with how society evolved in sectors, departments, and specializations, universities established faculties around emerging disciplines that became increasingly specialized on ever 'smaller' fractions of societal issues (Perkin 2007). Within those faculties, incentives and systems of recognition and rewards were set up that rewarded 'academic excellence' and research quality, often taking 'number of citations' or 'publication in highest ranked journals' in a specific field as a measure (Aksnes et al. 2019). Increasingly, universities became managed through strategies of command and control following ideas of 'new public management' (Bartels et al. 2020). Academic career paths are designed to follow a linear pathway within specific disciplines and reward academics for contributions to the field. In this, temporary contracts and competition for tenure are the norm for especially younger academics, creating precariousness and tensions (Ahmed et al. 2020). There are also structural inequalities, especially with regards to minorities and women in higher positions such as professorships (Fox 2006).

The EUR as example

Within Erasmus University Rotterdam (EUR[3]), the Netherlands, this model was very successful, especially in economic and public policy. The EUR emerged out of a regional economic school for higher education and has, since 1973, evolved to become one of the prominent Dutch universities with a strong economic and business profile. It produced Nobel laureate Tinbergen and its School of Economics remains very influential in developing models and theories in support of economic development. Its business school, the 'Rotterdam School of Management', occupies a top rank globally, and the 'Erasmus School for Social Sciences and Behaviour' is world leading in public administration, playing a role in mainstreaming ideas of new public management in the 1990s and network governance since the 2000s.

[3] See www.eur.nl (accessed 10-03-2023).

EUR Schools this way helped to shape and became successful in a context of economic growth, liberalization, deregulation, and globalization, developing and advocating values and practices such as profit maximization, business efficiency, and process management. It has historically achieved a top-ranked position on disciplinary academic standards: publishing in top-journals in the specific fields is a requirement for promotion or tenure, as is receiving grants in competition with peers. With it comes a dominant understanding of what constitutes 'good academic work'. Namely, as a 'neutral, objective and descriptive' activity: using models, theory, and empirical work to describe and analyze reality and formulate insight and perhaps recommendations. The dominant discourses, values, and the structures of disciplinary schools have been translated in educational programs, through which these are reproduced, reinforced and transferred to students.

In educating students, universities like EUR have been caught in a process of democratizing higher education, international competition and accomodating enormous growth in student population. Educational programs are often part of research groups within schools and act as platforms for academics to educate students within the different disciplines as part of their positions. The educational model is often based on established curricular and the body of knowledge accumulated within the disciplines. The focus is on transferring knowledge and tests play a central role. In organizational terms, academics are employed to teach a certain amount of their working time. The educational programs themselves receive government funding for each graduated student, incentivizing growth and optimization of the staff–student ratio (at EUR one of the highest in the Netherlands with 1–16). Over the past decades, this has led to an enormous growth in the number of programs and students, recently even leading to a temporary stop in recruitment of international students to the Netherlands.

Characterizing the twentieth century model

This 'twentieth century model' has been financed by substantial amounts of 'basic funding' for universities through national governments. Funding mechanisms and systems have developed for research in support of the production and transfer of knowledge. In research, funding schemes have developed within the disciplines and focused on financing excellent research, often supporting individual researchers that compete for grants with their peers. Intricate systems of calls, review, and selection have been put in place to ensure academic quality as well as innovation within the discipline. Collaborative grants are more and more common, especially at the European level, also emphasizing academic quality and proposing research projects that advance the state-of the-art in specific fields. Proposals often have to present

Table 1 Design principles of the twentieth century university

Institutional dimensions	Twentieth century model
Incentives	Excellence
Career paths	Academic and hierarchical
Funding	Subsidized grants and basic funding
Organization	Schools and support
Positioning	Outside society
Learning philosophy	Linear transfer

what and how they will research to receive funding. Funding schemes often fund up to 90% of the costs (e.g., salary costs and part of the overhead cost) but often much less, meaning that universities have to co-fund it themselves.

These funding mechanisms at universities are intimately linked to the dominant models of education and research. The basic funding universities receive are combined with the predictable income from education and the competitive grants from research funders as well as from contract research or foundations (VSNU 2022[4]). This last category is substantial, on average 30% of the funding is attracted through external sources, at the EUR it is typically well below 30% and declining. From a business model perspective, these mixed funding structures have led to a cost-based model: schools are focused on covering all costs for existing staff and educational and research commitments by combining the different streams of funding. Under pressures of budget cuts, growth in number of students, and the broader societal push towards efficiency and competition, it has led to decreasing spaces for experimentation and failure and increasing overhead costs and bureaucratic structures.

Simultaneously, a process occurred in the social sciences that led to a shift in how academic quality is predominantly defined. Whereas a lot of social sciences scientists in the 1960s and 1970s were engaged, idealistic, and sometimes activistic, over time they retreated within their disciplines and started to define academic quality in similar terms as the natural sciences: objective, descriptive, and empirical. Researchers should not engage with their subject of research but observe and analyze and formulate insight so that others can or cannot use it as they like. Combining these trends, we characterize the institutional design of the twentieth century university as follows (see Table 1).

Redefining the university mission

The Strategy 2019–2024 of the EUR, with its focus on 'Creating positive societal impact', fits within broader calls for universities to focus on addressing grand societal challenges (Schneidewind and Singer-Brodowski 2014; Berchin et al. 2021). It is argued they can do so by engaging in co-creation for sustainability with regional actors (Trencher et al. 2014), through becoming more activistic (Gardner et al. 2021) or through a focus on their 'societal impact' (Reed and Fazey 2021). The latter seems often to be missing the more critical thinking and offers a broad range of different connotations. Some consider societal impact of universities to be the dissemination of academic output or the continuation of a further neoliberalization of the academic system (Bartels et al. 2020; Reed and Fazey 2021) through a focus on valorization, transfer offices, science communication, and the like. Others welcome it to reframe and open the dialogue on new roles for universities and their researchers to address societal challenges (Bradbury et al. 2019). Still others also highlight potential problems resulting from this shift to prioritise social impact, and warn for negative effects on academic freedom (Chubb and Reed 2017) or negative consequences of this impact such as an "impact or implode" paradigm (Reed and Fazey 2021).

Arguably, such discourses need to be accompanied by fundamental changes within the institutional design for universities to fully live up to their ambitions to contribute to societal transitions—this was the case for the focus on economic development under the third mission (Rubens et al. 2017) and it is the case for addressing societal challenges as this implies alternative ways of knowledge (co-) production and dissemination (Stephens and Graham 2010; Schneidewind et al. 2016; Deleye et al. 2019). Knowledge co-production and co-creation challenge and conflict with unidirectional models of knowledge transfer from science to society and are practically also hardly accomodated within universities that are organized in a Neo-Taylorist way based on disciplinary, academic and 'neutral' knowledge ideals (Bartels et al. 2020).

Universities have therefore seen increasing debates around their purpose and function in society—especially in relation to a mounting pressure to open up the 'ivory tower', while the way societies consider the legitimacy of scientific knowledge and academic involvement in public debate is changing (Saltelli and Funtowicz 2017). Thus, on the one hand, scientific evidence is more than ever guiding policy decisions, with expertise by virologists and epidemiologists guiding far-reaching interventions in many countries during the COVID19 pandemic. On the other hand, skepticism towards scientific authority and eroding trust in scientific expertise is mounting. To regain this societal trust and to become relevant for complex societal challenges, implies fundamental changes in how research and education are perceived, organized, and practiced.

From this account, the path dependency of future directions for universities and the broader academic system

[4] See https://www.universiteitenvannederland.nl/en_GB/change-in-research-funding (accessed 10-03-2023).

become clear—there are many structural and cultural barriers that stand in the way of adopting more transformative approaches to research and education, including institutionalized funding streams, pre-determined and internationally harmonized career paths, an academic workforce trained in doing 'excellent' research, deeply ingrained valuing of objectivist, disciplinary research and more. This means that while universities strategically aspire to engage with 'societal challenges' to achieve 'positive societal impact', there are many institutionalized values and practices that prevent mainstreaming of more transdisciplinary or normative ways of working. We will next introduce the concepts of transformative research and education before reflecting upon the transition in the university necessary to accommodate them.

Transformative research[5]

An emerging new paradigm

Since climate change and biodiversity loss started to emerge as persistent and complex problems, researchers and universities have been looking for new ways to do research and support societal transitions. Transdisciplinary research (Lang et al. 2012; Lam et al. 2021), for example, seeks to facilitate processes of co-creation between academics and practitioners to integrate different types of knowledge. Sustainability science (Kates et al. 2001; Miller et al. 2014) explores interdisciplinary collaboration across natural and social sciences in search of a more holistic and systemic understanding of persistent problems. Action research (Greenwood and Levin 2007; Bradbury et al. 2019; Wittmayer et al. 2021a) is re-emerging as an approach to address questions of societal transformation and democratization. Citizen science (Sauermann et al. 2020) mobilizes citizens in research processes, e.g., by collecting data and building a knowledge base for analysis. Finally, transition research (Markard et al. 2012; Loorbach et al. 2017) focuses on understanding the systemic patterns of inertia and transformation to develop governance strategies to guide and accelerate desired future transitions.

These alternative research approaches use existing quantitative and qualitative research methods in collaborative processes of knowledge co-production. Such knowledge co-production for sustainability is situated in particular contexts, builds on and captures the plurality of knowing and doing, is problem driven and goal oriented as well as interactive and collaborative among diverse actor groups (Norström et al. 2020). It can create space for experimental processes in which different types of scientific and practical knowledge are combined to rethink existing situations, redefine desired futures, and reposition short-term action. Knowledge is not created for its own sake (or mere career advancement), but with the "purpose to promote social analysis and democratic social change", and following an emancipatory intent for communities and organizations "to control their own destinies more effectively and to keep improving their capacity to do so within a more sustainable and just environment" (Greenwood and Levin 2007). Such knowledge co-production, thus, differs from more traditional descriptive analytical research and since it sets out to support societal transformation, we refer to this kind of research as transformative research.

From description to exploration

Transformative research does not refer to one specific research methodology or approach, but to a family of approaches that have in common a focus on action, research and participation related to just sustainability transitions (Greenwood and Levin 2007). Transformative research is part of a broader and loose movement in science towards more relevance, robustness and engagement that includes the approaches outlined above, but also others such as Mode-2 knowledge production (Gibbons et al. 1994; Nowotny et al. 2001), post-normal science (Funtowicz and Ravetz 1994; Wesselink and Hoppe 2011), science and technology studies (Funtowicz and Ravetz 1994; Saltelli et al. 2016; Dankel et al. 2017), and knowledge co-production in sustainability science and sustainability transitions research (Miller 2013; Miller et al. 2014; Caniglia et al. 2021).

Transformative research carries a future- and solutions orientation (Miller et al. 2014). It explores reconstruction of new or adapted structures, cultures, and practices that can then potentially replace the deconstructed unsustainable systems—a focus on that which 'can be'. According to Avelino and Grin (2017), such reconstruction combines an understanding of how things are at a certain point in time, with how they ought to be in the future, and crucially, how things 'can be' at any point in time. Transformative research also has affinities with the work of Science and Technology Studies scholars such as Sheila Jasanoff (2004a, 2015), who has emphasized the necessity to frame differing narratives of the same circumstances as sets of imaginaries—stories told about facts which in turn influence how those facts are interpreted. The reconstruction is not only about visions, imaginaries and narratives, but also encompasses action through experimentation with seeds of change to see what can be learned about putting these into practice (Wittmayer et al. 2019).

[5] Parts of this section are drawing upon the collaborative DIT paper Transformative Research and we want to acknowledge the other contributors Bogner, K., Hendlin, Y., Hölscher, K., Lavanga, M., Vasques, A. Von Wirth, T. and De Wal, M. to this: https://www.eur.nl/en/media/2021-11-dit-working-paper-1dit-platformerasmus-university-rotterdam2021 (accessed 01-31-2023).

From multi- and inter- to transdisciplinarity

To explore such alternative futures and narratives as well as to integrate a deeper understanding of how it works in practice, more than scientific knowledge is needed (Hirsch Hadorn et al. 2008; Flyvbjerg et al. 2012). Consequently, transformative research approaches are inter- and transdisciplinary and include the participation of and collaboration with societal stakeholders in addition to trained scientists from multiple disciplines (Kates et al. 2001; Saltelli et al. 2016). Such research approaches are necessary not only to draw on knowledge from across disciplines and actor groups, but also to draw on normative orientations providing guidance for developing solutions, and to increase ownership, and legitimacy, but also accountability, for both problem understanding and possible solutions from all involved (Lang et al. 2012).

It also means that insights derived from using different research perspectives and approaches are necessary. For example, Avelino (2011, p. 22) contends that we "cannot afford" to choose sides between different approaches to science in the face of questions concerning persistent (complex, normative) problems and transition processes. Thus, what is needed here is the knitting together of kindred—and even conflicting—perspectives; and the refusal of letting any one of these dominate at the exclusion of all others, that is methodological and possibly theoretical pluralism (Midgley 2011). It has been suggested that the interpretive research paradigm can offer the openness to accommodate such pluralism (Avelino 2011; Avelino and Grin 2017) as can a pragmatic stance (Greenwood and Levin 2007; Popa et al. 2015). Such a stance requires transformative researchers to be skilled in a repertoire of research methods and to engage in methodologically rigorous research, if only because outcomes will have a direct effect on the lives of stakeholders (Greenwood and Levin 2007).

From objectivity to reflexivity

In order not to reproduce unequal power relations, taken-for-granted framings or habitual practices through its system analysis or its experimental and generative practice, transformative research practice needs an outspoken orientation and commitment to increase overall reflexivity. There are a range of ways through which reflexivity can be engaged in research processes: from accounting for the positionality of the researcher, allowing differences to be voiced to attending to the broader contexts within which results are produced and shared (Finlay 2002). At its fundament, it acknowledges the impossibility of researchers being positioned 'outside' of their research (Schwartz-Shea 2006). Going beyond, reflexivity in transformative research also concerns the capacity of individuals and groups to not only diagnose persistent problems but also to confront the approaches, structures and systems that reproduce them (Voß et al. 2006; Hendriks and Grin 2007), which is often related to modernity. As a capacity, the reflexivity of a transformative research project can then be considered as its "ability to interact with and affect the institutional setting in which it operates" (Beers and Van Mierlo 2017). Such a view on reflexivity allows for agency of individuals and also for systems change, and is, thus, generative of alternative structures, cultures and practices.

To summarize, transformative research refers to academic practices in which 'academic' researchers work together with practitioners to reframe and interpret existing contexts, the persistent problems present and their historical origins. Based on this, they can collaboratively explore and experiment with transformative alternatives (narratives, futures, scenarios, practices, models, structures). Subsequently, they can reflect, learn, and adapt their understanding and approaches based on progress made and insight developed. To do so, they need to be able to use different methods, tools, and approaches, and play different roles (e.g., researcher, knowledge broker, facilitator, mediator, and translator). In these processes, researchers become engaged with their subject and explicitly explore desired future changes.

Transformative education[6]

An emerging new paradigm

Finding new ways to address complex persistent problems requires a critical analysis and rethinking of our disciplines and how they contribute to social change. It is now broadly agreed upon amongst sustainability and education researchers that proactively dealing with sustainability transitions requires more than deep knowledge within a specific discipline and literacy about persistent sustainability problems. It also requires an interdisciplinary perspective and a critical mindset. It requires the ability to collaborate across disciplines and professions. It requires an experimental and entrepreneurial way of working to contribute to societal value creation.

The academic educational system has for longer been discussed as problematic when it comes to educating students (learners) for sustainability transitions (Bien and Sassen 2020; O'Riordan et al. 2020). A general argument is that the predominantly knowledge-oriented and disciplinary education limits the learner's ability to navigate complexity and enhance a linear problem-solving approach rather

[6] Parts of this section draw upon the unpublished DIT working paper on Transformative education and we want to acknowledge the contributing authors Elvira, Q., Dorst, K. and Beers, PJ.

than a more design oriented, experimental, and creative one. What is generally needed is that learners develop an orientation towards societal issues and reform processes in societal systems. Through educational programs, learners need to 'unlearn' as well as go through a process that helps them to understand and appreciate complexity, diversity, and uncertainty, as opposed to understanding the world through one specific paradigm or discipline (Scholz et al. 2006; Herrero et al. 2019).

From transfer to co-creation and social learning

'Transformative education' (Paul and Quiggin 2020) in the context of societal transitions is about learning about transitions and sustainability but even more so about the process of personal transformation enabling learners to let go of predeveloped assumptions, social conventions and what is considered 'normal' (Sutherland and Crowther 2008). If we need to fundamentally change how society and the economy work, learners need to be able to challenge, alter, and replace the status quo. Transformative education, therefore, entails an experiential process through which students develop a new outlook through engaging with a variety of practices, perspectives, and types of knowledge. Learners who go through such a process experience a "paradigmatic shift" by having their frame of reference—assumptions and expectations that direct their tacit points of view and influence their thinking, beliefs, and actions—challenged, reflected upon and acted on.

To help us understand these changes of perspective that occur in students, we draw on transformative learning theory (TLT). Transformative learning is "a deep, structural shift in basic premises of thought, feelings, and actions. It is a shift of consciousness that dramatically and permanently alters our way of being in the world" (O'Sullivan et al. 2016). It often describes learning that occurs when a learner engages in activities that cause or allow them to see a different worldview from their own (Mezirow 2003) and is largely understood as a means of adapting to the needs and demands of the broader, social–cultural context (Dirkx 1998). Teaching for change is not limited to the individual student journey; complex issues as well require innovative solutions, that irrevocably lead to change.

From individual to collaborative

When working toward change, design thinking—an iterative model and prototyping mindset to show people that change might be possible—considers how focusing on questions, ideas, and integration of stakeholder requirements can foster creativity and innovation. Design thinking's process of quickly building and iterating on solutions is valuable for generating the evidence necessary to persuade stakeholders to fund and support a fledgling idea. Design thinking emphasizes the importance of collaboration and multiple perspectives, which builds human connections, creating empathy, which helps in making better decisions. Whether it is transformative learning or design thinking the collaboration between people is central to bringing about change.

Collaborative learning reflects the ideas that the shared learning of interdependent stakeholders—the presence and participation of other learners is the defining component—is a key mechanism for arriving at more desirable futures. To gain insights into these desirable futures, learning should form a bridge between complexity and governance in that it describes and explains the co-evaluation between actors, structures and practices. This means in concrete terms that teaching the "how" of complex social issues requires interactive and collaborative learning processes (community of learners) (Miller 2022). Curriculum design that enables the "what" of complex social issues to continually emerge and be redefined through group interaction around intersubjective production practices prepares students for the kind of experimental creativity, reflexivity, and collaboration that will be required to produce new sustainable ways of knowing and living.

In this process, it is essential to (be able to) combine and possibly integrate diverse types of knowledge (transdisciplinarity) to address the complexity of problems and the diversity of perceptions of them. Transdisciplinarity is inherently a process of co-creation and collaboration: you cannot do it by yourself. To make such collaboration productive and transformative implies on the one hand a structured way to engage students as well as to facilitate a process of joint learning. On the other hand, it requires the learner to take a holistic perspective to look into the world. Findeli (2001) stressed that this holistic approach is inherent to design thinking; extending boundaries by emphasizing that a project will more likely produce sense-making results the further one extends the limits of the system in which a project evolves.

From knowledge to capacities

Encountering new concepts and terminology from other disciplines that do not fit existing mental models may result in a disorienting dilemma for the learner. This is the first step in transformative learning. Under the right conditions, this may lead to a revision of their existing mental models (i.e., critical reflection). To complete the process of transformative learning, these revised mental models must then be iteratively vetted and synthesized through reflective discourse with collaborators to generate a salient and inclusive integrated conceptual framework (Pennington et al. 2013). Transformative education, thus, has at its core a collaboration between learners: instead of an individual learning

process, it implies a learning journey that a learner goes through in interaction and collaboration with her or his environment (including peers, teachers, and practitioners), building upon ideas around group and team learning (Decuyper et al. 2010).

In this approach, 'sharing', 'co-construction', and 'constructive conflict' are considered as the basic collaborative learning processes. Where the basic process variables are responsible for the power of team learning, the facilitating process variables give context and focus to team learning, influencing both its efficiency and effectiveness (DeCuyper et al. 2010). These collaborative learning processes lead to outcomes that describe what learners should know**,** understand**,** and be able to do in a course or program (Huba and Freed 2000). It provides direction for the design of instructional activities and clearly communicates to learners the end-product of the learning journey. The outcomes of transformative education should be knowledge, skills, attitudes and mindset that can be used in future debates about complex social problems. In general, these include outcomes relating to cognitive ('think'), relational ('connect'), entrepreneurial ('act'), and reflexive ('learn') competences. These four dimensions are interrelated and in one way or another used in recent literatures on sustainable education (Berchin et al. 2021), inner development goals[7] or transformative learning (Pennington et al. 2013).

To summarize, transformative education implies the creation of programs that are inter- and transdisciplinary and cater for a student journey that is transformative in itself but also builds transformative capacities in the students. This is a process that can only be partly assessed in summative ways through tests and exams, and also requires formative assessments in terms of qualitative feedback and reflexive learning. It also means program designs that include practitioners, group exercises, experiences and a diversity of teachers representing different views from academia and practice. By definition, this not only requires collaborative efforts from academics from different disciplines, but also that they develop curricula together to provide an integrated and overall coherent program for the students.

Transforming a university

In 2020, Erasmus University launched its Strategy 2024 'Creating Positive Societal Impact' following a longer discussion from within the different schools and across campus, that there is a need for more scientific relevance and collaboration to address complex societal challenges (Erasmus University Rotterdam 2019). Under its strategy, the EUR started a wide number of initiatives focused on impact in education and research and changing university structures and conditions to enable impact-oriented academic work, including recognition and rewards, measuring and evaluating societal impact, and bringing impact into education (Erasmus University Rotterdam 2022)[8].

It also links up to, for example, the cross-university program of Dutch universities on Recognition & Rewards (Erkennen en Waarderen). The Recognition & Rewards program is a response to the need for a modernized system of recognition and rewards that moves away from the one-sided emphasis on research performance, and more towards including scientific education and impact in quality assessment (Universiteiten van Nederland 2019). Consequently, the newly updated Standard Evaluation Protocol that is used to evaluate research units has incorporated a greater emphasis on societal impact, open science, diversity and talent policy (Universiteiten van Nederland 2020).

As part of Strategy 2024, the EUR initiated the Design Impact Transition (DIT) platform as one of the strategic projects.[9] DIT is funded for four years as an 'institutional experiment' with the explicit aim to explore, through action research, how the transition of the university could be accelerated. It experiments with a new model of how a transformative university could be and, in this process, encounters the barriers and resistance against it from the existing model. Its aim is to advance sustainability and transition in education and research and do so by exploring how the university more broadly could become more impactful on sustainability transitions. It received a budget of over four million Euros and started in the summer of 2021.

DIT aims to establish the institutional basis for developing design, impact and transition-oriented education, research and engagement. As a facilitator and catalyst for impact-oriented academic ecosystems, co-creation with stakeholders in transitions, and societal engagement, it has a threefold mission:

1. Advance transdisciplinary design, impact, and transition methodologies and programs.
2. Develop and nurture transformative academic ecosystems to impact the envisioned changes.
3. Help scholars develop their design, impact, and transition career pathways.

The model DIT works from is to experiment with the idea of a transformative university: what values would it

[7] See here https://www.innerdevelopmentgoals.org/.

[8] See https://www.eur.nl/en/about-eur/strategy-2024/strategy-practice (accessed 10-03-2023).

[9] See here https://www.eur.nl/en/about-eur/strategy-2024/strategy-practice/dit-platform (accessed 10-03-2023).

foster, which institutional design elements would it exhibit and how would transformative academic work be practiced. Drawing upon the described characteristics of transformative research (Sect. "Transformative research") and education (Sect. "Transformative education") and a design-based approach, DIT developed a 'narrative for change' (DIT platform 2023)[10] that outlines the following principles and values underlying an academic environment for transdisciplinarity:

- *Together*: providing space to connect, collaborate, and exchange
- *Profound*: value and apply academic rigor
- *Systemic*: research and develop new ways of thinking, doing, framing, and organizing
- *Appreciative and respectful*: being inclusive and honoring different points of view
- *Experimental*: learning-by-doing
- *Reflexive and self-reflexive*: Challenging ourselves and others.

From these values, DIT develops transformative research and education initiatives, projects and activities that in themselves challenge the dominant university model. The tensions DIT encounters in actually practicing university transition already shed light on the types of structural changes necessary and the institutional design for a transformative university. In the following, we describe several DIT activities to illustrate future directions of universities and to shed light on the tensions with the twentieth century model. Our knowledge about these activities is based on our involvement with the DIT initiative in different capacities: as DIT academic and DIT academic lead, we have been part of the initiative and its action research from its inception.

Career paths and organizing

From DIT's vision on academia as a collaborative, experimental, and action-oriented environment, it built up a platform that is designed for (i.e., rewards and recognizes) collaboration and transformative academic work. An organizational structure was developed consisting of a core team of designers, facilitators, developers, and academic and organizational leaders.[11] Rather than being considered 'support' functions, these roles are responsible for transforming research and education and require a diversity of expertise, skill, and knowledge that are complementary to research and education skills. Around this core team, a group of academics is engaged: these continue to be employed by their respective faculties and are linked via secondments to DIT. Each DIT academic formulates their assignment allowing them to (continue to) research specific issues related to the design of a future university. Through this organizational set-up, DIT practically explores new ways of devising academic career paths and organizing diverse teams needed to support transformation.

As part of the academic assignments and DIT's mission, the aim is to develop wider engagement with the university community to build academic ecosystems: partly self-organized networks of academics that share knowledge and experience, meet and collaborate across disciplines and institutional boundaries and together work on transformative changes. For example, in the ecosystem around transformative education, EUR academics at large discuss and share new models for transformative learning, develop shared publications, and exchange ideas to develop new educational programs and trainings for staff. The core team of DIT supports these types of activities by bringing in design skills, communication, and organizational support to co-create events that are engaging, sustainable, and fun.

As an example of such a collaborative effort, DIT is currently co-organizing university-wide dialogs on sustainability. It had already proposed to do so to the university boards, but the process accelerated following 'OccupyEUR', a local student protest in December 2022[12] which is part of a broader global movement to cut the ties between universities and the fossil industry. After students were evicted from the campus by the police, academic staff rallied in their support, pressuring the university board to take more rapid and substantial action on sustainability.[13] DIT then supported and worked with a team of all female academics to organize a round table with students, staff and the university board with the goal to formulate concrete steps the university can take in understanding and cutting its ties with the fossil industry. It led to a concrete and substantial commitment of the university board to address the climate emergency and mainstream sustainability.[14] Thereafter, DIT was commissioned by the university board to organize a series of dialogs and sessions and has organized it so that the academics working on these will receive formal acknowledgement of this institutional

[10] See the extended description of the mission and approach here: https://www.eur.nl/en/media/2021-11-narrative-changedit-platformerasmus-university-rotterdam2021 (accessed 10-03-2023).

[11] See https://www.eur.nl/en/about-eur/strategy-2024/strategy-practice/dit-platform/about-dit (accessed 10-03-2023).

[12] See https://www.eur.nl/nieuws/statement-college-van-bestuur (accessed 10-03-2023).

[13] See https://www.eur.nl/nieuws/dit-solidair-met-de-ontruimde-studenten-van-occupyeur (accessed 10-03-2023).

[14] See the declaration here: https://www.eur.nl/en/news/erasmus-university-rotterdam-declares-climate-and-ecological-emergency (accessed 10-03-2023).

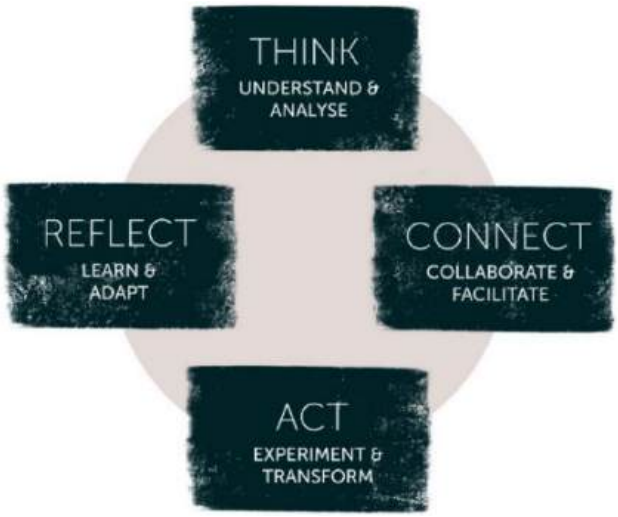

Fig. 1 Transformative capacities. Source: Erasmus School of Philosophy and DIT Platform (2022, p. 13)

work by receiving a compensation of 0.1 fte. This is a very practical way to actually 'recognize and reward' academics for impact.

This way, DIT is seeking to create a context within which both academics and others are working on a specific form of impact, assuming that as academics, they will also investigate this through publications, proposals, courses, and programs as part of their academic work. This specific form of 'impact' itself is always linked to societal transitions or in this case the university transition: as transformative academic work, it builds upon a hypothesis around persistent problems and explores a desired direction for change. This is different from the formal Recognition and Reward approach in which 'impact' is added to research, education and management as core activities and mainly framed in neutral terms as 'societal engagement'. This often means that impact is added to the existing workload and to develop the impact profile implies the need to first excel in research and/or education.

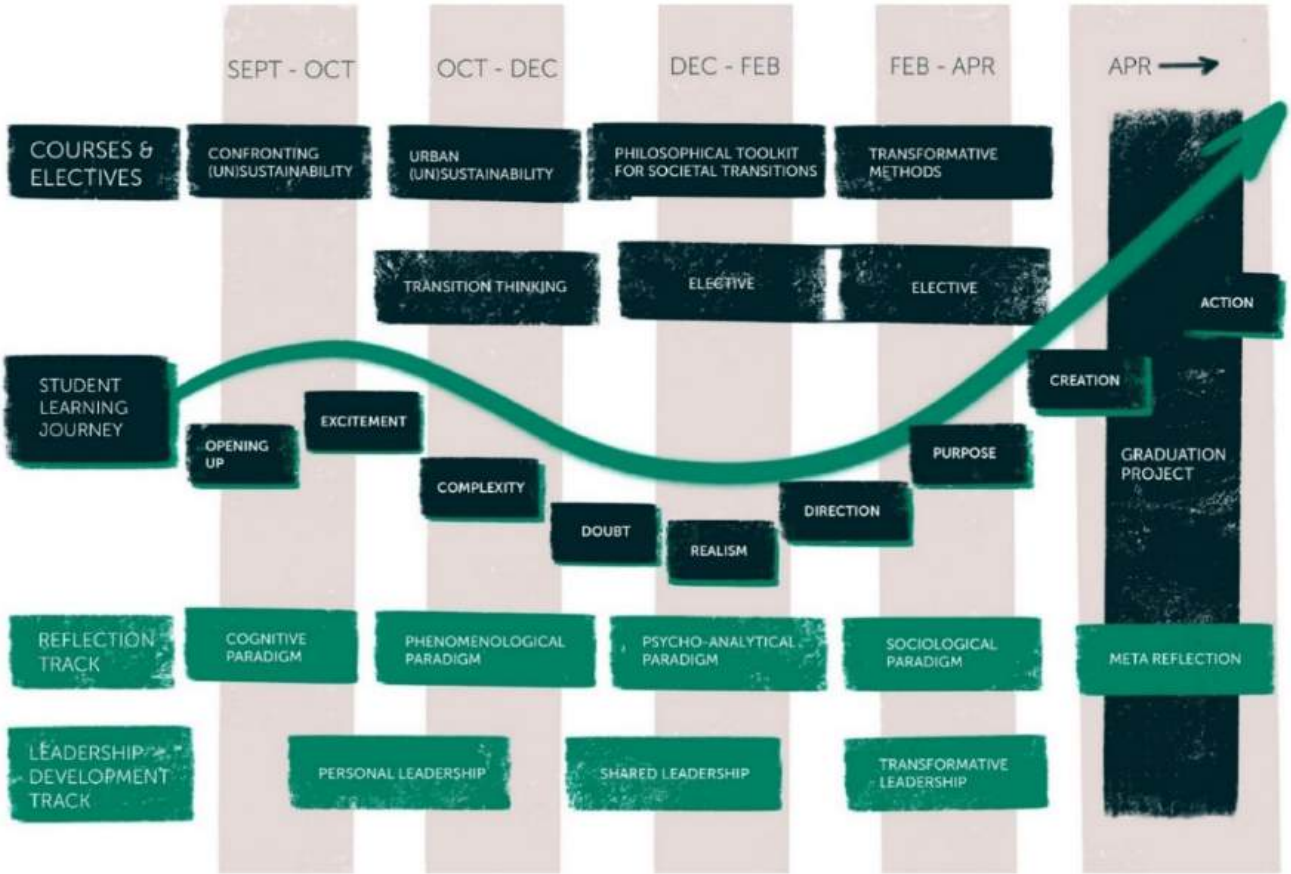

Fig. 2 Original program design Master of Societal Transitions. Source: Erasmus School of Philosophy and DIT Platform (2022, p. 17)

Transformative education and the Master in Societal Transitions

The transformative learning philosophy as outlined under Sect. "Transformative education" has been translated in the design of a new masters program on Societal Transitions.[15] For it, the DIT team built a program to support the development of four different capacities with students (see Fig. 1) through a learning journey (see Fig. 2) in which co-creation and constructive conflict are embedded. The program engages learners in a process of confronting assumptions and facing the ecological crisis via developing systemic understanding and appreciation for plurality towards practical tools and methods for engaging in societal transitions. Their journey ends by developing a collaborative and transformative intervention where students show their progress on each of the competences. Added to the program are a leadership and a reflexivity track meant to support the students and teachers to systematically reflect upon their progress, emotions, and challenges (Erasmus School of Philosophy and DIT Platform 2022).

The governance of the program was to be a 'joint venture': different groups from different schools and institutes of the EUR were to contribute to the program and invest in its development. Contributions were to be calculated based on actual cost (salary plus overhead) and income and revenues were to be shared according to contributions made. This model, however, conflicted with the dominant model, where masters programs are governed by one school and the hiring of external staff (i.e., from other schools) is done based on salary cost. Not only does this not cover actual costs, but it also effectively translates into the purchase of a 'service', thereby disincentivizing actual collaboration. This program received official accreditation by the end of 2022 and now creates internal dynamics around the need for revisiting the organizational model of financing masters programs, but also the need for new exam boards for interdisciplinary programs and synchronization across different programs on campus to facilitate exchange, combined tests, shared lectures and in general more coordinated programming.

Transformative research

To explore and develop new ways to organize research, DIT academics are building ecosystems around transformative research, where in working groups, workshops, and collaborative writing, the academic basis for doing transformative research is laid (Wittmayer et al. 2021b). But they also apply more traditional academic research on the university itself to identify the tensions, barriers and drivers towards transformative research. This includes classic interviews and workshops with those fellow academics across different schools that do engaged work to understand which forces support and hinder them in doing such academic work. Two striking insights emerged from this. First, that a lot of researchers are uncertain and sometimes afraid that deviating from the dominant academic pathways threatens their possibilities for promotion, while they do not know what the rewards for a more impact-oriented approach would be or how they could do that. Second, researchers at all levels (from PhD to retired professors) say that they now 'accept certain unpleasant tasks to be rewarded in the next phase': PhD that do education and work on a professor's project and expect to be able to do their own research when they become postdoc up to professors that will finally write the book they want when they retire. The results are shared with the university board and are communicated via policy briefs (DIT Platform 2022) and interviews with the university magazine.[16]

Another stream of more action-oriented research is about new ways of funding for which DIT partners with ACCEZ, a knowledge program by the Dutch Province of South Holland to accelerate the development of its circular economy. ACCEZ has rounded off its first stage of transdisciplinary and impact-oriented research funding in 2022 and together with DIT is now taking stock of lessons learned (DIT Platform and ACCEZ 2023). Together, they want to learn about how research programs that allow for more transformative forms of academic work (e.g., participatory, engaged or action-oriented) are designed with a focus on their funding and governance. While this work is ongoing, emerging lessons include: (a) the topic needs to be formulated in a way that it is interesting for a broad array of actors including universities, policy makers, businesses, and civil society; (b) funding needs to be available already for a prephase that leads to a research proposal—this initial phase is where actors with different perspectives come together to understand each other's questions and knowledge needs; (c) exchange between research projects of a research program needs to be facilitated to increase learning amongst one another and find synergies; (d) funding needs to cover all costs including salary, overhead and risk; (e) funded activities should allow for anticipatory, experimental, future-oriented, reflexive, and critical work in relation to the societal problem at hand; (f) funders need to become partners; and (g) trainings on skills and competences pertaining to inter- and transdisciplinary work (e.g., communication, facilitation, etc.) needs to be provided to all those funded.

[15] See https://www.eur.nl/en/esphil/master/societal-transitions (accessed 10-03-2023).

[16] See for example https://www.erasmusmagazine.nl/en/2023/01/26/positive-and-impactful-research-currently-not-tenable-at-this-university/ (accessed 10-03-2023).

Table 2 Core design principles for a transformative university

Institutional dimensions	Twentieth century model	Transformative university
Incentives	Excellence	Relevance
Career paths	Academic and hierarchical	Role diversity
Funding	Subsidized grants and basic funding	Entrepreneurial and basic funding
Organization	Schools and support	Schools and ecosystems
Positioning	Outside society	Part of society
Learning philosophy	Linear transfer	Co-creation

Institutional design

These activities try to shape research, education and engagement within the EUR in a new way and in doing so also identify barriers and mechanisms now in place that prevent it. As an 'institutional experiment' DIT seeks to systematically do so, using a reflexive monitoring inspired approach (Van Mierlo et al. 2010; Beers and Van Mierlo 2017) internally to track and reflect upon these interactions; with an ultimate goal to support structural changes within the university structures towards accommodating transformative academic work. In a very general way and based on the experiences so far, we can summarize the contours of a new institutional design for a transformative university in Table 2.

Reflection and discussion

In this paper, we sought to explore the way universities can transform so that they become a driving force for societal transitions towards sustainable and just futures. Building on the literature, we argued that the currently dominant model in many universities is shaped around a notion of progress and subsequent role of academic research and education that is not sufficient for this purpose. Instead, it is optimized around the accumulation of knowledge within disciplines, educating professionals for specific positions and in general understanding academia as a producer and provider of objective knowledge. While many universities are engaging in a process to reconnect to society in support of sustainability, this often remains limited to specific institutes or initiatives: a wider transformation of universities is needed but only small steps are visible.

Taking the Erasmus University Rotterdam (EUR), the Netherlands, as an example, we aimed to illustrate the problems with the dominant (twentieth century) model of universities in the social sciences, but also how experimentation can take place to support a transition. Within the broader context of Dutch universities' efforts to diversify career paths and engage with complex societal challenges, EUR's Strategy 2024 pushes the university community to open up for more diverse forms of research and education to increase societal impact and relevance. The DIT initiative was highlighted as shedding light upon the structural and institutional changes needed through being an institutional experiment accompanied by action research.

With no claims to be all encompassing, this example shows that a university transition implies institutional work: career incentives, organizational structures and funding schemes often work against collaboration, transdisciplinarity and entrepreneurship. But also, the approach to research, definitions of 'academic quality', epistemological perspectives, and attitudes towards working with practitioners are often hampering steps forward and, thus, need to be addressed. Within EUR discussions on these topics as well as initiatives within and around the existing organization have been developing for awhile, but to build up the momentum and pressure for transformative change requires a much more concerted and strategic effort.

We also have to note that the ideas presented in this paper are primarily focused on the internal transition of universities. Obviously, aiming on the longer term to have a different kind of impact in the outside world. Right now, the dominant model of external collaboration is often 'triple helix': institutional exchange and partnerships between academia, government and industry to advance societal growth and innovation. A transformative university would allow for and facilitate more networked collaboration and co-creating between academics and social actors to advance just sustainability transitions. It would imply critical positioning and developing a self-assessment of what is unjust and unsustainable and formulating conditions upon which collaboration is possible or not. It would require developing university-based future visions and aims to collaborate for.

The DIT platform in our paper acted as an example of a concerted and strategic effort to build momentum. It needs to be understood in its context and is only two years into operation. While it will not achieve a full transition by itself, it already uncovered some of the sore points and structural constraints for achieving critical changes. In doing so, it opened institutional conversations and actions around these. In its design and approach, however, it might serve as exemplar and inspiration for others that seek to help scale and diffuse ideas about a transformative university. Be it at the operational level as academic or at a more institutional level as policymaker: it requires a critical analysis of the

current status quo, an inspiring and transformative vision for the future and an experimental, learning-by-doing action approach to make transformation work in practice.

Acknowledgements The authors would like to acknowledge the work, expertise, and wisdom of their colleagues at DIT platform, Erasmus University Rotterdam and in the broader academic ecosystem that helped shape the practices we described and our thinking about it. We also would like to thank the two reviewers for their constructive comments.

Funding This paper is based on original academic work of the authors. The authors received funding from the Erasmus University's Strategy Office through the DIT platform to experiment with and (action) research new forms of academic work.

Data availability For this paper we have not analysed or generated datasets but build on literature, publishes interviews and conceptual work. One can obtain the relevant materials from the references below.

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8) Influence of global university rankings on strategic decisions at Ho Chi Minh City University of Education in balancing global competitiveness and local educational goals (2025)	MULTIDISCIPLINARY REVIEWS (Article From : MALQUE PUBLISHING)

25th JUNE 2025

SOURCE: PERPUSTAKAAN UTM

Multidisciplinary Reviews

MINI REVIEW
Published Online: November 22, 2024
https://doi.org/10.31893/multirev.2025124

Influence of global university rankings on strategic decisions at Ho Chi Minh City university of education in balancing global competitiveness and local educational goals

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Abstract University rankings serve as crucial tools for evaluating and comparing the quality of higher education institutions worldwide. This study examines the impact of global university rankings on the strategic choices made by higher education institutions, with a focus on developing countries such as Vietnam. This study investigates rankings, including QS, Times Higher Education (THE), and Webometrics, and analyzes their emphasis on research output, internationalization, and reputation, frequently at the expense of teaching quality and community engagement. The reviewed literature comprises peer-reviewed articles and studies published from 2010--2023, emphasizing Vietnamese universities such as Ho Chi Minh City University of Education, which encounter difficulties in reconciling global competitiveness with local educational objectives. The findings demonstrate that global rankings tend to favor universities with robust research infrastructures and extensive international networks, resulting in disparities between well-funded institutions and those with limited resources. While emerging trends such as contributions to the United Nations Sustainable Development Goals (SDGs) are becoming more prominent, research metrics continue to be the primary determinants. The study concludes that existing ranking systems fail to adequately represent the broader objectives of universities in developing countries, especially those emphasizing local impact.

Keywords: university rankings, developing countries, teaching quality, social impact

1. Introduction

University rankings have emerged as a significant instrument for assessing and comparing the character of higher education institutions on a global scale. These rankings are a source of reference for a variety of stakeholders, such as students, faculty, governments, and employers, and they are used to inform decisions regarding university funding, collaboration, and student enrollment (Hazelkorn, 2015; Kayyali, 2023; Sarrico & Godonoga, 2021). In the last two decades, rankings such as QS World University Rankings, Times Higher Education (THE) Rankings, and Webometrics have gained significant prominence, establishing them as crucial indicators of institutional performance (Chen & Chan, 2021). Although these rankings provide a method for assessing and benchmarking universities on a global scale, they also present obstacles, particularly in terms of conforming their criteria to the diverse missions of institutions, particularly those in developing countries (Dill & Soo, 2005; Serafini et al., 2022).

Rankings are employed by higher education institutions worldwide to establish themselves in competitive international academic environments. Rankings enhance the reputation of universities by attracting top talent, including students, academics, and research funding, and providing visibility and prestige (Marginson, 2007; Salmi, 2021; Soysal et al., 2024). Many universities have adopted this as a strategic objective, prioritizing their performance in global rankings. Nevertheless, classification systems are not without criticism in terms of their methodologies. Numerous rankings prioritize research output, citation counts, and international reputation, frequently disregarding other critical components of a university's mission, including teaching quality, community engagement, and contributions to societal development (Galleli et al., 2022; Hauptman Komotar, 2019).

The dependence on global rankings can be both a constraint and an opportunity for universities in developing countries, such as Vietnam. Rankings can provide opportunities for institutional funding, global visibility, and increased international collaboration. However, numerous universities in these regions may lack the resources to compete with established institutions in Europe or North America, which could result in a potential disparity between the ranking criteria and the institution's local or national priorities (Hazelkorn, 2009; Jöns & Hoyler, 2013; Marginson, 2006). The primary mission of Ho Chi Minh City

University of Education (HCMUE) is to provide quality education, foster pedagogical excellence, and address local educational needs. Therefore, the pursuit of international recognition through rankings must be balanced with this principle.

The relevance of university rankings in Vietnam is on the rise as the country further integrates into the global education market. The Vietnamese government has established ambitious objectives for higher education, such as promoting the participation of universities in international evaluations to improve their global reputation (Harman et al., 2010; Hoang et al., 2018). Nevertheless, this procedure presents unique obstacles for numerous Vietnamese universities, including HCMUE. These encompass challenges in adhering to the publication standards established by ranking agencies that prioritize English-language journals, inadequate international collaborations, and inadequate financial resources for research infrastructure (Truong & Cuong, 2019; Vuong & Tran, 2019). Additionally, there are ongoing discussions regarding the extent to which global ranking systems accurately represent the distinctive contributions of universities in emerging economies, particularly in the areas of social impact, teaching quality, and community service (Hazelkorn, 2015).

The primary goal of this literature review is to evaluate the impact of university rankings on the strategic objectives of HCMUE, with a particular emphasis on their function and significance. This review analyzes the historical evolution of university rankings, discusses the current trends and challenges they present, and investigates the key theoretical frameworks that underpin them. In doing so, the objective of this study is to offer a more comprehensive comprehension of the methods by which HCMUE can navigate the global ranking landscape while still adhering to its mission of educational and social development.

2. Theoretical Framework

University rankings are founded on a variety of fundamental theories regarding competition, reputation, and performance measurement in higher education. These frameworks assist in elucidating the reasons why institutions prioritize rankings and the implications of these rankings for their strategies, objectives, and global academic positioning.

Hazelkorn (2011) claimed that the theory of global competition is a foundational theory in this domain. It argues that rankings are a means for universities to demonstrate their global competitiveness. Hazelkorn stated that universities are no longer merely national institutions in a world that are becoming more interconnected; rather, they are a component of a global knowledge economy. Rankings function as a criterion in this context, enabling universities to assess their performance in comparison to their international counterparts (Adam, 2020; Marginson, 2007). Institutions that succeed in these evaluations are perceived as having superior quality, which can have a beneficial impact on their capacity to attract international students, faculty, and research funding (Dill & Soo, 2005; Mazzarol, 1998). This theory is inextricably linked to the concept of global reputation management, in which universities employ rankings as a signaling mechanism to increase their visibility and prestige on a global scale (Wedlin, 2011). The competitive race for talent and resources is significantly influenced by the perception of excellence, which is further bolstered by strong ranking positions.

The RBV of institutions, as articulated by Barney (1991), is another pertinent theory. The performance of a university in rankings is a reflection of its internal resources and capabilities, as per RBV. These resources encompass infrastructure, international collaboration, research output, and faculty expertise. Universities that possess and effectively employ these resources are more likely to achieve success in global rankings. For example, indexes such as QS and Times Higher Education (THE), which prioritize these criteria, tend to favor institutions with a greater number of research publications and international partnerships. Universities can further improve their competitive advantage by achieving high rankings, which in turn attract additional resources in a positive feedback loop (Lee et al., 2020; Mahdi et al., 2019). Nevertheless, this perspective also underscores the disparities between universities with substantial financial or academic assets and those with fewer. According to Hazelkorn (2011), the resources of universities vary, resulting in unequal competition and an environment in which fewer or less-funded institutions are unable to maintain their ranking performance in comparison to well-established institutions.

Furthermore, the institutional theory of isomorphism is instrumental in comprehending university rankings. Isomorphism is the process by which organizations, and institutions in particular, become more similar over time as a result of external pressures, such as ranking metrics (DiMaggio & Powell, 1983; Hersberger-Langloh et al., 2021; Wedlin, 2007). Rankings impose a form of coercive pressure on institutions to adhere to specific standards, such as increased research output or internationalization efforts, to increase their ranking position. Consequently, universities may adjust their strategies to more closely align with the criteria established by ranking agencies, potentially at the expense of their local missions or other distinctive aspects of their identity (King, 2009; Morphew & Swanson, 2011). For example, institutions may prioritize international student recruitment or English-language publications to increase their ranking scores, although these areas are not fundamental to their original mission.

Legitimacy theory is another critical theory that posits that universities seek validation and legitimacy from external stakeholders, such as governments, donors, and potential students (Circa et al., 2021; Deephouse & Carter, 2005; Parker, 2011). Rankings serve as a means for universities to establish credibility by illustrating their compliance with international standards of excellence. An institution's reputation can be improved by strong performance in rankings, which indicates to stakeholders that it meets or exceeds international quality standards. However, this pursuit of legitimacy can occasionally result in mission

drift, in which universities prioritize activities that enhance their ranking position over those that are consistent with their primary mission, such as community engagement or teaching quality (Hazelkorn, 2015).

Additionally, signaling theory provides a perspective on the manner in which universities employ rankings as a means of communicating their status and value to external audiences. Universities with high rankings convey a positive signal to prospective students, faculty, and partners, indicating that they are high-quality institutions (Al Hassani & Wilkins, 2022; Dicker et al., 2019). This signal can create a self-reinforcing cycle in which highly ranked universities attract more talented students and faculty, resulting in improved outcomes and higher rankings. Nevertheless, this theory also elucidates why universities that do not perform well in rankings may face difficulty in gaining entry into the elite group. Although they provide a higher quality of education or research, they are perceived as inferior institutions (Lynch & O'riordan, 1998).

Finally, the marketization of higher education is a theoretical framework that is expanding and is associated with university rankings. Universities have become increasingly competitive in their pursuit of students and resources, notably on a global scale, as a result of the transition to viewing education as a market commodity (Connell, 2013; Soysal & Baltaru, 2021). In this marketized environment, rankings are essential, as they provide an ostensibly objective measure of the quality of universities. Institutions that are highly ranked are perceived as providing a superior “product”, which in turn stimulates demand from students and other stakeholders (Abina et al., 2020). This theory asserts that higher education is becoming more commercialized, with evaluations serving both as a marketing tool and a benchmark for institutional performance.

University rankings are not merely a reflection of performance; they also affect the strategic behaviors and decisions of higher education institutions. A comprehensive framework for comprehending the significance of rankings and the ways in which they influence the actions and priorities of universities is provided by theories such as global competition, the resource-based view, institutional isomorphism, signaling theory, and the marketization of higher education (Tayar, 2015). These theories emphasize the complexity of the ranking system and the diverse effects it has on institutions, particularly those in developing countries, which may encounter difficulty in reconciling local educational objectives with the requirements of global competitiveness.

3. Methods

3.1. Search strategy

The literature reviewed for this study was selected through a thorough search of numerous academic databases, such as Google Scholar, JSTOR, and ScienceDirect. These databases were selected because of their extensive access to peer-reviewed journal articles, books, and conference papers. The primary search terms were as follows: “university rankings”, “higher education rankings”, “impact of rankings on universities”, “QS World University Rankings”, “Times Higher Education (THE) Rankings”, “Webometrics”, “developing countries”, “Vietnamese higher education”, “HCMUE” and “ĐHSP TP.HCM”. To encompass a wide range of literature regarding the role of rankings in higher education, with a particular emphasis on their influence in developing countries and on Ho Chi Minh City University of Education (HCMUE), these terms were chosen.

To guarantee relevance, the search was restricted to articles published between 2010 and 2023, as this time frame encompasses the most recent advancements in global ranking systems and their increasing impact on university policies and strategies. Foundational texts, including those of Hazelkorn (2011), which offer critical theoretical insights into global competition in higher education, were granted exceptions.

3.2. Process of selection

The literature review was selected on the basis of thorough inclusion and exclusion criteria. Articles were incorporated if they were peer reviewed, published in reputable academic journals, or authored by credible researchers in the field of higher education. Furthermore, articles were required to explicitly address the impact of university rankings on institutional strategies or in the context of developing countries or Vietnamese universities. The methodologies of prominent ranking systems, including QS, Times Higher Education (THE), and Webometrics, were the focus of specific literature.

Articles were excluded if they were deemed outmoded or irrelevant to the current state of global university rankings or if they focused on unrelated topics, such as primary or secondary education. Conference papers and non-peer-reviewed materials were also excluded unless they offered distinctive perspectives on the specific obstacles encountered by developing countries in higher education rankings.

A total of 40 documents were chosen for in-depth review after these criteria were applied. This selection guaranteed a harmonious balance between empirical studies on the impact of university rankings, theoretical discussions on the subject, and case studies that concentrated on Vietnam and other developing regions.

3.3. Categorization

Categorization refers to the process of classifying or grouping items on the basis of shared characteristics or criteria. It is a fundamental cognitive process that aids in organizing information and facilitating understanding.

The literature review was categorized into three primary sections: (1) Historical evolution of university rankings, (2) theoretical perspectives on rankings and their impact, and (3) practical implications for developing countries and Vietnamese universities. The categories facilitated a systematic examination of the literature, emphasizing the evolution of ranking systems and their strategic implications for institutions.

Historical Evolution of University Rankings: This section encompasses research that examines the origins and progression of prominent ranking systems such as QS, THE, and Webometrics. This study examines adaptations in the methodologies of these systems in response to the evolving global higher education landscape.

This category examines the theoretical frameworks present in the literature, including *Hazelkorn's theory of global competition and the resource-based view (RBV)* (Barney, 1991; Hazelkorn, 2011). This section examines the reasons behind the significant influence of rankings on university strategies.

Implications for Development in Emerging Economies and Vietnamese Higher Education Institutions: This section examines the particular challenges encountered by universities in Vietnam and other developing nations in enhancing their rankings. This study examines Vietnamese universities, specifically HCMUE, and analyzes the impact of global ranking pressure on their decision-making and internationalization strategies.

The literature was categorized to facilitate a comprehensive analysis that incorporates global perspectives on university rankings alongside the specific context of HCMUE.

4. Review of the Literature

4.1. Historical perspective

University ranking systems have significantly evolved since their inception. Initial rankings, demonstrated by the Shanghai Academic Ranking of World Universities (ARWU) established in 2003, emphasized research output, specifically metrics such as publication numbers, citation rates, and faculty honors such as Nobel Prizes (Aithal & Kumar, 2020; Alaşehir, 2010; Irungu et al., 2020). These metrics predominantly favor English-speaking countries, particularly in the fields of science and technology, owing to the prevalence of high-impact journals published in English. This prompted criticism that the rankings failed to reflect the complete diversity of institutional strengths, especially in fields such as the social sciences and humanities (Welsh, 2019). The ARWU ranking prioritizes scientific output, thereby excluding universities that excel in teaching or community engagement (Dmitrishin, 2013).

In response to these critiques, more equitable ranking systems emerged, including the QS World University Rankings established in 2004 and the Times Higher Education (THE) Rankings introduced in 2010. The rankings incorporated supplementary criteria such as academic reputation, employer reputation, and teaching quality, with the objective of achieving a more thorough assessment of universities (Liu & Cheng, 2005). Despite these advancements, research outputs and internationalization metrics, including the ratio of international students and staff, continue to be pivotal to these rankings. Webometrics, established in 2004, introduced an alternative methodology by emphasizing the digital presence and visibility of universities, utilizing data from institutional websites as the foundation for their rankings (Khamala et al., 2018; Thelwall et al., 2005). This approach highlights the significance of universities' online presence in a progressively digital landscape.

4.2. Current trends in university rankings

Recent trends in university rankings indicate an increasing focus on internationalization and sustainability, highlighting changes in the priorities of higher education. The Times Higher Education (THE) Impact Rankings evaluate universities according to their contributions to the United Nations Sustainable Development Goals (SDGs), emphasizing aspects such as quality education, gender equality, and climate action (Perović & Kosor, 2020; Serafini et al., 2022). This change in ranking metrics underscores the growing significance of universities' social impact, extending beyond conventional indicators such as academic performance and research output (Adler & Harzing, 2009). This comprehensive evaluation framework prompts institutions to prioritize both academic excellence and their contributions to advancing global sustainability objectives (Hazelkorn, 2015; Yarime et al., 2012).

The QS World University Rankings have integrated additional criteria that acknowledge the increasing significance of cross-border partnerships in higher education. The emphasis on international research network collaboration highlights the importance of global cooperation in enhancing academic research and institutional prestige (Atta-Owusu et al., 2021; Chen et al., 2019). The rankings prioritize employer reputation, a crucial element in assessing the alignment of university programs with job market demands. Employer reputation indicators assist prospective students in assessing the career prospects and market value of a university's degrees, rendering this a critical criterion for numerous global ranking systems (Marginson, 2007, 2014).

Despite these advancements, numerous ranking systems continue to prioritize research output and citations as fundamental metrics for evaluation. For example, THE Rankings assign as much as 30% of their score to research influence, quantified by citation impact (Kanellos et al., 2019). The persistent emphasis on research excellence prompts concerns regarding the potential neglect of other critical dimensions of higher education, including teaching quality and community engagement. This is especially pertinent for institutions such as Ho Chi Minh City University of Education (HCMUE), where the

main focus may prioritize teaching and local educational requirements over research output (Harman et al., 2010; Nguyen, 2014).

4.3. Analysis of the major ranking systems

University ranking systems serve as valuable tools for assessing institutional performance; however, each system possesses inherent limitations and has been subject to criticism regarding particular methodological aspects. The QS World University Rankings have faced criticism due to their dependence on subjective measures, including academic reputation surveys (Marginson, 2014). These surveys gather responses from scholars globally, asking them to evaluate institutions according to their perceived reputation. Goddard and Puukka (2008) noted that these surveys often favor well-established institutions with extensive global networks, which can disadvantage smaller or newer universities lacking comparable visibility. Consequently, newer universities or those located in developing countries may find it challenging to attain high rankings, despite their actual performance and contributions to education and research (Anowar et al., 2015).

Furthermore, the QS methodology places significant emphasis on employer reputation, which, although critical, may be subject to similar biases (Huang, 2012). Institutions with established relationships with multinational corporations or those situated in economically robust countries may obtain higher evaluations from employers, thereby distorting the rankings in favor of these institutions. The dependence on subjective measures has led to critiques that QS rankings may not consistently reflect an accurate or comprehensive assessment of a university's quality (Adler & Harzing, 2009; Dill & Soo, 2005).

The Times Higher Education (THE) Rankings are criticized for their excessive focus on research metrics, especially their significant dependence on citation impact and research output. Although these metrics serve as significant indicators of academic influence, they often obscure other essential functions of a university, including teaching quality and community service. Strand et al. (2003) argues that an emphasis on research may result in a limited perspective on university performance, disadvantaging institutions that prioritize teaching or community engagement. Universities such as Ho Chi Minh City University of Education (HCMUE), which prioritizes pedagogical excellence and community development, may receive rankings that do not accurately reflect their true strengths (Hazelkorn, 2009; Kayyali, 2023).

Webometrics adopts an alternative methodology by evaluating universities according to their digital presence and online visibility (Khamala et al., 2018). This approach, despite its innovation, has limitations in accurately evaluating academic excellence. Webometrics primarily emphasizes quantitative metrics, such as the number of webpages and the visibility of universities on search engines, rather than assessing the quality of publications or the impact of research. Critics argue that Webometrics rankings prioritize universities with robust digital infrastructures over those with significant academic accomplishments (Govender & Nel, 2021; Thuranira & Diki, 2023). Universities that significantly invest in their online platforms may achieve higher rankings, regardless of whether their research output and academic quality align with their digital presence.

Despite these limitations, Webometrics provides a distinct perspective by assessing a university's influence in the digital realm, which is increasingly significant in today's interconnected environment. The increasing importance of online learning and open access research indicates that a university's digital presence is essential for its global influence. Hazelkorn (2015) observes that universities with a strong online presence are more effectively able to connect with a global audience, thereby positioning Webometrics as a valuable instrument for assessing dimensions of university performance that may be neglected by other rankings.

Each ranking system offers valuable insights; however, their methodologies may introduce biases that favor specific types of institutions. Universities, particularly in developing countries, face the challenge of excelling in diverse ranking criteria while remaining aligned with their mission and values (Montesinos et al., 2008).

4.4. Gaps in the literature

Despite comprehensive studies on university rankings, notable gaps remain. There is a paucity of research regarding the alignment of global ranking systems with national education policies and the institutional missions of universities in developing countries. Many global ranking systems are structured for international competition, frequently emphasizing metrics that may not adequately reflect the local priorities of universities in developing countries. Universities such as HCMUE, which focus on teaching excellence and community engagement, may struggle to achieve high rankings that prioritize research output and internationalization (Hazelkorn, 2009).

Moreover, existing rankings frequently neglect nonresearch contributions, including policy consultation, community engagement, and various forms of public service (Moore & Ward, 2010). These contributions are essential for universities, especially in developing countries, where institutions significantly influence societal development. The literature indicates the need for contextualized ranking systems that more accurately reflect the distinct missions and contributions of universities across various regions.

The identified gaps underscore the necessity for future research to concentrate on the creation of more inclusive ranking systems that acknowledge the varied roles of universities, especially in emerging economies. Addressing these gaps will enable

future research to create more equitable and meaningful metrics for university performance that correspond with global standards and local priorities.

5. Synthesis and Discussion

5.1. Integration of findings

The literature on university rankings offers important insights into their substantial impact on institutional strategies, especially in developing countries such as Vietnam. The findings indicate that rankings significantly influence universities' international visibility and global competitiveness. Rankings such as QS, Times Higher Education (THE), and Webometrics are essential tools for assessing university performance, influencing important decisions regarding student recruitment, faculty appointments, and research funding (Hazelkorn, 2015; Taylor et al., 2014). These systems depend significantly on metrics, including research output, internationalization, and reputation, frequently favoring universities with superior financial and academic resources (Reddy et al., 2016). This advantage enables well-established institutions to enhance their global status, placing smaller, resource-limited universities at a comparative disadvantage.

The literature consistently highlights the growing importance of internationalization in university rankings, which has emerged as a critical element in the competitiveness of global higher education. Systems such as the THE Impact Rankings illustrate this trend by evaluating universities' contributions to the United Nations Sustainable Development Goals (SDGs), emphasizing the significance of both academic performance and social impact (Beynaghi et al., 2016). This expands university evaluations to encompass global contributions to critical issues such as climate action, gender equality, and quality education, thus prompting institutions to align their strategies with global development goals. The integration of cross-border partnerships and international research collaborations has become increasingly important, as rankings acknowledge the role of global academic networks in enhancing knowledge exchange and research impact (Gui et al., 2019; Hazelkorn & Gibson, 2017).

Nonetheless, the literature indicates a prevalent critique that numerous ranking systems, notably QS and THE, often place excessive emphasis on research metrics, particularly citation impact. The excessive focus on research outcomes frequently results in the oversight of other essential aspects of a university's mission, including teaching quality, community engagement, and contributions to society (Strand et al., 2003). Universities such as Ho Chi Minh City University of Education (HCMUE), which emphasize teaching quality and local educational requirements, may face challenges in achieving high rankings because the evaluation criteria predominantly favor research-intensive institutions (Hazelkorn, 2009; Kayyali, 2023). Consequently, there is increasing apprehension that existing ranking methodologies fail to offer a thorough assessment of university performance, especially for institutions in developing countries, whose objectives encompass not only research but also substantial contributions to regional development and community service.

The emphasis on research intensifies the disparity between universities in developed and developing countries, as those with strong research infrastructure and global partnerships are more likely to occupy the highest positions. Universities that excel in pedagogy and community-focused initiatives often struggle to achieve recognition in global rankings, despite their essential contributions to local educational advancements and social change. The literature emphasizes the necessity for balanced ranking systems that incorporate various dimensions of university contributions, such as educational quality, social impact, and community engagement, alongside research performance (Marginson, 2007).

5.2. Connections

The analyzed studies collectively emphasize the role of research metrics in influencing university rankings across different systems, notably in QS and Times Higher Education (THE) rankings. Both systems highlight the significance of research output and international reputation, resulting in similar pressures on universities to dedicate considerable resources to publication and global recognition. This has created a competitive landscape in which universities are driven to improve their research output and visibility to attain higher rankings (Adler & Harzing, 2009; Marginson & Van der Wende, 2007). The focus on citation impact and global ranking influences institutional strategies and funding decisions, as universities with higher rankings tend to attract greater investment in research and international collaboration. Consequently, universities in developing countries are compelled to prioritize research metrics, frequently to the detriment of other essential functions such as teaching and community engagement.

Webometrics emphasizes digital visibility, reflecting a broader trend that encourages universities to improve their global presence in an increasingly digitized environment (Khamala et al., 2018). Webometrics assesses universities by measuring their online impact and digital presence, thereby promoting the development of strong online infrastructures and outreach initiatives among institutions (Rafique et al., 2024). This indicates a common goal among ranking systems to establish universities as global entities that are accessible and influential beyond national boundaries.

The studies focus on the increasing importance of internationalization in university rankings, as demonstrated by the incorporation of indicators such as international students, staff, and research collaborations. These measures are integral to QS and THE methodologies, illustrating the growing global character of higher education. Universities are incentivized to

enhance their international presence via student exchange programs, joint research initiatives, and cross-border collaborations to increase their ranking positions (Deb, 2020). The Impact Rankings have implemented a more comprehensive framework by incorporating universities' contributions to the United Nations Sustainable Development Goals (SDGs), thereby broadening the evaluation criteria beyond academic performance and research output (De la Poza et al., 2021). This includes recognizing the social responsibilities of universities and prompting institutions to address global challenges, including climate change, gender equality, and sustainable education. The increasing focus on social impact in rankings such as THE Impact presents a comprehensive perspective on university performance, enabling institutions in developing countries, which may demonstrate strength in local and regional engagement, to enhance their global standing.

Despite these innovations, the prevalence of research metrics continues to be a consistent feature across all ranking systems, leading to ongoing discussions regarding the sufficiency of these criteria in representing a university's broader mission. Institutions primarily dedicated to teaching or emphasizing community service may be at a disadvantage in rankings that prioritize research output as the main indicator of academic success (Hazelkorn, 2009). This results in a disconnection for institutions such as Ho Chi Minh City University of Education (HCMUE), which focuses on educational quality and regional development. Universities must balance the pursuit of global recognition with their local responsibilities and educational objectives as they navigate ranking systems.

5.3. Contradictions

While there is general agreement on the significance of research and internationalization, discrepancies exist in the weighting of these factors across various ranking systems. For example, QS and THE emphasize research output, whereas Webometrics focuses on online visibility, which does not directly reflect the quality or impact of research (Khamala et al., 2018). This prompts an examination of the equity of ranking universities predominantly on the basis of metrics that may inadequately represent their comprehensive contributions, especially in teaching and community service.

A further contradiction exists in the evaluation of teaching quality among various rankings. Although THE asserts the integration of teaching excellence within its framework, research suggests that this component is frequently eclipsed by the emphasis placed on research metrics (Eynon & Iuzzini, 2020). Consequently, universities that emphasize teaching or community involvement may struggle to achieve favorable rankings, resulting in discrepancies in how these rankings represent the varied missions of higher education institutions.

5.4. Implications

These findings have significant implications for universities, especially in developing countries such as Vietnam. The persistent focus on research output and internationalization in rankings exerts pressure on universities to dedicate substantial resources to these domains, frequently compromising their fundamental missions in teaching and community engagement. Universities such as Ho Chi Minh City University of Education (HCMUE) face a strategic dilemma in balancing the pursuit of higher rankings with their commitment to pedagogical excellence and local educational needs.

The increasing dependence on rankings to assess university quality may intensify disparities between well-resourced institutions and those with limited resources. Smaller universities or those located in developing regions may find it challenging to compete in global rankings, as these systems typically favor institutions with well-established international networks and substantial research output. This can result in mission drift, wherein universities prioritize ranking metrics over their core objectives, including teaching quality and local impact (Hazelkorn, 2015).

University rankings serve as important benchmarks; however, they pose challenges for institutions that do not conform to the conventional model of research-intensive, globally oriented universities. Universities in developing countries require ranking systems that are contextualized to reflect their distinct missions and contributions to local and national development.

6. Research Directions and Recommendations

6.1. Future research

The literature identifies multiple gaps that present opportunities for future research, especially concerning the alignment of global university rankings with the missions of universities in developing countries. Future research should concentrate on creating contextualized ranking systems that more effectively consider local priorities and institutional missions in countries such as Vietnam. Research could examine the potential for rankings to integrate metrics that prioritize teaching quality, community engagement, and policy contributions, which are frequently neglected by current ranking systems.

A potential area for future research is the examination of the long-term effects of rankings on university strategies. Research may investigate the extent to which the pressure to excel in global rankings contributes to mission drift, wherein universities divert their attention from local obligations to pursue broader global objectives. This is particularly pertinent for institutions such as Ho Chi Minh City University of Education (HCMUE), which may encounter difficulties in balancing their primary emphasis on pedagogical excellence with the necessity of enhancing their research output and international visibility.

Furthermore, research may explore the equity implications of global rankings, specifically examining how smaller or less resourced institutions can compete in a landscape dominated by universities with extensive international networks and substantial research funding. The development of strategies to equalize opportunities for resource-limited universities may mitigate the biases inherent in existing ranking systems.

6.2. Recommendations

Enhancing university ranking methodologies requires the development of more balanced metrics that accurately represent the varied missions of higher education institutions. For example, QS and THE could incorporate supplementary indicators that evaluate a university's influence on local communities or its educational outcomes in conjunction with current research and internationalization metrics. This approach would yield a more comprehensive assessment of university performance, especially for institutions focused on education and community engagement (Ćulum, 2018).

Furthermore, Webometrics could enhance its framework by incorporating metrics that evaluate research quality in addition to digital presence. Webometrics has innovatively emphasized online visibility; however, integrating metrics of academic excellence and research impact would improve the ranking's credibility and relevance for universities pursuing academic prestige (Sanchez, 2012). This would also mitigate the risk of excessive dependence on web presence, which may not consistently reflect institutional quality.

It is advisable to establish regional or national ranking systems that are customized to the specific local context. This approach may assist universities in developing countries in evaluating their performance relative to peers with comparable missions and resources rather than competing with globally recognized institutions that prevail in conventional rankings. These systems may prioritize regional concerns, including educational quality, local impact, and policy influence, thereby providing a more equitable and pertinent comparison for institutions such as HCMUE.

Improving the transparency of ranking methodologies is essential. Numerous rankings, especially QS, have faced criticism for lacking transparency regarding the weighting and analysis of subjective indicators, such as reputation surveys (Marginson, 2014). Enhancing methodological transparency would foster trust in ranking outcomes and assist universities in identifying strategies to improve their positions while maintaining their fundamental missions.

7. Conclusion

This literature review analyzed the evolution and impact of global university ranking systems, including QS, Times Higher Education (THE), and Webometrics, emphasizing their effects on higher education institutions, especially in developing countries such as Vietnam. These systems, although valuable for assessing global performance, have faced criticism in prioritizing research output and internationalization. This focus tends to advantage well-resourced institutions while neglecting universities that emphasize teaching excellence and community engagement. Recent trends, such as the incorporation of sustainability and social impact in the impact rankings, indicate a transition toward more comprehensive evaluations of university success, although research metrics continue to prevail in numerous rankings. The review highlighted deficiencies in the literature, specifically the necessity for contextualized rankings that more accurately represent the missions of institutions in developing regions, underscoring the significance of teaching and local contributions. This analysis enhances the understanding of the influence of rankings on university strategies and highlights the need for more inclusive and balanced ranking systems that consider the varied roles of universities in local and global contexts.

Ethical Considerations

Not applicable.

Conflict of Interest

The authors declare no conflicts of interest.

Funding

This research is funded by the Ho Chi Minh City University of Education Foundation for Science and Technology under grant number CS.2023.19.13ĐH.

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Article

Academic Third Mission through Community Engagement: An Empirical Study in European Universities

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Abstract: Community engagement is fundamental for tertiary education, as it allows universities to connect with external stakeholders, create social impact, and improve the development of strategies for public engagement. The current study aims to evaluate the level of community engagement in tertiary education, assess the level of sustainable practices, and identify areas for improvement. The research employed a survey method, using a standardized questionnaire to gather data from 44 respondents, representing 35 European universities from nine countries. The survey covered various aspects of community engagement, such as university commitment, documentation, public awareness, investments, incentives, training, and stakeholder engagement. Quantitative analysis was employed using ANOVA and AHP to analyze the data collected from 20 questions. The results revealed that universities have a clear commitment to public engagement and have well-documented policies in place. However, there were areas identified for improvement, such as increasing investments to encourage public engagement and offering more training activities to support it. Additionally, the universities were found to have a limited target group for their community engagement activities and insufficient communication of the results of impact assessments. The findings of this study will be used to improve the development of strategies and enhance public engagement in tertiary education through the Academic Third Mission.

Keywords: third mission; tertiary education; community engagement; participatory and deliberative processes

Citation: Spânu, P.; Ulmeanu, M.-E.; Doicin, C.-V. Academic Third Mission through Community Engagement: An Empirical Study in European Universities. *Educ. Sci.* **2024**, *14*, 141. https://doi.org/10.3390/educsci14020141

Academic Editor: Andrew Holliman

Received: 30 November 2023
Revised: 13 January 2024
Accepted: 25 January 2024
Published: 30 January 2024

1. Introduction

Academic Third Mission is a priority on universities' agendas, focusing on the role of higher education institutions in contributing to the socio-economic development of their regions and communities through activities such as technology transfer, community outreach, and applied research [1,2]. This mission is in addition to the traditional roles of teaching and research, which are often referred to as the "first" and "second" missions, respectively [3–5]. The concept of the Academic Third Mission is intended to encourage universities to engage more actively with their local communities and to contribute to the development of a knowledge-based society. The European Union (EU) has recognized the importance of the Academic Third Mission and has made it a priority to support the engagement of universities with their local communities and regions [6,7]. The EU has implemented several initiatives and programs aimed at promoting the Third Mission, such as the Horizon 2020 program and the European Regional Development Fund [8,9]. These initiatives provide funding and resources for universities to conduct applied research and engage in technology transfer and community outreach activities.

There are several policy instruments that have been designed to support, monitor, and evaluate the engagement of universities in the community in relation to the Third Mission and can include funding programs, performance indicators, impact assessments, regional development strategies, public-private partnerships, and community engagement [10–13]. Worldwide governments and organizations, including the EU, provide funding for universities to engage in activities that support the Third Mission, such as applied research

and technology transfer. Universities are often required to report on their engagement in Third Mission activities and are evaluated on their performance in these areas [14,15]. This can include measures such as the number of patents filed, the number of startups created, and the number of community outreach programs [16,17]. Studies and evaluations are conducted worldwide to assess the impact of universities' Third Mission activities on the community and society [18]. Universities are encouraged to engage with regional development strategies and to align their Third Mission activities with regional priorities [19,20]. Governments and organizations often support universities to form partnerships with businesses and industry to boost progress and prosperity [21]. Of all the policy instruments, community engagement is particularly important.

Community engagement is a key aspect of the Third Mission, as it is through engagement with the local community that universities can truly understand the needs and priorities of the region and tailor their activities to have the most impact [3,22]. Community engagement allows universities to identify the needs of the community through direct engagement and communication with residents, organizations, and local leaders [23]. This helps universities develop programs and services that are responsive to local needs and priorities. It also helps build trust between the universities and the community by demonstrating their commitment to addressing local issues and by involving community members in the planning and implementation of Third Mission activities. By engaging with the community, universities can better understand the social, economic and environmental issues that affect the community and design their programs and services to have the greatest positive impact [24]. Community engagement can provide opportunities for students and faculty to gain real-world experience, which can enhance the educational experience and prepare graduates for careers that impact the community positively. Also, it promotes collaboration between universities, businesses, and organizations to address local issues and create new opportunities [25–28].

Due to all the benefits of community engagement within the Academic Third Mission, the authors proposed a study on the participatory and deliberative processes of several European universities, with the final goal of designing a general framework for academic community-led innovation. Participatory practices refer to the involvement of 'the public' in the decision-making processes of universities [29]. These processes entail actively involving community members in the planning and implementation of Third Mission activities to ensure that they are responsive to local needs and priorities [30]. This can include involving community members in the design and implementation of research projects, technology transfer initiatives, community outreach programs, co-creation and co-design of curriculum, and public engagement [31–33]. Participatory processes ensure that community members have a say in the activities that affect them and that their perspectives and experiences are taken into account.

Deliberative processes are aimed at making decisions upon an issue involving the weighing of reasons for and against a course of action [34]. Participation focuses on empowering citizens to take action. Deliberation focuses on discussion and debate between citizens and other stakeholders [35,36]. The process involves community members in a structured and informed discussion to identify and evaluate options and make collective decisions [25,37]. These processes allow community members to express their views, consider different perspectives, and make informed decisions. Deliberative processes can include public meetings, community forums, and other forms of consultation and dialogue [22,24,38].

Given the importance of participatory and deliberative processes within the global scope of the Academic Third Mission through community engagement the current research provides valuable insights into the current practices and challenges of European universities. The study involves a research methodology that uses quantitative tools, focusing on specific practices and strategies that universities use to engage with their communities and the impact of these practices on the community. It also examines the barriers and challenges that universities face in engaging with their communities and the strategies they use to

overcome these barriers. Additionally, it assesses the effectiveness of participatory and deliberative processes in promoting community engagement and the alignment of Third Mission activities with community needs and priorities.

2. Research Methodology

The current study was carried out under the TENACITY European project funded by Erasmus Plus through grant agreement no. 2021-1-IT02-KA220-HED-000032042. The project focuses on the Academic Third Mission and, specifically, on supporting universities to develop participatory and deliberative practices. In this context, the main objective of the research was to detect the needs, gaps and opportunities for designing a framework for the Higher Education Third Mission by collecting information from nine different European countries. This was conducted by applying an online questionnaire aimed at investigating universities' commitment to public engagement activities. Specifically, the investigation focused on the university experience with participatory and deliberative processes. The questionnaire was targeted at university staff/professors/researchers involved in managing/delivering relevant activities.

The research was conducted on a sample of 44 respondents from 35 universities in 9 different European countries (Table 1).

Table 1. European universities which participated in the conducted study.

Country	No. of Universities	Universities
Germany	4	University of Stuttgart; Münster University of Applied Sciences—FH Münster; Deggendorf Institute of Technology; Martin Luther University Halle-Wittenberg
Greece	7	University of Thessaly; Harokopio University; Panteion University; Aristotle University of Thessaloniki; University of the Aegean; University of Patras; National Technical University of Athens.
Italy	2	University of Bolzano; University of Firenze
Lithuania	3	Vilnius University, Faculty of Communication; SMK University of Applied Sciences; Kazimieras Simonavičius University
Malta	1	University of Malta
Portugal	1	University of Minho, Institute of Education
Romania	7	University of Bucharest, Faculty of Foreign Languages and Literatures; Carol Davila University of Medicine and Pharmacy, Faculty of Dentistry; Transylvania University of Brașov, Faculty of Materials Science and Engineering; Bucharest University of Economic Studies, Faculty of Management; Ferdinand I Military Technical Academy; Craiova University, Faculty of Engineering and Management of Technological Systems; University of Targu Jiu, Faculty of Engineering, Constantin Brancusi
Spain	6	Santiago de Compostela University; University of Jaen; University of Valladolid; Universidad Autónoma de Madrid; University of Seville, Department of Developmental and Educational Psychology; Pablo de Olavide University
Sweden	4	Södertörn University; KTH Royal Institute of Technology; University West; Umeå University

The 35 universities were selected randomly amongst European institutions. The sample consisted of 31 professors, 4 researchers, 4 doctoral students, and 5 administrative staff members (1 rector, 1 chancellor, 1 public engagement officer, and 2 other administrative staff). This distribution of the positions held in the institutions by the survey participants is not a limitation for the research and is not significantly influencing the research results. Within the TENACITY project, a letter of consent was created at the consortium level, outlining the purpose and ethical considerations of the research, including issues such as anonymity, voluntary participation, and confidentiality. The initial version of the questionnaire was specifically designed to target the university experience in participatory and deliberative processes, taking into account the characteristics of the target audience.

The research process was carried out in two stages. The first stage involved the completion and validation of the questionnaire. The initial English version of the questionnaire was reviewed by experts from each partner institution to ensure that the questions

were clear and easily understood by survey participants. The final English version of the questionnaire was implemented in Google Sheets and distributed by e-mail to the target group for participation in the research. The data collection process was carried out in approximately two months. Quantitative analysis was used to assess public engagement using a 7-point Likert scale, where value 1 corresponds to "totally disagree" and value 7 corresponds to "totally agree". The scale provided two moderate opinions along with two extremes, two intermediate, and one neutral opinion to the respondents. This scale provides better accuracy of results and more data points to run statistical information. The survey was constructed with 20 items (Table 2) that used the same response scale in order to allow the application of an Analysis of Variance (ANOVA) to the data set. This approach was preferred in order to improve the consistency of information from a large number of participants, such as university staff, community members, and researchers, on their perceptions and experiences of participatory processes of public engagement, as well as facilitate the use of statistical analysis on the numerical data.

Table 2. Question set used for survey in public engagement.

ID	Question
Q1	Is the university's commitment to public engagement clearly defined?
Q2	Is the commitment to public engagement well documented?
Q3	Does the university ensure that the documented commitment to public engagement is also publicly known and understood?
Q4	Are people at different levels of the university responsible for implementing the public engagement agenda?
Q5	Does the university currently make adequate investments to encourage public engagement?
Q6	Does the university offer incentives and rewards to promote public engagement?
Q7	Does the university offer training activities to support public engagement?
Q8	Does the university integrate external services into its portfolio of services to promote public engagement?
Q9	Does the university have clearly defined target groups for its (community) public engagement activities?
Q10	Does the university use up to date (e.g., didactic) methods and approaches to develop public engagement skills among students?
Q11	Does the university integrate public engagement practices into degree programs?
Q12	Does the university promote interdisciplinary educational paths?
Q13	Does the university compare and identify the needs of its external stakeholders?
Q14	Does the university use indicators to measure its activities and public engagement results (of the community)?
Q15	Does the university ensure that the results of the impact assessment of public engagement activities are used for future planning and organizational development?
Q16	Does the university communicate the results of the assessment on the impact of its public engagement activities inside and outside the institution?
Q17	Does the university influence (community) engagement at local and regional levels?
Q18	Does the university create a social impact from public engagement activities?
Q19	Has the university defined the kind of impact it aims to create through public engagement?
Q20	Does the university integrate (community) stakeholders into the institution's leadership?

ANOVA was selected as an appropriate validation method due to the overall goal of the study and the necessary prerequisites being met. The main goal of the research was to detect the needs, gaps, and opportunities for designing a framework for the Higher Education Third Mission by collecting information from different HEIs in European countries. ANOVA was a useful tool in this research context for comparing responses across different target groups and analyzing aggregated scores from the Likert scale survey. The method helped in assessing whether perceptions and needs vary significantly from one European country to another. The survey was constructed to investigate different aspects of the

Third Mission of Higher Education (commitment, implementation, investments, incentives, training, educational paths, and community engagement). ANOVA was used to analyze these aspects simultaneously, providing insights into which aspects differ significantly across different groups. Although in line with the research's main goal, ANOVA was deployed only after validation of its prerequisites.

The first prerequisite, independence of observations, was ensured through the distribution channel and application of the questionnaire. The final English version of the questionnaire was distributed by e-mail, individually to each member of the target group. Members of the target group were selected randomly from information available online. After selection, the consortium members validated the final 44 participants, verifying that they did not have any prior collaboration and were not in contact for the completion of the survey. The questionnaire was completed without revealing personal information like name, surname, age, or gender and involved completing a Google survey on their personal computers.

Normality was the second prerequisite of ANOVA, which was analyzed before applying the method. This prerequisite entails that the data in each group should be approximately normally distributed, which is particularly important for small sample sizes (which is the case). The Shapiro–Wilk test (best for small to moderate sample sizes) was used to calculate a statistic (W) and a *p*-value for each of the 20 questions in each country except Italy, Malta, and Portugal, which had less than 3 respondents. The test showed that the majority of questions have a normal distribution (Tables A1 and A2, shown in Appendix B of the manuscript). To validate even further the normality of the data, a Q-Q plot was put together (Figure A2, Appendix B), and the normally distributed data appears as roughly a straight line. Considering the aforementioned, the normality prerequisite was considered met.

Homogeneity of variances is the third important ANOVA prerequisite and was verified using Levene's test. This checks for homogeneity of variances and is less sensitive to deviations from normality, making it suitable for Likert scale data. It is performed by comparing the variance within each group (country) to the overall variance. Homogeneity of variances was considered met if Levene's Test *p*-value was over 0.05. Calculations conducted in Table A3, and Appendix C validates this prerequisite.

The fourth prerequisite is related to the *level of measurement*. This is met due to the structure of the survey. The 1 to 7 scores represent ratings, where differences are consistent and meaningful across the entire scale, for all 20 questions.

Random sampling, the fifth prerequisite, has been ensured since the early stages of the experiment design. The request for involvement in the study was sent randomly to HEIs around Europe with a timeframe of one month for receipt upon initial acceptance. With 44 respondents from 35 universities giving a positive reply in this timeframe, they were further verified for having no prior connection and validated for taking the study individually. The e-mail instructions highlighted the importance of independent responses. The responses were collected independently, ensuring anonymity and avoiding situations where participants from the same country and university discuss their responses before completing the survey.

Group independence of observations is the sixth prerequisite of ANOVA and is critical for its validity. The experiment design phase ensured group independence based on the premise that each country's data was selected and collected independently of the others. Moreover, the Durbin-Watson test was conducted on the residuals of ANOVA to check for autocorrelation as a proxy for independence. A value of 2.42 was obtained, suggesting a small degree of negative autocorrelation. However, this value is close enough to 2 to generally not be a cause for concern regarding the independence of observations. This result is a good indicator of the independence of the responses.

The seventh prerequisite of applying ANOVA, related to an *appropriate sample size*, is the main determinant in selecting this method, as it does not impose a minimum value. Nevertheless, a very small sample size can lead to a lack of statistical power, making it difficult to detect a real effect if it exists. To counteract this limitation, Cronbach's Alpha

was used to measure the internal consistency and reliability of the set of scales used and test items.

Based on all prerequisites being met and alignment with the study goal, ANOVA was the appropriate method to use in the conducted research.

3. Results Interpretation and Discussion

3.1. Quantitative Analysis

Quantitative analysis involved an Analysis of Variance (ANOVA) on the collected data set for items Q1 ÷ Q20 (Table 3). The statistical analysis was conducted to examine the differences between groups on a particular measure. The groups in the data set were the different questions (Q1, Q2, Q3, etc.), and the measures being analyzed were the responses given to each question. These responses were given in numbers, where each number represented an option on a 1–7 Likert scale (Appendix A—Figure A1). The items for public engagement must show a common variant, correlate with each other, and, at the same time, correlate each item with the score that reflects this attribute.

Table 3. ANOVA on public engagement data set.

Source of Variation	*SS*	*df*	*MS*	*F*	*p-Value*	*F Crit*
Rows	2102.727	43	48.90063	23.51994	3.6×10^{-114}	1.394538
Columns	113.1636	19	5.955981	2.864672	4.31×10^{-05}	1.599272
Error	1698.636	817	2.079114			
Total	3914.527	879				
Cronbach's Alpha = 0.957483						

After conducting the ANOVA with Two-Factor Without Replication the results include the source of variation, the sum of squares (*SS*), the degrees of freedom (*df*), the mean squares (*MS*), the *F*-ratio, the *p*-value, and the *F* critical value. These indicate that there is a significant difference between the means of the groups on the measure being analyzed (*p*-value is less than 0.05), and the source of variation was broken down into three main parts: Rows, Columns, and Error.

The Rows source of variation demonstrates that there is a significant difference between the means of the groups that were formed by rows. The Rows source of variation in the ANOVA results refers to the variation in the responses between the different questions. The calculated value of SS of 2102.727, *df* of 43, *MS* of 48.90063, *F* of 23.51994, *p*-value of $3.6 \cdot 10^{-114}$, and *F crit* of 1.394538 are all indicators of the statistical significance of the variation between the questions. The results suggest that there is a significant difference in the responses given to the 20 questions, with a large *F*-ratio and a very small *p*-value. Thus, all values are significant, indicating that there is a difference in means among the groups. The relevance of these values is that they can be used to identify which questions are most important to the participants, which questions are not well understood, and which questions are measuring different aspects of public engagement. The Columns source of variation shows that there is a significant difference between the means of the groups that were formed by columns. The *SS* is 113.1636, *df* is 19, *MS* is 5.955981, *F* is 2.864672, *p*-value is 4.31·10-05, and *F crit* is 1.599272. The calculated values are significant, indicating again that there is a difference in means among the groups. The Columns source of variation in this analysis refers to the variation in responses between the different questions. The relevance of the calculated values in terms of the questions can be determined by looking at the *p*-value and the F-value for each question. A low *p*-value (typically below 0.05) and a high *F*-value represent that there is a significant difference in the responses between the different questions, indicating that the question is measuring a different aspect of public engagement. For example, if we analyze the question "Does the university offer incentives and rewards to promote public engagement?" (Q6), the *p*-value and *F*-value are both low, indicating that there is a significant difference in responses between this question

and the other questions. Thus, offering incentives and rewards is an important factor in promoting public engagement [12,39]. On the other hand, if we look at the question "Does the university integrate external services into its portfolio of services to promote public engagement?" (Q8), the *p*-value and F-value are both relatively high, indicating that there is not a significant difference in responses between this question and the other questions. This shows that integrating external services may not be a major factor in promoting public engagement [15,18,19]. The Error Source of Variation is the variability that is not explained by the other sources of variation. It represents the random variation or noise in the data set. In terms of the questions, it represents the degree to which the responses to each question vary from the overall mean of the sample. A lower error variance corresponds to more consistent and less random responses for a given question, while more variable and less consistent responses have a higher error variance.

Focusing on the need to assess the consistency and reliability of the scale used, Cronbach's Alpha was used to assess the reliability and internal consistency in the development and validation stages. The ANOVA undertaken for public engagement has a Cronbach's Alpha of 0.957483, which is a strong indicator of the internal consistency of the questionnaire, which means that the items on the scale or questionnaire are measuring the same underlying construct and the results are reliable. Results show that there is a significant difference between the means of the groups or conditions on the measure being analyzed, and the source of variation in the difference is coming from both Rows and Columns. Moreover, the Cronbach's Alpha coefficient was used in the analysis of the results as the main indicator of the measurement accuracy of the test. Since F > F crit (23.51994 > 1.394538), the null hypothesis will be rejected. Population means are not all equal. Which means that at least one of the means is different. Because $p < 0.001$, it means that at least two means differ highly significantly from each other.

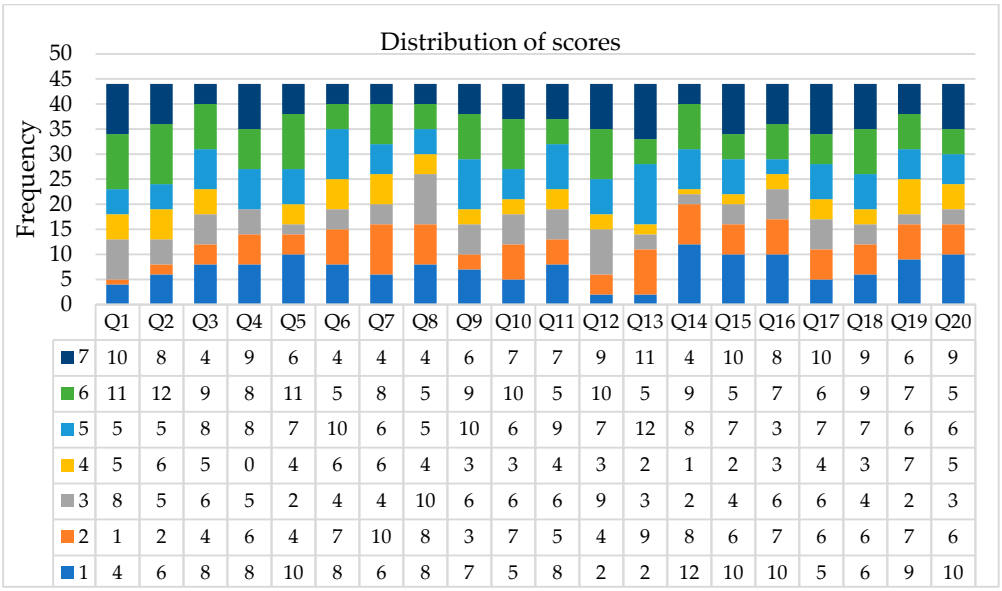
To further analyze the significance of each question, Table 4 was put together, containing information about the number of respondents (Count), the sum of scores (Sum), the average of scores, and the variance and standard deviation (Std. Dev.) for each item (Q1 ÷ Q20). The results show that there is a range of averages and variances among the questions. The average ranges from 3.477 to 4.795, and the variance ranges from 3.469 to 5.465, indicating that there is a significant difference between the means of the questions and the measure being analyzed. It is also worth noting that the variance is an indicator of the spread of the data; the larger the variance, the more spread out the data is, and it could involve the presence of outliers.

A low standard deviation means that most of the scores are near the mean, and a high value means that the scores are more dispersed. To identify which questions are considered more significant by the participants, the average scores were evaluated and contrasted among the questions. Questions with higher average scores are considered more significant by the participants. Furthermore, questions with a lower standard deviation imply that the responses are more consistent; hence, it is more likely that the question is considered more important by the participants. Based on the results from Table 4, in hierarchical order, starting with the most important, questions Q1, Q12, Q13, Q9, and Q10 are the most significant for the participants in terms of importance and consistency.

To determine which questions are not well understood, apart from the standard deviation, the distribution of responses was calculated and analyzed. The distribution of scores is a measure of how the scores are distributed across the range for each question. It can be visualized for all 20 questions using the histogram and the frequency distribution presented in Figure 1.

Table 4. Standard deviation and variance for the 20-question data set regarding public engagement.

Question ID	Count	Sum	Average	Variance	Std. Dev.
Q1	44	211	4.795	3.701	1.924
Q2	44	202	4.591	4.108	2.027
Q3	44	176	4.000	4.047	2.012
Q4	44	186	4.227	5.110	2.261
Q5	44	183	4.159	4.928	2.220
Q6	44	166	3.773	3.901	1.975
Q7	44	168	3.818	3.966	1.992
Q8	44	153	3.477	3.790	1.947
Q9	44	189	4.295	4.120	2.030
Q10	44	188	4.273	4.296	2.073
Q11	44	176	4.000	4.419	2.102
Q12	44	207	4.705	3.469	1.862
Q13	44	204	4.636	3.958	1.989
Q14	44	160	3.636	5.027	2.242
Q15	44	177	4.023	5.465	2.338
Q16	44	167	3.795	5.236	2.288
Q17	44	192	4.364	4.423	2.103
Q18	44	194	4.409	4.619	2.149
Q19	44	171	3.886	4.615	2.148
Q20	44	174	3.955	5.207	2.282



	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
7	10	8	4	9	6	4	4	4	6	7	7	9	11	4	10	8	10	9	6	9
6	11	12	9	8	11	5	8	5	9	10	5	10	5	9	5	7	6	9	7	5
5	5	5	8	8	7	10	6	5	10	6	9	7	12	8	7	3	7	7	6	6
4	5	6	5	0	4	6	6	4	3	3	4	3	2	1	2	3	4	3	7	5
3	8	5	6	5	2	4	4	10	6	6	6	9	3	2	4	6	6	4	2	3
2	1	2	4	6	4	7	10	8	3	7	5	4	9	8	6	7	6	6	7	6
1	4	6	8	8	10	8	6	8	7	5	8	2	2	12	10	10	5	6	9	10

Figure 1. Distributions of scores for the public engagement data set.

For example, for question Q1, the frequency of scores is given by {1:4, 2:1, 3:8, 4:5, 5:5, 6:11, 7:10}. Four respondents gave a score of 1, one respondent gave a score of 2, eight respondents gave a score of 3, and so on. Questions with a wide range of responses and a high standard deviation are generally not well understood. For all 20 questions, the calculated range was 6. Although the standard deviation for all questions is low, the study requires further clarifications for question Q15. The average values for the question range from 3.477 to 4.795, with Q1 having the highest average value of 4.795. The participants generally agreed that the universities' commitment to public engagement is clearly defined. However, it is worth noting that the average for Q1 is only slightly above the midpoint of the scale (4.5), which means that the results are not overwhelmingly in favor of the statement. There were some participants who disagreed or were uncertain about the statement; thus; there is a need for further investigation [18].

Regarding the documentation of public commitment (Q2), the lowest results were recorded in Greece (with an average of 3.85) and the best results were recorded in Germany with an average of 6.33, indicating that German universities have the best practices for documentation of public engagement activities. The results suggest that the commitment to public engagement is well documented, but there may be room for improvement in terms of clarity and dissemination of information. As other research shows, confusion on the subject can be due to a lack of consistency in the channels of information and the diversity of tools [11,34]. In order to further investigate this issue, Q3 was analyzed.

According to the respondents, most universities make efforts so that their documented commitment to public engagement is known and understood; there are no significant differences between the partner countries. The conclusion aligns with several other findings at a European level and can be explained mainly due to cultural and societal similarities but also due to strategic collaboration paths between institutions [6,7,9,22,24]. Based on the results, it can be inferred that the universities may need to improve their efforts to ensure that their documented commitment to public engagement is also publicly known and understood. Such strategies are implemented and actively promoted by universities and institutions worldwide, but with notable differences in the effectiveness of the tools [26,33]. Depending on the cultural approach, universities need to establish the most effective methods for undertaking public engagement documentation.

When asked if people from different levels of the university are responsible for the implementation of the public involvement agenda (Q4), the respondents appreciated the efforts of the university staff, suggesting that there is a fair level of responsibility among people at different levels of the university for implementing the public engagement agenda. European universities tend to assume a high level of responsibility in undertaking academic third-mission actions, endeavors sustained by a variety of common efforts and initiatives [6,7,12,22]. However, there is still room for improvement as the mean score is not the highest, indicating that there may be some lack of clarity or understanding of the responsibilities related to public engagement across different levels of the university. Several studies found that lack of clarity can be due to improper communication throughout the universities' management and organizational hierarchies [17,19].

Surveyed universities are concerned with investments to encourage public involvement (average = 4.159 for Q5), but they are less involved in offering incentives and rewards to promote audience involvement (average = 3.773 for Q6). Some universities have been known to strongly encourage public engagement through student involvement, which has proven beneficial in the long-term development of third mission strategies [37]. The EU has promoted continuous development of public engagement through the academic third mission of universities [6], so as to counteract the gap between academia and entrepreneurs. The average score for Q6 is 3.773, which is relatively low compared to the other questions. For this question, the respondents generally disagree with or are neutral in their opinion that their universities offer incentives and rewards to promote public engagement. The standard deviation of 1.975 also infers that there is a significant amount of variation in the responses, indicating that some respondents may strongly disagree while others may be more neutral or slightly disagree. There is definitely room for improvement in this area for the universities in terms of offering incentives and rewards to promote public engagement. This is mainly performed through structural funds [8,9], but also through local initiatives [13,15].

The results for questions Q7, Q8, and Q9 were very close to the central tendency (average: Q7 = 3.818, Q8 = 3.477, Q9 = 4.295). Training activities to support public involvement are not sufficient, and services to promote public involvement are less satisfactory in surveyed universities. A fair interpretation of the obtained results could be that the respondents do not believe that the university is effectively integrating external services into its portfolio to promote public engagement. This was also the case for several other institutions outside of the study [15,20,21,30]. Thus, this is a clear area for improvement

for the university in terms of its public engagement efforts and is in correlation with other literature findings [32,39].

For questions Q10 and Q11 there are no significant differences between the results collected from different countries. These results reflect, in the opinion of the respondents, the satisfactory preoccupation of universities in using updated methods and approaches to develop public engagement skills among students and in the integration of public engagement practices in study programs [23]. The general opinion of the respondents is that they do not believe that the university is effectively integrating public engagement practices into its degree programs. For this question respondents stated that there are universities where the public is involved to some extent in the study programs. The justification for this statement is based, in the opinion of the respondents, on the fact that the universities consider the opinion of the public based on the feedback received from them, especially formulated during internships, and volunteering. It could be beneficial to follow up with strategies that have proven successful over one common framework [18,22,24].

By identifying the needs of external stakeholders (Q13 = 4.636), the universities are involved in the promotion of interdisciplinary educational paths (Q12 = 4.705), as the surveyed professors claim. Most of the participants think that their university is effectively promoting interdisciplinary educational paths. The results show that universities effectively promote interdisciplinary educational paths, and this is something that is positively perceived by the respondents, a result that aligns with most literature research [20,21,32].

Regarding the evaluation of the activities and results of public commitment (Q15 = 4.023) and indicators used (Q14 = 3.636), the best results were recorded in the universities of Romania and Lithuania, and lower results were obtained in Greece. These results could be explained by the fact that the respondents from Romania are teaching staff directly involved in the evaluation activity, compared to Greece, where doctoral students were involved in the survey. This context also explains the average obtained for question Q16 = 3.795 regarding the communication of the evaluation results on the impact of the institutions' activities. This issue is of particular importance in the process of standardization, and universities should address their challenges based on proven strategies [16]. Results suggest that the respondents feel that the universities are not effectively using indicators to measure their activities and public engagement results, and it may be beneficial for universities to review and improve their methods for measuring and evaluating the effectiveness of public engagement activities. Insight into these processes is given by literature and professionals [11,14,20]. The low average score and large variation in responses suggest that this may be an area where the university could improve in terms of public engagement efforts [2]. This set of data shows that there is a need for the universities to improve in integrating the results of their public engagement activities into future planning and organizational development [2,4]. The standard deviation of 2.103 for Q17 means that the responses to this question are relatively spread out. This is also supported by the distribution of scores. In the ANOVA table, the values reveal that there is a significant difference between the means of the different rows, inferring that the responses to this question vary between different groups. Regarding the influence of universities at the local and regional level in Q17, the lowest average was obtained for universities in Greece; for the other countries, the results were approximately equal.

Social impact from public involvement activities and the definition at the university level are not fully satisfactory for respondents from all countries (Q18, Q19), with the averages obtained being close to the recorded central tendency. This satisfactory result was also recorded for question Q20 regarding the integration of interested parties in the management of the institution. Based on the obtained results, it can be concluded that the universities are generally successful in setting and communicating the goals and objectives of their public engagement activities and have a clear sense of direction in terms of how they want to create impact. This is a positive indication and hints at the fact that the universities effectively communicate their purpose and objectives with regard to public engagement with their communities and stakeholders [13,15]. Relationships with various stakeholders are crucial for universities in order to train students for real-life case scenarios

and offer a smooth transition to the job market. Integration initiatives include joint labs, entrepreneurship accelerators, spin-off communities, and many others, for the mutual benefit of universities and companies alike [13,20,21,36,39].

In order to avoid the dependence between two quantitative variables in the sample of data collected by applying the questionnaire, Pearson's correlation coefficient (r) was determined. The obtained coefficients had values between –1 (perfectly negative correlation) and 1 (perfectly positive correlation). The sign of the coefficient represents the meaning of the correlation, namely: the positive value corresponds to the variations of the same meaning and the negative one to those of the opposite direction. The absolute values of the correlation coefficients, presented in Table 5, express the intensity of the association between the items. Thus, for $\alpha < 0.05$, values of the correlation coefficient from −0.25 to 0.25 were obtained, representing a weak or zero correlation, from 0.25 to 0.50 (or from −0.25 to −0.50) acceptable degree of association, from 0.50 to 0.75 (or from −0.50 to −0.75) moderate to good correlation, and from 0.75 to 1 (or from −0.75 to −1) very good correlation.

Table 5. Correlation of coefficients.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
Q1	1.00																			
Q2	0.73	1.00																		
Q3	0.77	0.84	1.00																	
Q4	0.39	0.46	0.42	1.00																
Q5	0.49	0.55	0.61	0.66	1.00															
Q6	0.47	0.53	0.64	0.65	0.74	1.00														
Q7	0.46	0.53	0.56	0.53	0.56	0.66	1.00													
Q8	0.43	0.50	0.49	0.61	0.54	0.56	0.36	1.00												
Q9	0.46	0.50	0.59	0.48	0.67	0.72	0.55	0.62	1.00											
Q10	0.46	0.53	0.63	0.55	0.59	0.62	0.46	0.49	0.71	1.00										
Q11	0.43	0.57	0.60	0.60	0.47	0.61	0.69	0.38	0.47	0.54	1.00									
Q12	0.12	0.24	0.17	0.27	0.13	0.35	0.33	0.31	0.37	0.35	0.52	1.00								
Q13	0.22	0.37	0.30	0.40	0.46	0.56	0.57	0.36	0.56	0.37	0.59	0.65	1.00							
Q14	0.31	0.54	0.44	0.51	0.49	0.55	0.52	0.51	0.47	0.35	0.62	0.60	0.67	1.00						
Q15	0.32	0.55	0.52	0.51	0.58	0.54	0.66	0.37	0.54	0.55	0.66	0.52	0.70	0.85	1.00					
Q16	0.47	0.55	0.61	0.53	0.58	0.64	0.66	0.47	0.53	0.46	0.72	0.45	0.67	0.74	0.77	1.00				
Q17	0.48	0.35	0.40	0.44	0.50	0.61	0.57	0.41	0.47	0.35	0.41	0.26	0.48	0.40	0.48	0.53	1.00			
Q18	0.59	0.51	0.60	0.53	0.64	0.64	0.71	0.41	0.58	0.58	0.64	0.34	0.54	0.62	0.76	0.74	0.69	1.00		
Q19	0.52	0.55	0.62	0.63	0.61	0.69	0.76	0.54	0.64	0.64	0.72	0.46	0.56	0.70	0.80	0.74	0.57	0.87	1.00	
Q20	0.41	0.29	0.36	0.45	0.54	0.63	0.41	0.37	0.42	0.31	0.45	0.37	0.55	0.51	0.50	0.59	0.50	0.61	0.54	1.00

Among all the survey items in the first part of the questionnaire, only positive values were recorded that corresponded to variations of the same meaning. There are some moderate-to-strong positive relationships between the different questions. For example, Q2 and Q3 have a correlation coefficient of 0.84, indicating a strong positive relationship between the two questions.

Q4 and Q5 have a correlation coefficient of 0.66, indicating a moderately positive relationship between the two questions. Similarly, Q5 and Q6 have a correlation coefficient of 0.74, indicating a moderately positive relationship between the two questions. The highest association was recorded between items Q18 and Q19 (0.87), Q2 and Q3 (0.84), and Q15 and Q19 (0.80). However, it can also be seen that there are some weaker or no relationships between certain questions. For example, Q10 and Q14 have a correlation coefficient of 0.35, indicating a weak relationship between the two questions, and Q8 and Q17 have a correlation coefficient of 0.41, indicating a moderate relationship between the two questions.

The weakest correlation between items was recorded between items Q12 and Q1 (0.12), Q12 and Q5 (0.13), and Q12 and Q3 (0.17). These results suggest that there are moderate to strong positive relationships between some of the questions, indicating that the answers to

these questions may be related to one another. However, there are also some weaker or no relationships between certain questions, indicating that the answers to these questions may not be as related to one another. It is important to keep in mind that correlation does not imply causation, and further analysis would be needed to understand the underlying relationships between the variables.

3.2. Relative Importance of Community Engagement

The questionnaire was put together so that the answers reflect a different facet of community engagement in European universities. Questions do not overlap in information but rather offer a complementary vision on how universities integrate community engagement practice into their academic third missions. Thus, each question is viewed both as a separate entity, with its own value in the setting of the overall objective of the questionnaire, and as a puzzle piece in the development of transformative actions.

In this context, results obtained by ANOVA and Pearson's correlation showed that further analysis is necessary to substantiate the construction of a cohesive framework that could impact the decision-making process regarding community engagement in European universities.

Given the complexity of the analyzed issue, the Analytic Hierarchy Process (AHP) was applied to define the importance of each one of the 20 questions, respectively, as an underlying component of community engagement. The authors identified AHP as the most suitable method, attributing its effectiveness to its ability to minimize biases in the results of the decision-making process [40,41]. This approach necessitated a total of 190 pairwise comparisons among all 20 questions. In AHP, a consistency ratio below 10% is considered acceptable for maintaining result accuracy [42]. Goepel's AHP Online System facilitated the analysis [43].

A decision matrix needs to be put together, evaluating the importance of each question in relation to all others and the degree of that importance. The used AHP scale was: 1—Equal Importance, 3—Moderate Importance, 5—Strong Importance, 7—Very Strong Importance, 9—Extreme Importance (2, 4, 6, 8 values in-between). To set the values for each pair of questions, the calculated standard deviation (Table 4) was used.

There are two important steps in putting together the matrix, as follows: 1. Which question is more important than the other; 2. How much more important is one question than the other based on the AHP scale. The first step is straight-forward as the question with the lowest standard deviation is the most important of the two being compared.

The second step involves weighing the differences in standard deviation and spreading them across the 9-point scale. A square matrix is used to calculate the standard deviation differences (1).

$$\begin{array}{c} \\ Q_1 \\ Q_2 \\ Q_3 \\ \cdots \\ Q_i \\ \cdots \\ Q_{20} \end{array} \begin{array}{c} \begin{array}{ccccccc} Q_1 & Q_2 & Q_3 & \cdots & Q_j & \cdots & Q_{20} \end{array} \\ \begin{pmatrix} x_{11} & x_{12} & x_{13} & \cdots & x_{1j} & \cdots & x_{120} \\ x_{21} & x_{22} & x_{23} & \cdots & x_{2j} & \cdots & x_{220} \\ x_{31} & x_{32} & x_{33} & \cdots & x_{3j} & \cdots & x_{320} \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ x_{i1} & x_{i2} & x_{i3} & \cdots & x_{ij} & \cdots & x_{i20} \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ x_{201} & x_{202} & x_{203} & \cdots & x_{20j} & \cdots & x_{2020} \end{pmatrix} \end{array} \quad (1)$$

where x_{ij} is the difference between the standard deviation of question Q_i and the standard deviation of question Q_j. If x_{ij} has a negative value, then Question Q_i is more important than question Q_j. Based on the maximum absolute value amongst these differences, each question gets assigned a point on the AHP scale, according to the procedure shown in Table 6.

Table 6. Criteria to assign points on the AHP scale for each pairwise comparison.

Points on the AHP Scale	Interval Range for $\left\|x_{ij}\right\|$ When Assigning Points on the AHP Scale *
1	0
2	$\left(0\ ,\ \frac{max\left\|x_{ij}\right\|}{n-1}\left((n-8)+\frac{1}{2}\right)\right]$
3	$\left(\frac{max\left\|x_{ij}\right\|}{n-1}\left(1+\frac{1}{2}\right)\ ,\ \frac{max\left\|x_{ij}\right\|}{n-1}\left((n-7)+\frac{1}{2}\right)\right]$
4	$\left(\frac{max\left\|x_{ij}\right\|}{n-1}\left(1+\frac{1}{2}\right)\ ,\ \frac{max\left\|x_{ij}\right\|}{n-1}\left((n-6)+\frac{1}{2}\right)\right]$
5	$\left(\frac{max\left\|x_{ij}\right\|}{n-1}\left(1+\frac{1}{2}\right)\ ,\ \frac{max\left\|x_{ij}\right\|}{n-1}\left((n-5)+\frac{1}{2}\right)\right]$
6	$\left(\frac{max\left\|x_{ij}\right\|}{n-1}\left(1+\frac{1}{2}\right)\ ,\ \frac{max\left\|x_{ij}\right\|}{n-1}\left((n-4)+\frac{1}{2}\right)\right]$
7	$\left(\frac{max\left\|x_{ij}\right\|}{n-1}\left(1+\frac{1}{2}\right)\ ,\ \frac{max\left\|x_{ij}\right\|}{n-1}\left((n-3)+\frac{1}{2}\right)\right]$
8	$\left(\frac{max\left\|x_{ij}\right\|}{n-1}\left(1+\frac{1}{2}\right)\ ,\ \frac{max\left\|x_{ij}\right\|}{n-1}\left((n-2)+\frac{1}{2}\right)\right]$
9	$\left(\frac{max\left\|x_{ij}\right\|}{n-1}\left(1+\frac{1}{2}\right)\ ,\ \frac{max\left\|x_{ij}\right\|}{n-1}\left((n-1)+\frac{1}{2}\right)\right]$

* $n = 9$, the maximum value on the AHP scale.

Using the criteria given in Table 6, 190 comparisons were made in pairs and an AHP decision matrix was put together (Figure 2a). The relative importance of each question was calculated based on the decision matrix, using the principal eigenvector solution with five iterations and a delta value of 4.7×10^{-8}. Each question's weight was assigned based on the priority in the AHP Ranking, as shown in Figure 2b.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	3.00	2.00	7.00	6.00	2.00	2.00	2.00	3.00	4.00	4.00	0.50	2.00	6.00	8.00	7.00	4.00	5.00	5.00	7.00
2	0.33	1	0.50	5.00	4.00	0.50	0.50	0.50	2.00	2.00	2.00	0.25	0.50	5.00	6.00	5.00	2.00	3.00	3.00	5.00
3	0.50	2.00	1	5.00	4.00	0.50	0.50	0.50	2.00	2.00	3.00	0.25	0.50	5.00	6.00	6.00	3.00	3.00	3.00	6.00
4	0.14	0.20	0.20	1	0.50	0.17	0.17	0.17	0.20	0.25	0.25	0.12	0.17	0.50	2.00	2.00	0.25	0.33	0.33	2.00
5	0.17	0.25	0.25	2.00	1	0.20	0.20	0.17	0.25	0.33	0.33	0.14	0.20	2.00	3.00	2.00	0.33	0.50	0.50	2.00
6	0.50	2.00	2.00	6.00	5.00	1	2.00	0.50	2.00	3.00	3.00	0.33	2.00	5.00	7.00	6.00	3.00	4.00	4.00	6.00
7	0.50	2.00	2.00	6.00	5.00	0.50	1	0.50	2.00	2.00	3.00	0.33	0.50	5.00	7.00	6.00	3.00	4.00	4.00	6.00
8	0.50	2.00	2.00	6.00	6.00	2.00	2.00	1	2.00	3.00	4.00	0.50	2.00	6.00	8.00	7.00	4.00	4.00	4.00	7.00
9	0.33	0.50	0.50	5.00	4.00	0.50	0.50	0.50	1	2.00	2.00	0.25	0.50	5.00	6.00	5.00	2.00	3.00	3.00	5.00
10	0.25	0.50	0.50	4.00	3.00	0.33	0.50	0.33	0.50	1	2.00	0.20	0.50	4.00	5.00	5.00	2.00	2.00	2.00	5.00
11	0.25	0.50	0.33	4.00	3.00	0.33	0.33	0.25	0.50	0.50	1	0.20	0.33	3.00	5.00	4.00	2.00	2.00	2.00	4.00
12	2.00	4.00	4.00	8.00	7.00	3.00	3.00	2.00	4.00	5.00	5.00	1	3.00	7.00	9.00	8.00	5.00	6.00	6.00	8.00
13	0.50	2.00	2.00	6.00	5.00	0.50	2.00	0.50	2.00	2.00	3.00	0.33	1	5.00	7.00	6.00	3.00	4.00	4.00	6.00
14	0.17	0.20	0.20	2.00	0.50	0.20	0.20	0.17	0.20	0.25	0.33	0.14	0.20	1	3.00	2.00	0.33	0.33	0.33	2.00
15	0.12	0.17	0.17	0.50	0.33	0.14	0.14	0.12	0.17	0.20	0.20	0.11	0.14	0.33	1	0.50	0.20	0.25	0.25	0.50
16	0.14	0.20	0.17	0.50	0.50	0.17	0.17	0.14	0.20	0.20	0.25	0.12	0.17	0.50	2.00	1	0.25	0.33	0.33	0.50
17	0.25	0.50	0.33	4.00	3.00	0.33	0.33	0.25	0.50	0.50	0.50	0.20	0.33	3.00	5.00	4.00	1	2.00	2.00	4.00
18	0.20	0.33	0.33	3.00	2.00	0.25	0.25	0.25	0.33	0.50	0.50	0.17	0.25	3.00	4.00	3.00	0.50	1	0.50	3.00
19	0.20	0.33	0.33	3.00	2.00	0.25	0.25	0.25	0.33	0.50	0.50	0.17	0.25	3.00	4.00	3.00	0.50	2.00	1	3.00
20	0.14	0.20	0.17	0.50	0.50	0.17	0.17	0.14	0.20	0.20	0.25	0.12	0.17	0.50	2.00	2.00	0.25	0.33	0.33	1

(**a**)

Cat		Priority	Rank	(+)	(-)
1	Q1	11.6%	2	3.6%	3.6%
2	Q2	5.4%	8	1.6%	1.6%
3	Q3	6.3%	7	2.1%	2.1%
4	Q4	1.2%	17	0.4%	0.4%
5	Q5	1.6%	15	0.5%	0.5%
6	Q6	8.5%	4	2.9%	2.9%
7	Q7	7.2%	6	2.3%	2.3%
8	Q8	9.9%	3	3.0%	3.0%
9	Q9	5.0%	9	1.5%	1.5%
10	Q10	4.0%	10	1.2%	1.2%
11	Q11	3.4%	11	1.1%	1.1%
12	Q12	15.8%	1	5.7%	5.7%
13	Q13	7.8%	5	2.5%	2.5%
14	Q14	1.4%	16	0.5%	0.5%
15	Q15	0.8%	20	0.3%	0.3%
16	Q16	1.0%	19	0.4%	0.4%
17	Q17	3.2%	12	1.0%	1.0%
18	Q18	2.3%	14	0.8%	0.8%
19	Q19	2.5%	13	0.8%	0.8%
20	Q20	1.1%	18	0.4%	0.4%

(**b**)

Figure 2. AHP for 20 questions on community engagement in European universities: (**a**) AHP Decision matrix; (**b**) AHP Ranking.

The consolidated results of the AHP reveal a consistency ratio of 3.5% (Figure 3), significantly lower than the predetermined threshold. Consequently, the model's inconsistencies

are within an acceptable range, allowing the derived importance coefficients to be reliably utilized in subsequent decisions.

Number of comparisons = 190
Consistency Ratio CR = 3.5%
Principal eigen value = 21.077
Eigenvector solution: 5 iterations, delta = 4.7E-8

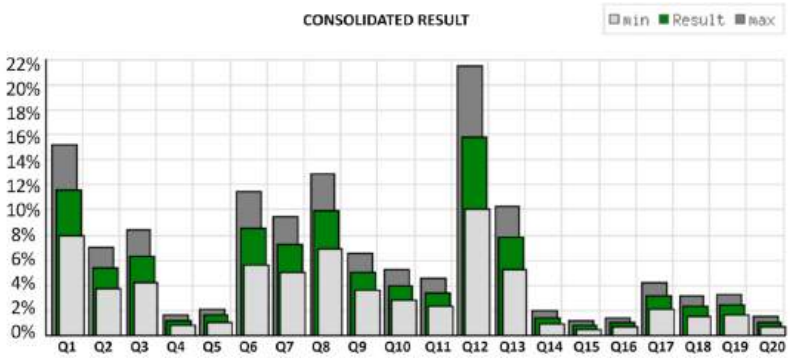


Figure 3. AHP consolidated result for all 20 questions on community engagement in European universities.

AHP shows that the most important questions relate to the promotion of interdisciplinary educational paths (Q12), the clarity of the public engagement definition (Q1), the integration of external services into universities' portfolios of services to promote public engagement (Q8), and the offer of incentives and rewards to promote public engagement (Q6). Q12, although the most important for the survey participant universities, has the lowest correlation coefficient of all questions, implying that this is a mandatory area of improvement and further investigation for all universities.

It is interesting to note that ANOVA identified Q1 as having the highest average value amongst the group, and according to AHP, it is the second most important component for universities. In this regard, there is a balance between value and importance, and further steps might involve improving functionality rather than value.

The ANOVA on Q8 showed that European universities do not effectively integrate external services into their portfolio to promote public engagement. This result corroborated its' importance. AHP shows that universities should implement a more efficient framework targeting practical solutions to external service integration. Q6 has strong positive values, with all other questions showing the grounded connection in research, making its' importance valuable for further analysis and improvement. Based on the AHP and ANOVA results the authors put together a set of recommendations and limitations fort the current study.

3.3. Recommendations and Study Limitations

The Academic Third Mission refers to the engagement of universities with their local communities through activities such as research, education, and services [5,23]. Public engagement, or the involvement of citizens in these activities, is crucial for the success of the Third Mission [35]. However, the results of the current study indicate that there are a number of challenges to effective public engagement in tertiary education. These challenges include a lack of awareness and understanding of the Third Mission among citizens, difficulty in involving citizens in decision-making processes, and conflicts of interest that arise in the participatory process. In light of these challenges, it is essential to develop strategies for improving public engagement in tertiary education through the Academic Third Mission [18,19,22]. Some possible strategies include increasing awareness and understanding of the Third Mission among citizens, involving citizens in decision-making processes and providing them with the tools and resources to participate effectively,

and addressing conflicts of interest in the participatory process. Based on the obtained results, the authors propose nine different strategies (S1 ÷ S9) for further development.

Improving public engagement in tertiary education requires a multifaceted approach, emphasizing transparency, early involvement, and a culture of participation. A key strategy is enhancing transparency and communication between universities and the community (S1). This can be effectively achieved by regularly publishing the results of participatory activities on the university's website and establishing a dedicated online channel to listen to and implement citizens' recommendations. Involvement of citizens should begin at the initial stages (S2), including the collection and processing of context data, identification of priorities, and planning and programming of interventions. Such early engagement ensures that their needs and perspectives are integral to decision-making processes. Additionally, fostering a culture of participation within the university is crucial (S3). This involves providing training and support to staff and students in participatory methods and encouraging active participation in decision-making processes. The formation of interest groups and coalitions during debates ensures diverse perspectives in decision-making (S4). Equally important is the regular evaluation and monitoring of the participation process (S5) to identify areas for improvement, ensuring inclusivity and fairness. Diverse participatory methods, such as town meetings, deliberative surveys, and design workshops, are essential to represent varied viewpoints (S6). Collaboration with other organizations and experts is another key aspect (S7), providing access to a broad range of perspectives and expertise in decision-making. It is also important to consider the available resources and the level of conflict (S8) related to the intervention area and the local community before implementing any strategy. Finally, supporting citizens to understand their needs and make informed decisions is paramount (S9). This includes informing them of the outcomes of the participatory process, the work conducted by researchers and experts, and collecting feedback for potential interventions and improvements. A specific online channel for listening to and implementing citizens' recommendations further supports this strategy, making for a more robust and inclusive approach to public engagement in tertiary education.

In order to facilitate the implementation of the above strategies, the study showed that there are still several areas in which universities can improve their engagement with citizens through the Academic Third Mission [1,4]. In order to effectively involve citizens in the decision-making process and ensure that their needs are being met, universities should consider implementing a variety of good practices. First, universities should prioritize transparency and communication throughout the participatory process. This includes clearly communicating the goals and objectives of the participatory process to citizens, as well as providing regular updates on the progress of the process and the outcomes achieved [2]. Universities should also make an effort to ensure that the results of the participatory process are widely shared and easily accessible to citizens, such as through a dedicated section on the university website. Second, universities should actively involve citizens in the planning and implementation of the Third Mission activities. This can be achieved through a variety of methods, such as working groups, town meetings, and participatory budgeting [20]. By involving citizens in the planning process, universities can ensure that their needs and priorities are taken into account and that the resulting interventions are more effective. Third, universities should consider providing support to citizens to understand their needs and make informed decisions. This can be achieved through a variety of methods, such as information desks, listening points, and providing information about the final result produced by the participatory process and the work conducted by researchers and experts [21,23,30]. Fourth, in order to prevent conflicts of interest, universities should have a clear policy in place to identify and address such situations. This can include the establishment of a conflict-of-interest committee, the implementation of a code of conduct, and the provision of training to staff and stakeholders on how to handle conflicts of interest [33,35]. Finally, universities should conduct regular evaluations of the participatory process to identify areas for improvement and ensure that the needs and priorities of citizens are being met. This can include conducting surveys or

focus groups to gather feedback from citizens, as well as conducting internal evaluations of the process [37].

The study revealed the main areas of improvement for the involved European universities and some important recommendations were proposed for further development. Based on these an initial framework is proposed in Figure 4.

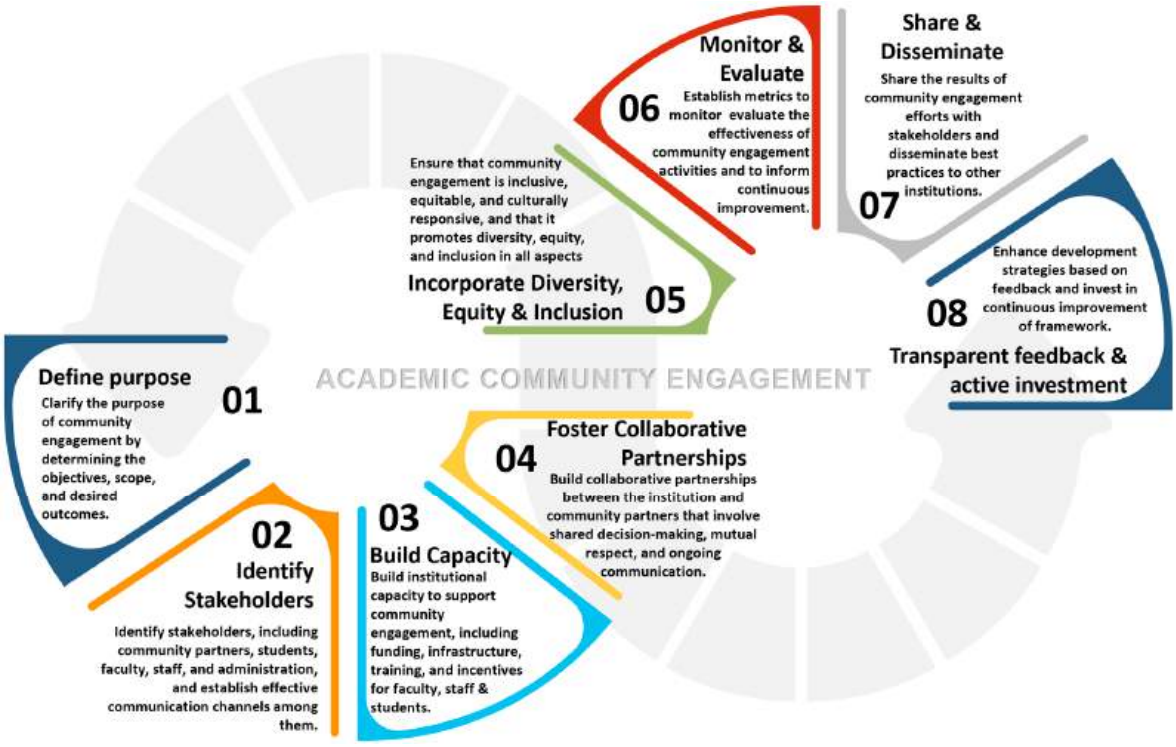


Figure 4. General framework for promoting academic community engagement.

To substantiate the framework and apply the identified sustainable strategies, the project consortium developed an online platform which enables stakeholders to get involved, participate and decide on sustainable academic contexts. The platform is available at www.tenacityplatform.com (accessed on 15 November 2023) and allows sustainable implementation of academic deliberative arenas for open science and innovation, and the delivery of an e-learning platform for academic deliberative practitioners. In accordance with study findings, the platform allows six main categories of stakeholders to participate in the creation of sustainable academic practices, namely: citizen, policy maker, professor, researcher student and teacher.

An important feature of this interactive tool is the iterative feedback loop which allows participants to the deliberative process to improve on any subroutine, enhancing the overall sustainability and probability of use for future applications. This approach also lowers the impact of identified limitations, all the way to potentially eliminating some of them. Multifunctionality was also promoted, and organic development of novel avenues was permitted, all leading to sustainable product development in academic settings.

Nevertheless, the study brings with it limitations which should be considered when assimilating the presented information and conclusions. One potential limitation of this study is the small sample size of the survey participants. With only 44 participants, it is difficult to generalize the findings to the larger population of citizens and universities. Small samples may have limited representativeness and statistical power, and assumptions such as normality can be more challenging to meet. Nonetheless, even a small quantitative study can establish baseline data on a topic, providing a starting point for future research and comparisons.

Additionally, the survey responses were self-reported and may not accurately reflect the true experiences and perspectives of the participants. The study also relies on the assumption that the participants have a clear understanding of the term "participatory practices" and have had similar experiences in their participation in university activities. There could also be a bias in the survey responses, as the participants may have had a vested interest in presenting their experiences in a certain way. Another limitation is that the study does not consider other factors that may influence the implementation of participatory practices in universities. For example, the survey does not take into account the specific political, economic, and cultural context of each university or the level of resources available to support participatory practices.

One mentionable limitation is that the study does not consider how the COVID-19 pandemic may have affected the ability of citizens and universities to participate in participatory practices, such as the shift to online engagement or the reduced availability of resources. The small sample size and self-reported nature of the survey responses, along with the assumptions made about the participants' understanding and experiences, may limit the generalizability of the findings. Also, the study does not take into account other factors that may influence the implementation of participatory practices in universities. To overcome the study limitations, it is recommended to conduct quantitative analysis and further research on larger studies. Future actions include the use of the current study as a pilot to inform a larger, more comprehensive research project. Additional qualitative methods, such as focus groups or case studies, will also supplement the survey data to provide a richer, more nuanced understanding of the third mission in different European HEIs, further developing the proposed framework.

The advantages of using ANOVA in our design analysis also counteract some of the study limitations. It allowed us to quantify trends and patterns for community engagement, even with the small sample size. This provided initial insights and identified potential areas of interest for further qualitative analysis. The quantitative data collection involved standardized instruments; the survey used Likert scales, allowing for consistency in data collection and facilitating comparisons across respondents and institutions.

4. Conclusions

The current study provides valuable insights into the current state of public engagement in tertiary education through the Academic Third Mission in European universities. The results of this survey can be used to identify gaps and areas for improvement in the development of strategies for promoting public engagement. Additionally, the study leads to the conclusion that European universities need a general framework for promoting and improving public engagement in tertiary education through the Academic Third Mission. Furthermore, the study's findings can be used to enrich a repository of good practices in Europe, which will be showcased in a handbook and on the TENACITY project website. This can serve as a valuable resource for universities looking to improve their public engagement strategies. The obtained results can be used to help identify the needs of universities in order to improve their deliberative practices. A survey was designed and applied to collect the data from 44 respondents, representing 35 universities from nine European countries. Quantitative (ANOVA) and qualitative analysis was undertaken to analyze various aspects of public engagement, such as university commitment, documentation, public awareness, investments, incentives, training, and stakeholder engagement.

The ANOVA results showed that while the respondents generally have a neutral opinion on the statements regarding public engagement at the university, there are some areas where they feel more positively or negatively. For example, the higher scores for Q1, Q2, and Q9 suggest that the respondents feel that the university's commitment to public engagement is clearly defined, well documented, and has well-structured target groups for its community public engagement activities. Lower scores for Q3, Q4, and Q5 show that the respondents feel that the university does not ensure that the documented commitment to public engagement is also publicly known and understood, people at different levels

of the university are not responsible for implementing the public engagement agenda, and the university does not currently make adequate investments to encourage public engagement. Similarly, higher scores for Q6 and Q7 imply that the respondents feel that the university offers incentives and rewards to promote public engagement and offers training activities to support public engagement. The smaller values obtained for Q8, Q10 and Q11 showcase the situation where the respondents feel that the university does not integrate external services into its portfolio of services to promote public engagement, does not use up-to-date methods and approaches to develop public engagement skills among students, and does not integrate public engagement practices into degree programs. Results for Q12, Q13 and Q19 were registered in the upper part of the evaluation scale and signify that the respondents think that the university promotes interdisciplinary educational paths, compares and identifies the needs of its external stakeholders, and has defined the kind of impact it aims to create through public engagement. On the other hand, lower scores for Q14, Q15 and Q16 suggest that the respondents feel that the university does not use indicators to measure its activities and public engagement results, does not ensure that the results of the impact assessment of public engagement activities are used for future planning and organizational development, and does not communicate the results of the assessment on the impact of its public engagement activities inside and outside the institution. Higher scores for Q17, Q18, and Q20 entail that the university influences community engagement at local and regional levels, creates a social impact from public engagement activities, and integrates community stakeholders into the institution's leadership.

AHP was used to add value to the current study by prioritizing the questions based on their relative importance, thus offering a comprehensive view that is beneficial for both analytical and decision-making purposes. The analysis identified four key survey areas: promoting interdisciplinary paths (Q12), defining public engagement (Q1), integrating external services (Q8), and incentivizing public engagement (Q6). Q12, crucial but with the lowest correlation, highlighted a significant improvement area. Q1's high average in ANOVA aligned with its AHP importance, suggesting a need to focus on functionality. Q8's poor integration of external services in universities, as per ANOVA, combined with its AHP significance, called for more efficient external service integration strategies. Q6's strong correlations indicated its vital role in research and improvement.

The current study is an important contribution to the field of public engagement in tertiary education through the Academic Third Mission by providing valuable insights and recommendations that can be used to improve the development of strategies and enhance public engagement in European universities.

Author Contributions: Conceptualization: M.-E.U. and C.-V.D.; Methodology: P.S.; Validation: C.-V.D., P.S. and M.-E.U.; Formal analysis: C.-V.D.; Investigation: M.-E.U.; Resources: P.S.; Data curation: P.S., M.-E.U. and C.-V.D.; Writing—original draft preparation: M.-E.U.; Writing—review and editing: P.S. and C.-V.D.; Visualization: M.-E.U.; Supervision: C.-V.D.; Project administration: P.S.; Funding acquisition: P.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the European Community's ERASMUS+ PROGRAMME under grant agreement no. 2021-1-IT02-KA220-HED-000032042—ACADEMIC THIRD MISSION: comuniTy Engagement for a kNowledge bAsed soCIeTY (TENACITY). This work was supported by a grant from the National Program for Research of the National Association of Technical Universities—GNAC ARUT 2023, Grant No. 14/06.10.2023.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available in Appendix A.

Acknowledgments: Authors would like to acknowledge the contribution of University POLITEHNICA of Bucharest for the support given in the form of infrastructure and other resources not covered through the funded projects.

Conflicts of Interest: The authors declare no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data, in the writing of the manuscript, or in the decision to publish the results.

Appendix A

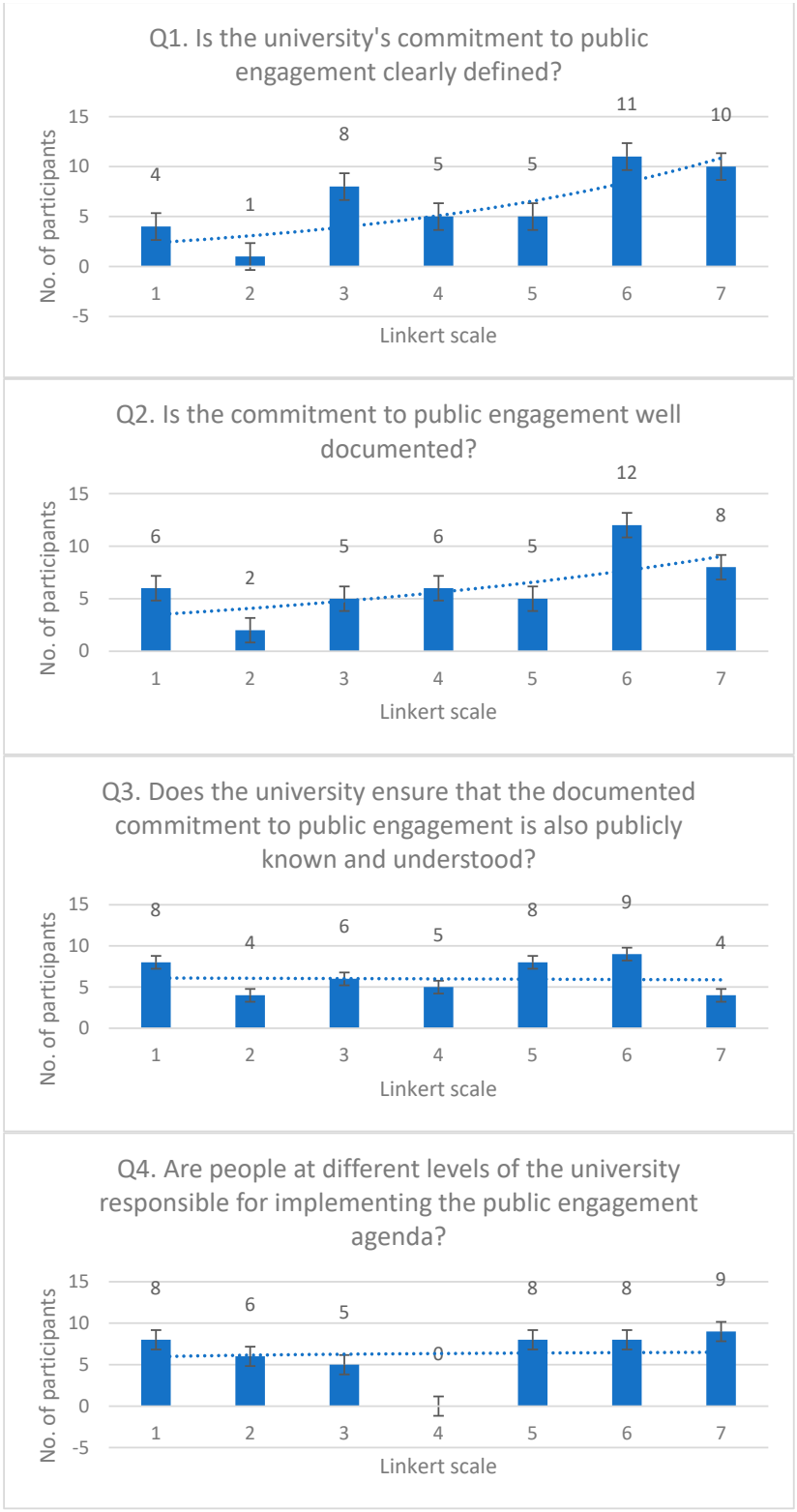
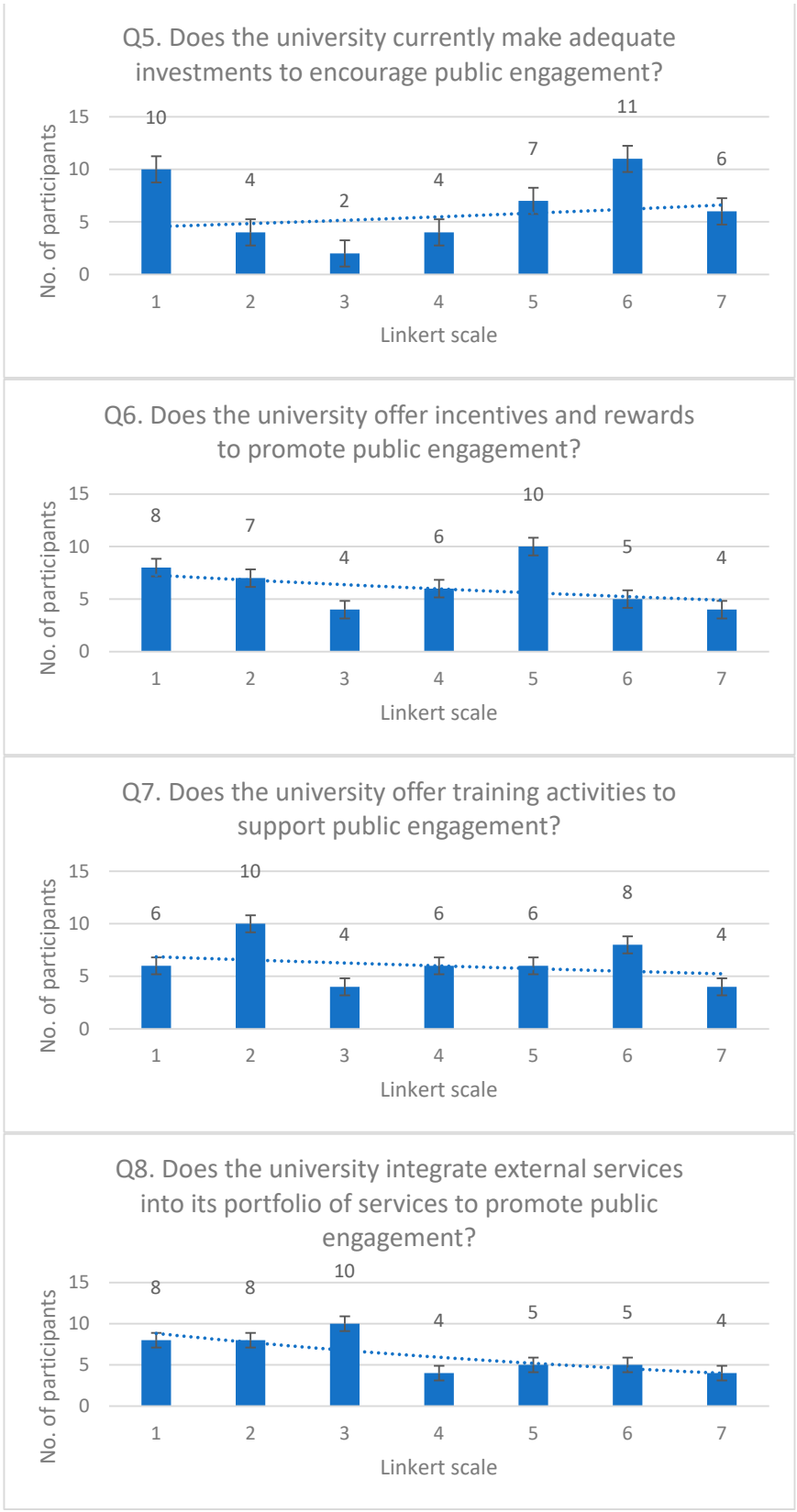


Figure A1. *Cont.*



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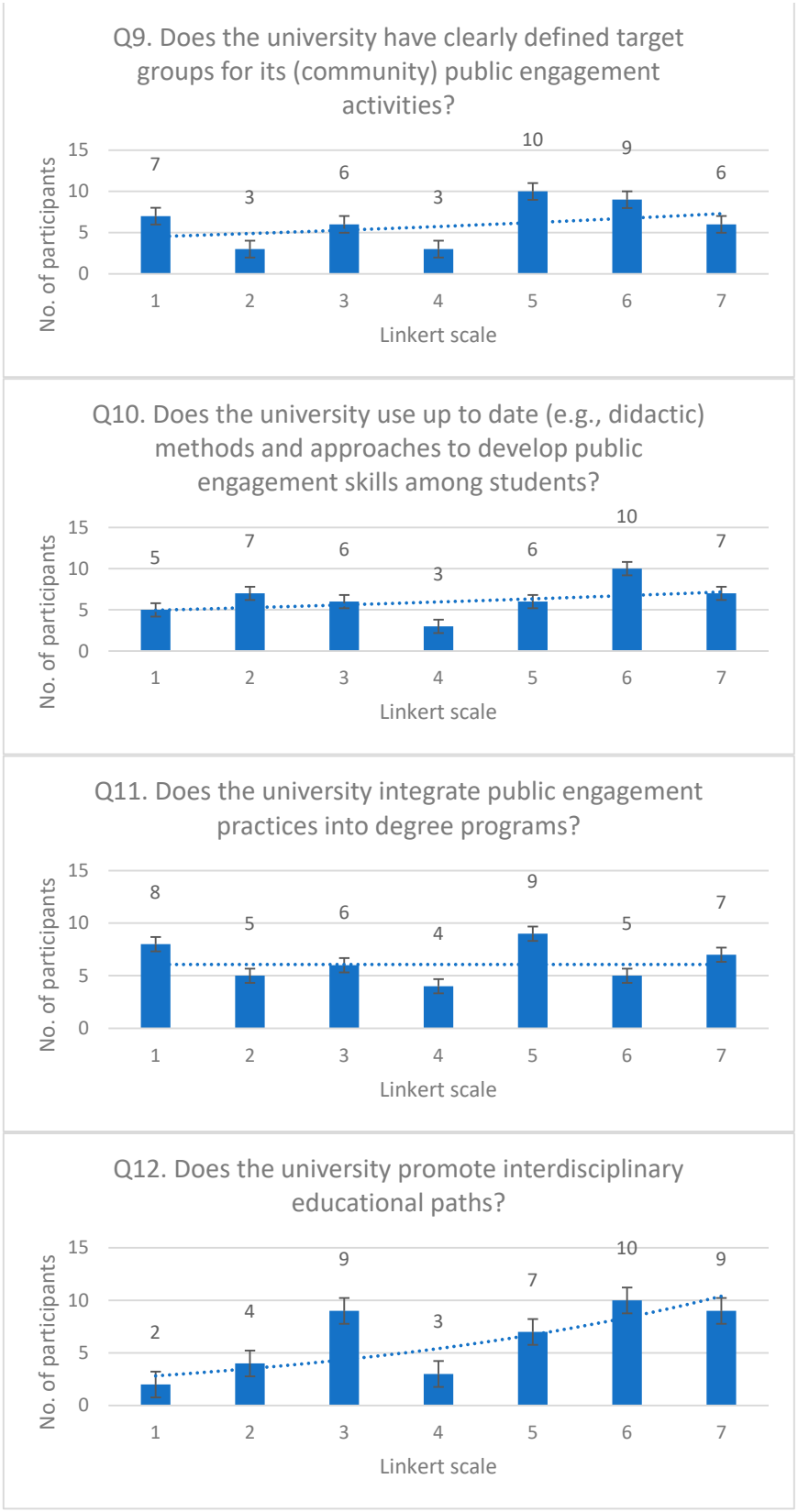

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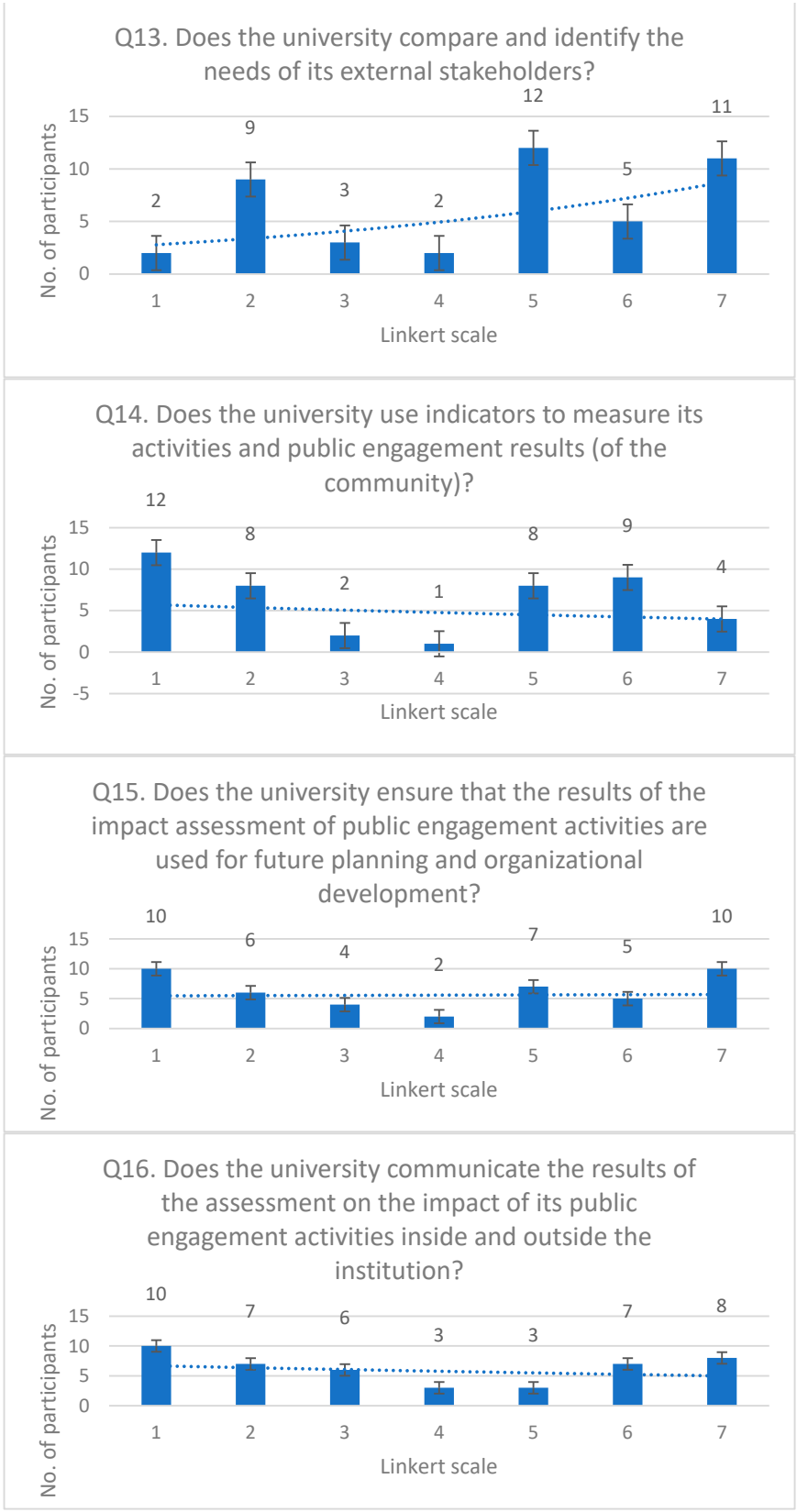

Figure A1. *Cont.*

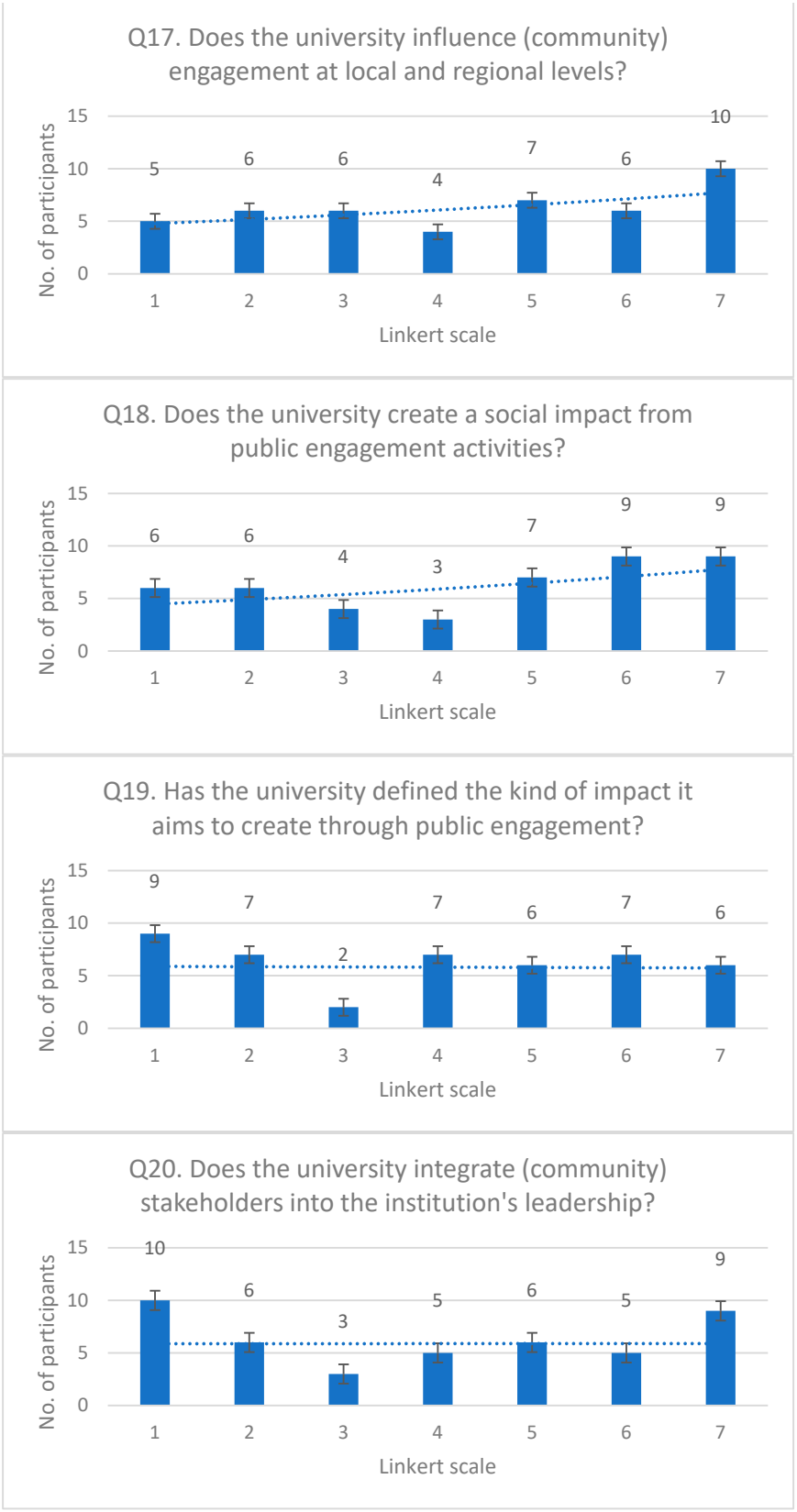

Figure A1. Results for the 20 items within TENACITY project.

Appendix B

Table A1. Shapiro–Wilk test applied to calculate the statistic (W) and the *p*-value for each of the 20 questions from the survey in Germany, Greece and Lithuania.

Question	Germany			Greece			Lithuania		
	W	***p*-Value**	**Normality**	**W**	***p*-Value**	**Normality**	**W**	***p*-Value**	**Normality**
Q1	0.629776	0.001241	No	0.94817	0.532673	Yes	0.860379	0.261574	Yes
Q2	0.944664	0.682961	Yes	0.958862	0.704304	Yes	0.91099	0.487663	Yes
Q3	0.849402	0.224231	Yes	0.899812	0.112078	Yes	0.971374	0.849971	Yes
Q4	0.790653	0.086487	Yes	0.881089	0.060231	Yes	0.848079	0.219999	Yes
Q5	0.944664	0.682961	Yes	0.819258	0.008724	No	0.894945	0.406387	Yes
Q6	0.91099	0.487662	Yes	0.881597	0.061244	Yes	0.839702	0.194534	Yes
Q7	0.863369	0.272453	Yes	0.859002	0.029495	No	0.963072	0.798227	Yes
Q8	0.849402	0.224231	Yes	0.909098	0.152901	Yes	0.839702	0.194534	Yes
Q9	0.992912	0.971877	Yes	0.845529	0.019323	No	0.992912	0.971878	Yes
Q10	0.827427	0.161191	Yes	0.876281	0.051458	Yes	0.743573	0.033567	No
Q11	0.629776	0.001241	No	0.934432	0.35164	Yes	0.863369	0.272453	Yes
Q12	0.800563	0.103233	Yes	0.760175	0.001673	No	0.629776	0.001241	No
Q13	0.93927	0.649878	Yes	0.904935	0.133024	Yes	0.848079	0.219999	Yes
Q14	0.949706	0.714281	Yes	0.844588	0.018768	No	0.772907	0.061847	Yes
Q15	0.827427	0.161191	Yes	0.857627	0.028237	No	0.763479	0.051229	Yes
Q16	0.998396	0.995064	Yes	0.832679	0.013032	No	0.886912	0.369	Yes
Q17	0.863369	0.272453	Yes	0.853856	0.025066	No	0.949706	0.714281	Yes
Q18	0.944664	0.682961	Yes	0.900759	0.11568	Yes	0.949706	0.714281	Yes
Q19	0.894945	0.406388	Yes	0.877539	0.053617	Yes	0.927082	0.577355	Yes
Q20	0.927082	0.577355	Yes	0.856535	0.027278	No	0.629776	0.001241	No

Table A2. Shapiro–Wilk test applied to calculate the statistic (W) and the *p*-value for each of the 20 questions from the survey in Romania, Spain, Sweden.

Question	Romania			Spain			Sweden		
	W	***p*-Value**	**Normality**	**W**	***p*-Value**	**Normality**	**W**	***p*-Value**	**Normality**
Q1	0.858486	0.146728	Yes	0.774708	0.022823	No	0.971374	0.849971	Yes
Q2	0.858486	0.146728	Yes	0.813434	0.055481	Yes	0.949706	0.714281	Yes
Q3	0.867412	0.176171	Yes	0.932528	0.572603	Yes	0.91099	0.487662	Yes
Q4	0.846302	0.113659	Yes	0.784353	0.028585	No	0.894945	0.406387	Yes
Q5	0.853883	0.133334	Yes	0.909711	0.393876	Yes	0.763479	0.051229	Yes
Q6	0.929357	0.545445	Yes	0.926057	0.517886	Yes	0.949706	0.714281	Yes
Q7	0.921579	0.481756	Yes	0.83571	0.090587	Yes	0.800563	0.103233	Yes
Q8	0.910662	0.400475	Yes	0.879977	0.226348	Yes	0.728634	0.023857	No
Q9	0.670536	0.001752	No	0.911128	0.403738	Yes	0.971374	0.849971	Yes
Q10	0.719758	0.006067	No	0.955536	0.77965	Yes	0.882072	0.34756	Yes
Q11	0.863961	0.164219	Yes	0.846302	0.113659	Yes	0.963072	0.798227	Yes

Table A2. *Cont.*

Question	Romania			Spain			Sweden		
	W	***p*-Value**	**Normality**	**W**	***p*-Value**	**Normality**	**W**	***p*-Value**	**Normality**
Q12	0.840044	0.099451	Yes	0.907051	0.375833	Yes	0.882072	0.34756	Yes
Q13	0.856091	0.139616	Yes	0.862486	0.159333	Yes	0.827427	0.16119	Yes
Q14	0.871193	0.190135	Yes	0.874451	0.202933	Yes	0.743573	0.033567	No
Q15	0.870328	0.186858	Yes	0.863961	0.164219	Yes	0.798526	0.099603	Yes
Q16	0.863225	0.161763	Yes	0.812736	0.054621	Yes	0.882072	0.34756	Yes
Q17	0.934584	0.590524	Yes	0.90903	0.389195	Yes	0.963072	0.798227	Yes
Q18	0.834969	0.089147	Yes	0.945253	0.686389	Yes	0.882072	0.34756	Yes
Q19	0.824948	0.071632	Yes	0.931918	0.567328	Yes	0.863369	0.272453	Yes
Q20	0.791718	0.033888	No	0.965365	0.863218	Yes	0.839702	0.194534	Yes

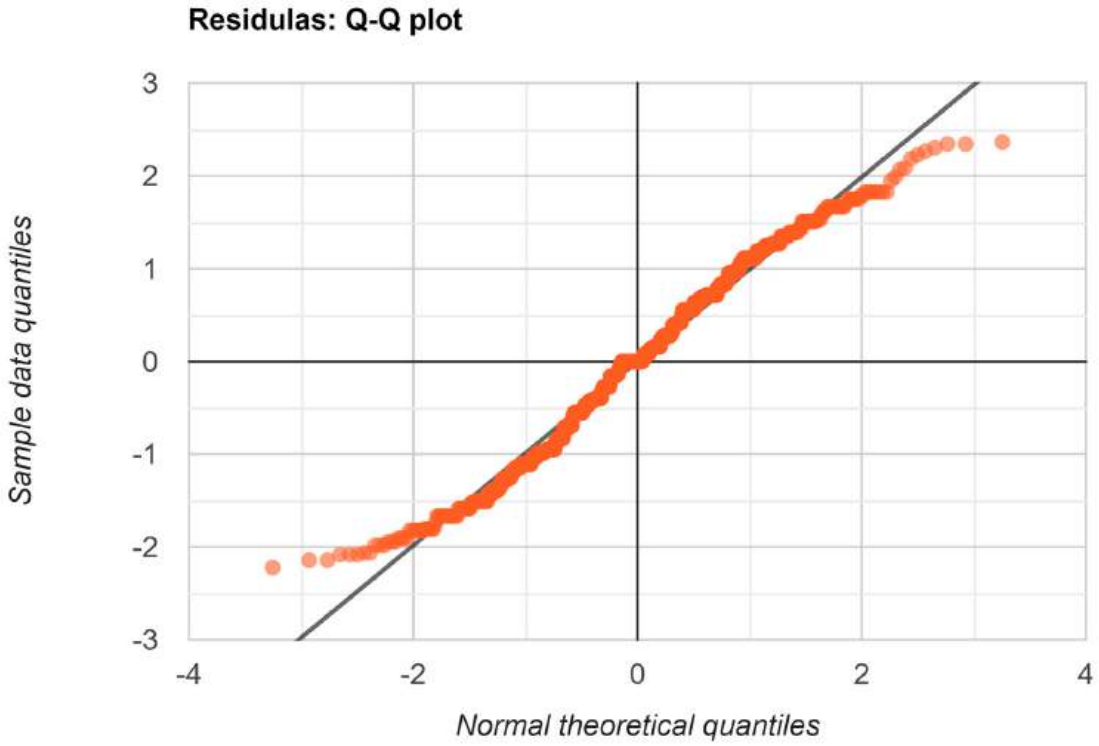

Figure A2. Q-Q plot of residuals.

Appendix C

Table A3. Levene's test for validation of homogeneity of variances for 20 questions of the survey (*p*-value > 0.05).

	Spain	**Romania**	**Italy**	**Sweden**	**Greece**	**Germany**	**Lithuania**	**Overall**	**Levene's Test Statistic**	**Levene's Test *p*-Value**	**Homogeneity**
Q1	2.952381	6.619048	0.500000	2.916667	2.131868	0.250000	6.000000	3.721254	1.640097	0.165415	Yes
Q2	2.571429	6.619048	0.000000	3.333333	3.362637	0.666667	5.666667	3.942509	1.725253	0.144158	Yes
Q3	2.666667	6.238095	0.000000	5.666667	3.412088	2.250000	2.916667	3.997677	1.058790	0.405442	Yes

Table A3. *Cont.*

	Spain	Romania	Italy	Sweden	Greece	Germany	Lithuania	Overall	Levene's Test Statistic	Levene's Test *p*-Value	Homogeneity
Q4	8.333333	6.666667	0.500000	6.333333	3.494505	3.583333	5.583333	5.027294	0.754531	0.610160	Yes
Q5	5.904762	4.476190	0.500000	5.666667	3.758242	0.666667	1.583333	4.840883	0.829477	0.555211	Yes
Q6	5.238095	2.904762	0.500000	3.333333	2.835165	5.666667	3.000000	3.865273	0.768821	0.599509	Yes
Q7	4.238095	4.952381	2.000000	4.916667	2.527473	0.916667	4.916667	3.930314	0.367364	0.894622	Yes
Q8	4.571429	5.285714	2.000000	8.333333	1.346154	2.250000	3.000000	3.816492	2.286003	0.057563	Yes
Q9	3.619048	2.904762	0.000000	2.916667	3.609890	1.666667	6.666667	3.983740	1.494975	0.208598	Yes
Q10	4.000000	1.810000	0.500000	8.667000	2.951000	2.000000	8.250000	4.063000	1.023930	0.426171	Yes
Q11	6.670000	5.570000	0.500000	4.920000	3.450000	4.000000	8.250000	4.320000	0.614851	0.716864	Yes
Q12	3.905000	1.905000	0.500000	8.667000	2.374000	4.917000	6.250000	3.503000	0.533000	0.884000	Yes
Q13	3.619000	2.905000	2.000000	2.000000	3.346000	7.583000	5.583000	4.007000	0.604000	0.725000	Yes
Q14	6.238000	6.952000	0.000000	4.667000	6.527000	2.333000	8.333000	5.928000	0.559000	0.784000	Yes
Q15	5.571429	5.285714	0.500000	10.250000	4.686813	2.000000	5.666667	5.292102	0.781004	0.590487	Yes
Q16	5.238100	6.904800	8.000000	8.666700	4.131900	4.333300	6.916700	5.356600	0.403400	0.871700	Yes
Q17	5.619048	2.238095	2.000000	4.916667	3.456044	0.916667	3.333333	4.192799	0.622752	0.710774	Yes
Q18	4.570000	5.810000	2.000000	8.670000	4.070000	0.670000	3.330000	4.670000	0.864975	0.530078	Yes
Q19	3.571429	5.238095	2.000000	8.250000	3.719780	1.583333	4.666667	4.527294	0.395607	0.876791	Yes
Q20	4.476190	7.476190	0.000000	3.000000	3.719780	4.666667	2.250000	4.987224	1.096671	0.383788	Yes

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Evaluating the Sustainable Development Goals in higher education institutions using Multi-Criteria Decision Making/Analysis: calculating the weights of criteria with the Analytic Hierarchy Process

Maria Kaloutsa, Katerina Kabassi & Aristotelis Martinis

To cite this article: Maria Kaloutsa, Katerina Kabassi & Aristotelis Martinis (2025) Evaluating the Sustainable Development Goals in higher education institutions using Multi-Criteria Decision Making/Analysis: calculating the weights of criteria with the Analytic Hierarchy Process, Sustainability: Science, Practice and Policy, 21:1, 2475592, DOI: 10.1080/15487733.2025.2475592

To link to this article: https://doi.org/10.1080/15487733.2025.2475592

Published online: 08 Apr 2025.

SUSTAINABILITY: SCIENCE, PRACTICE AND POLICY
2025, VOL. 21, NO. 1, 2475592
https://doi.org/10.1080/15487733.2025.2475592

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RESEARCH ARTICLE

Evaluating the Sustainable Development Goals in higher education institutions using Multi-Criteria Decision Making/Analysis: calculating the weights of criteria with the Analytic Hierarchy Process

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ABSTRACT

The world is striving to achieve the 17 Sustainable Development Goals (SDGs) set by the United Nations General Assembly in 2015 to tackle poverty, inequality, and climate change, by 2030. The 2024 SDG Report and the 2023 Global Sustainable Development Report call for urgent, science-based transformations and stronger leadership, as current progress remains insufficient. Higher education institutions (HEIs) play a critical role in advancing these goals through research, education, and partnerships. Integrating SDGs into HEIs' operations, curricula, and research agendas strengthens their commitment to sustainability, enhances innovation, and education. By preparing students to address complex global challenges, HEIs contribute to societal transformation and equip future generations with the knowledge and skills needed to drive sustainable development. To effectively evaluate the progress of HEIs toward the SDGs, we propose a structured approach using Multi-Criteria Decision Making (MCDM) through the Analytic Hierarchy Process (AHP). This approach identifies and weights 34 key indicators relevant to assessing a university's contribution to the SDGs. These AHP indicators – based on the 247 SDG indicators outlined in Agenda 2030 – vary in significance when evaluating university initiatives. Through pairwise comparisons, the AHP method assigns different weights to these indicators, acknowledging that they do not all hold equal importance. We classified the SDGs into four groups based on the weights assigned to the 34 AHP indicators, with the PriEst software used to ensure objective calculations. The application of AHP provides a clear, structured framework for assessing the progress of HEIs in embracing the SDGs and facilitating future evaluations and improvements.

ARTICLE HISTORY
Received 24 June 2024
Accepted 2 March 2025

KEYWORDS
Sustainable Development Goals; university; indicators; assessment tools; MCDM/A; AHP

Introduction

Since the early 1970s, administrators, faculty, and students within higher education institutions (HEIs) have increasingly recognized their role in fostering environmental sustainability, sustainable development, and community engagement (Angelaki et al. 2024; Berchin, de Aguiar Dutra, and Guerra 2021; Leal Filho et al. 2024; Viera Trevisan, Leal Filho, and Ávila Pedrozo 2024). This acknowledgment traces back to seminal events such as the 1972 United Nations Conference in Stockholm (Brundtland 1987), which underscored the pivotal role of education in environmental protection and conservation. Since then, various declarations, charters, and initiatives have emerged, emphasizing the importance of integrating sustainability principles into the fabric of HEIs (Berchin et al. 2018; Lozano et al. 2013; Leal Filho et al. 2019; Sylvestre, McNeil, and Wright 2013).

The SDGs play an important role in HEIs for several reasons. Knowledge creation, dissemination, and innovation are central functions of HEIs (Knight 2024; Spânu, Ulmeanu, and Doicin 2024), making them instrumental in advancing SDGs through education, research, and partnerships. Poverty, inequality, and climate change can be tackled through research agendas that produce solutions promoting sustainable development through innovative technologies, policies, and practices that foster environmental sustainability, social equity, and economic prosperity (Ammar et al. 2023; Alegre, Berbegal-Mirabent, and Martin-Sanchez 2025; Husic 2024; Kaweesi 2024). Universities' contribution to addressing global challenges for the common good aligns with the missions and values of many of these institutions (de Villiers, Dimes, and Molinari 2024; Hopkins et al. 2024; Mokski et al. 2023; Serafini et al. 2022). Moreover, HEIs educate the future generations that will address real-world challenges. By integrating the SDGs into curricula, research projects, community engagement, and operations, HEIs foster awareness,

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This article has been corrected with minor changes. These changes do not impact the academic content of the article.

critical thinking, and practical skills among students, equipping them to meet these challenges (Eichberg and Charles 2024; Leal Filho et al. 2023, 2024; López 2022).

There is a growing body of literature exploring how universities integrate the SDGs into their operations (Ashida 2022; Chankseliani, Qoraboyev, and Gimranova 2021; Caputo, Ligorio, and Pizzi 2021; Fia, Ghasemzadeh, and Paletta 2022; Serafini et al.2022). HEIs are embedding the SDGs into their curricula, research, and partnerships (Avelar, da Silva Oliveira, and Farina 2023), with academic staff and students leading transformative strategies to foster innovation in sustainability (de Assumpção and Neto 2020). For example, the performance of signatory business schools and HEIs in addressing the SDGs – through curriculum revisions, research initiatives, partnerships, and institutional management – provides valuable insights into the effectiveness of SDG mainstreaming (Albareda-Tiana, Vidal-Raméntol, and Fernández-Morilla 2018). A notable example of student contributions is the so-called University Rebellion in the Netherlands, which consists of students, university staff, and academics. Activists associated with the group challenge universities to act according to their responsibilities, holding them accountable by organizing and coordinating decentralized actions against failing university policy. More specifically, the movement calls on universities to act on the climate and ecological crises and their corresponding social injustices.[1] Another example is End Fossil, which calls on students to build alliances with other parts of the climate and social justice movement so that together, they can mobilize everyone to take radical action to end the fossil economy. At the University of Barcelona, this has led to a push for curriculum change.[2]

In addition to education and research, HEIs are connected to local communities and collaborate with various stakeholders to address social, economic, and environmental issues (Chankseliani, Qoraboyev, and Gimranova 2021). Universities form partnerships to bring together expertise and resources to advance the SDGs by engaging in community initiatives, outreach programs, and policy advocacy for inclusive and sustainable development (Eichberg and Charles 2024; Leal Filho et al. 2021; Sachs et al. 2018). Furthermore, large and small campuses alike have notable environmental, social, and economic impacts. Through sustainable practices in their operations, such as energy-efficiency upgrades and waste-reduction programs, universities can minimize their carbon footprint and promote responsible consumption (Anthony 2021; Longoria et al. 2021), thus giving students and staff a real-world example that living with sustainability principles is attainable. By setting a practical example of sustainability, HEIs have the potential to influence their community's views on sustainability matters while fulfilling their educational mission.

Evaluating sustainability in universities has become increasingly important, as HEIs play a critical role in addressing global challenges. There are several rankings to evaluate sustainability in universities (Martinis, Kaloutsa, and Kabassi 2024), yet one of the main traits of the Times Higher Education Impact Rankings (THE–IR)[3] is that this scorecard measures university performance against the SDGs, which were launched by the United Nations in 2015. The SDGs represent the only comprehensive and globally agreed approach for addressing the multifaceted challenges of sustainability, providing a unified blueprint for action.

While valuable for benchmarking university efforts toward the SDGs, these rankings can be criticized on several grounds. One major issue is the limited ability of the scoring to account for diverse local contexts and the varying resource availabilities across HEIs worldwide (Bautista-Puig, Orduña-Malea, and Perez-Esparrells 2022; Calderon 2023; De la Poza et al. 2021; Galleli et al. 2022). Many universities, especially in developing countries, face constraints in resources, infrastructure, and support systems, making it difficult to fairly compare their sustainability efforts with institutions in wealthier regions. Furthermore, the THE-IR rankings rely heavily on self-reported data, which may not always be verified, raising questions about the accuracy and transparency of the reported results (Calderon 2023). Additionally, these metrics often prioritize quantitative metrics over qualitative insights, failing to capture the holistic and context-specific impacts of universities on local communities and global challenges (Bautista-Puig, Orduña-Malea, and Perez-Esparrells 2022). For instance, initiatives that prioritize long-term community engagement or that address locally relevant sustainability issues might be overlooked or underrepresented in the rankings.

Additionally, THE-IR rankings, like similar frameworks such as the QS Rankings,[4] adopt a one-size-fits-all approach, which neglects the nuanced and multi-dimensional nature of sustainability in different HEIs. While these metrics provide an essential global perspective, they may not reflect the individual strategic goals of universities or their unique approaches to SDG implementation (Albareda-Tiana, Vidal-Raméntol, and Fernández-Morilla 2018). As more HEIs engage in reporting and publishing their contributions toward the SDGs (IAU 2023), it becomes clear that a more refined and context-sensitive

evaluation approach is required to capture the complexities of their sustainability efforts.

To overcome the limitations of current ranking systems like the THE-IR, we need a more adaptive evaluation framework, one that offers more flexibility, accounts for institutional differences, and integrates both quantitative and qualitative factors.

To effectively assess progress toward the SDGs, universities require structured and reliable methods. Multi-Criteria Decision-Making/Analysis (MCDM/A) has emerged as a robust approach for evaluating complex sustainability goals across different contexts. This methodology provides a structured approach that decision-makers can use to systematically weigh various sustainability indicators, balancing economic, social, and environmental factors. The method's suitability for SDG evaluation has been confirmed by studies that highlight its ability to integrate diverse criteria and stakeholders' values into sustainability assessments (Munda 2005; Sousa, Almeida, and Calili 2021). This systematic approach supports more informed and transparent decision-making, making it particularly relevant for evaluating HEI contributions to SDGs. Furthermore, MCDM/A is recognized for its ability to handle conflicting objectives, a common challenge in sustainability efforts, providing a balanced assessment of university progress (Turskis and Keršulienė 2024; Ren 2020).

In response to these challenges, this article presents a set of tailored indicators specifically designed for evaluating university actions toward the SDGs. While the 231 global SDG indicators serve as a comprehensive framework for assessing progress at the national and international levels, the indicators used in this study focus on aspects most relevant to the higher education context. These include metrics related to curricula, research output, partnerships, community engagement, campus operations, and institutional management.

This study primarily employs MCDM/A to determine the relative importance of each indicator. More specifically, we present a tool based on the Analytic Hierarchy Process (AHP), originating from the Greek context, for evaluating university actions toward the SDGs, serving as both a measurement mechanism and a catalyst for ongoing improvement. By identifying indicators that are objective and applicable yet adaptable to local contexts, this tool aspires to simplify sustainability assessments. While these indicators have been tested within the specific context of Greek higher education, they are designed with the flexibility to be applied in similar educational environments in other countries. Although we acknowledge that the indicators are not universally applicable in every context, they offer the potential to be relevant across multiple nations with comparable educational systems and sustainability challenges. This adaptability allows the tool to maintain its international perspective while ensuring it can be tailored to the unique realities of different HEIs, offering a balanced approach to assessing progress toward the SDGs.

This approach identifies and weights 34 key indicators relevant to assessing a university's contribution to the SDGs. These proposed indicators are based on the 231 SDG indicators and have received different weights of significance through pairwise comparison. By incorporating expert opinions and employing systematic decision-making frameworks, AHP offers a structured approach for navigating the complexities of sustainability assessment in HEIs and estimating the weight of importance of each indicator in the assessment of SDGs by the university.

The following section presents the AHP method that is employed in the following sections for weighting the indicators. In the third section, we present the AHP goal hierarchy for a specific domain and, in the fourth section, we outline the AHP stages for calculating the weights of the indicators along with the results of the AHP application. The fifth section analyzes the results, and the article concludes with some recommendations for research.

Analytic Hierarchy Process

MCDM/A has undergone rapid evolution over the past few decades owing to advancements in computational technologies, increased recognition of the complexity of decision-making processes, and growing demand for more sophisticated tools to address multifaceted decision problems (Sahoo and Goswami 2023; Zopounidis 2009). MCDM/A theories aim to create decision-making assistance instruments and procedures to address intricate decision-making challenges involving multiple parameters, aims, and contradictory objectives (Taherdoost and Madanchian 2023; Zopounidis and Doumpos 2000).

Several methods of MCDM/A, including AHP, Fuzzy AHP, Data Envelopment Analysis (DEA), and Multi-Attribute Utility Theory, offer diverse strategies for identifying goals and alternative weights (Beaudrie et al. 2021; Mohamadali and Garibaldi 2011). Among these approaches, AHP is one of the most prevalent (Saaty 1980; Tavana et al. 2023) and is favored for its formal approach to quantifying the qualitative criteria of alternatives, thus reducing partiality in the outcomes (Dodevska et al. 2023). Its capability to render judgments through pairwise comparisons of uncertain factors (both qualitative and quantitative) and to simulate expert viewpoints further enhances its appeal over other

options (Abughazalah, Khan, and Iqbal 2024; Mulubrhan, Mokhtar, and Muhammad 2014). Pairwise comparisons are central to preference modeling in AHP, as they provide a systematic means to assess priorities by comparing elements two at a time, ensuring impartiality. This makes AHP especially useful when multiple experts are involved in evaluating complex decisions (Abughazalah, Khan, and Iqbal 2024; Mulubrhan, Mokhtar, and Muhammad 2014). The pairwise comparison process facilitates decision-making through consensus by allowing experts to assign relative importance to criteria and alternatives, ultimately deriving an unbiased and well-structured solution.

The application of AHP typically involves several stages, as outlined below (Ho and Ma 2018; Zhu and Dale 2000).

1. Establishing a goal hierarchy: In this stage, the overall objective, criteria, and decision options are organized in a hierarchical format. Upon breaking down the problem into a hierarchy, the options at each level are compared in pairs to determine their relative preference for each criterion at a higher level.
1. Defining the overall objective: This substage involves defining the overarching objective.
2. Establishing the criteria set: Criteria may vary significantly depending on the evaluation method and field. In this substage, a study with the participation of experts is proposed, in which the criteria set is formed based on the views of the experts. The criteria are outlined in the following section.
3. Identifying alternatives for evaluation: The final selection of alternatives for assessment is determined during this substage
4. Structure the hierarchy: In this substage, a hierarchical framework is developed to enable the pairing of criteria and alternatives.
5. Setting up a pairwise comparison matrix of criteria: Criteria are compared at the same level using a comparison matrix. During the comparison procedure, a value from the scale, denoted as V, is initially assigned to the comparison of two elements, P and Q. Subsequently, the comparison value of Q and P is the reciprocal of V, that is, 1/V. The comparison values for P and P were 1. For instance, if the evaluation experiment comprises two levels of criteria, the criteria of each level are compared separately (e.g., Li 2015; Qunli and Xiaoge 2010; Wang and Wang 2012).
6. Calculating the criteria weights: After conducting the pairwise comparisons, the next stage is to calculate the weights of the criteria. This process involves deriving the principal eigenvalue and its corresponding normalized right eigenvector from the comparison matrix. The elements of this eigenvector represent the relative weights of the criteria or subcriteria.
1. Estimating the weights: Using the normalized eigenvector, the weights of the criteria are calculated, representing their relative importance in the decision-making process.
2. Using software tools: To simplify the calculation process, we employed the "Priority Estimation Tool "(PriEst) (Siraj, Mikhailov, and Keane 2015), an open-source decision-making software that implements AHP to compute the necessary weights and criteria rankings.
3. Rank alternatives: In this stage, the criteria and the weights of criteria defined in the previous stages are used to rank alternatives. This stage may be implemented using AHP or another MCDM/A theory.

The stages for the identification (Substage 1.3) and evaluation (Stage 4) of the alternatives are beyond the scope of this article, which mainly focuses on estimation of the weights of the criteria and, therefore, are omitted. For Substage 1.3 and Stage 4, various MCDM/A methods can be applied, for example, the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) (Behzadian et al. 2012; Hwang and Yoon 1981) or Simple Additive Weighting (SAW) (Hwang and Yoon 1981; Kaliszewski and Podkopaev 2016).

Analytic Hierarchy Process: establishing a goal hierarchy

In the previous section, we outlined how the AHP provides a structured approach to decision-making by breaking down complex problems into a hierarchy of simpler components. This section focuses on the first stage of AHP described above, namely establishing a goal hierarchy. This stage serves as the foundation for applying AHP and involves defining the overall objective and establishing the criteria[5] for evaluating the progress of universities toward implementing the SDGs.

Defining the overall objective

The primary aim is to evaluate how universities have implemented the SDGs.

Establishing the criteria set

We conducted a literature review, which is outlined in detail in Martinis, Kaloutsa, and Kabassi (2024). This review included both desk research and

systematic analysis of various academic tools to measure sustainability in HEIs. The review focused on keywords such as "university," "sustainability," indicators," and "assessment tools," with searches conducted in Google Scholar and Scopus databases.

Through this process, we identified 59 assessment tools developed between 1993 and 2019, most of which predominantly focused on the environmental aspects of sustainability. After narrowing the scope to the period 2015–2023, following the launch of Agenda 2030, the review found that only one ranking tool, the THE–IR, implemented in 2019, specifically addresses SDG implementation in HEIs.

To further refine the selection of indicators, we recruited a group of three experts with over 20 years of experience in sustainability. They applied the principles of completeness, operationality, nonredundancy, and minimality to the indicators used by the THE–IR with the primary goal of identifying suitable indicators for a new approach without compromising the quality and considering the local context. This process resulted in the selection of 34 indicators that were categorized under the 17 SDGs, avoiding duplications. The entire process, including how the indicators were aligned with the 17 SDGs and tailored to the local context, is described in detail in Martinis, Kaloutsa, and Kabassi (2024).

We reviewed the final set of indicators and aligned them with the 17 SDGs to ensure comprehensive coverage of sustainability objectives. Additionally, relevant national legislation was considered to adapt the framework to the specific needs and context of HEIs. We took the Greek context, as reflected in the relevant legislation for HEIs, into account. For instance, higher education in Greece is tuition-free, making certain indicators from the THE–IR – such as "the proportion of students receiving financial aid due to poverty" – irrelevant to the Greek context.

While the selected indicators cover a wide range of sustainability dimensions, we acknowledge the limitations of this set of criteria. Although the indicators aim to encompass the major areas outlined by the SDGs, some goals and targets may not be fully represented. For example, the emphasis on campus operations such as energy efficiency and waste reduction may lead to the underrepresentation of broader contributions in areas like education, research, and community engagement.

Another limitation is the local focus on the Greek context, as national legislation and practices were considered in the selection process, and this factor may constrain the applicability of the indicators to institutions in other countries. To improve universality, it will be essential to test and adapt the indicator set in diverse institutional and national contexts.

Future studies should address these limitations by expanding the scope of the indicators and considering additional sustainability dimensions, particularly in education and research. Before applying this model in broader studies, the authors plan to review and refine the indicator set to ensure a more comprehensive evaluation of the sustainability efforts of HEIs (see Figure 1).[6]

Calculating the weights of the criteria

In the previous section, the goal hierarchy was established, identifying the criteria and sub-criteria for evaluating the alignment of universities with the SDGs. This section focuses on the next stage: calculating the relative importance or weights of the criteria. The calculation of weights is crucial in applying the AHP methodology, as it enables a structured prioritization of sustainability indicators.

To calculate the weights of the criteria, we established a pairwise comparison matrix. This process involved collecting data that reflected the relative importance of each criterion through pairwise comparisons and expert interviews. In this study, experts were consulted to evaluate the criteria and sub-criteria, using the pairwise comparison method to assign importance levels between them. We then used the data collected from these interviews to calculate the final weights of each criterion, allowing for a structured and objective prioritization within the AHP framework. The experts conducted pairwise comparisons of the criteria using a nine-point scale as proposed by Saaty (1980), and these comparisons allowed the evaluators to assess the importance of one criterion relative to another, which is essential for establishing a hierarchical structure of criteria.

The expert panel and the pairwise comparison process

For this study, we selected ten experts to conduct the pairwise comparisons, and they simultaneously met the following qualifications: having professional experience in the university area and more than 30 years of professional experience in both sustainability matters and professional administrative experience at the university. Their expertise ranged from energy matters to environmental projects and cultural projects.

The selected professionals represented a diverse range of expertise within academia, particularly in fields related to engineering, environmental science, conservation, and administration. They held positions ranging from professors to deans, deputy directors, and vice-rectors to rectors. Their positions in

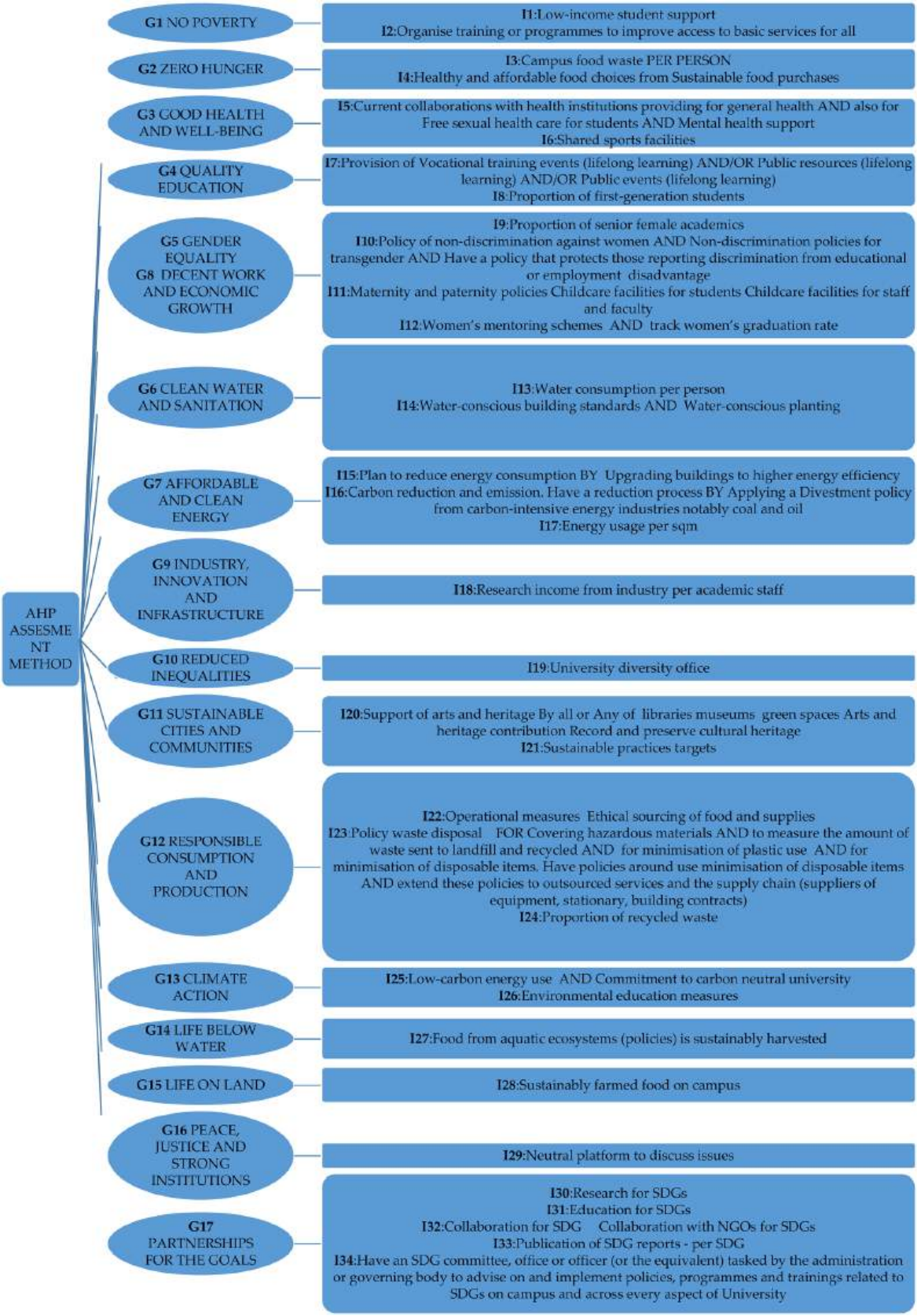

Figure 1. The final indicators for evaluating HEIs.
Note: Adapted from Martinis, Kaloutsa, and Kabassi (2024).

the university indicate their significant experience and leadership roles within their respective departments, including mechanical engineering with a focus on energy systems, environmental protection, and optimization of production systems; electrical and electronic engineering with expertise in power electronics and renewable energy sources; conservation of antiquities and works of art and cultural heritage management; environmental management and sustainable development; and personalized software

technology with applications in environmental studies. These individuals collectively possessed extensive experience and demonstrated a deep understanding of the environmental, educational, and administrative domains. Their expertise extended beyond academia, with involvement in the consultancy and private and public sectors, reflecting their multidimensional contributions to their respective fields.

Given their extensive background, these evaluators aptly represented the prevalent practices and viewpoints of the Greek university sector. We tasked them with evaluating the criteria and assigning relative scales using the nine-point scale to determine the importance of criteria or sub-criteria within the AHP mode (Saaty 1980; Saaty and Vargas 1994).

Justification for the selection of ten evaluators

Typically, in the AHP process, a representative sample of three to seven (often five) evaluators is selected to assign relative scales, as supported by the literature and empirical observations. Research suggests that as the number of evaluators increases, the relative gains diminish and the complexity of collecting pairwise comparison judgments increases. For this study, however, ten evaluators were chosen to ensure that the criteria were assessed from a variety of perspectives, thereby enhancing the robustness of the evaluation process (Saaty 1994).

We asked each evaluator to compare the criteria using the nine-point scale, where a value of one indicates equal importance between two criteria, and values greater or less than one represent varying degrees of relative importance. Evaluators compared the criteria at each level of the hierarchy separately from those at the next, with the process repeated across all levels of the hierarchy. The pairwise comparisons were conducted through personal interviews, which were preferred over questionnaires due to their enhanced effectiveness in data collection.

This format provided an opportunity to clarify definitions and ensure that evaluators had a consistent understanding of the success factors being assessed within the AHP model. This method also minimized discrepancies that might arise from varying interpretations of the criteria.

Results: calculation of the criteria weights

Once we collected the pairwise comparisons, the PriEst software was employed to calculate the priority weights of the criteria (Siraj, Mikhailov, and Keane 2015). We computed the geometric mean of the pairwise comparisons to derive the final weights, which reflect the relative importance assigned to each criterion. This approach also ensured consistency across the evaluations, as it aggregated the judgments from all ten experts.

We checked the consistency of the comparisons using the consistency ratio (CR), with a threshold of 0.10 being considered acceptable (Saaty 1980). In this study, the consistency ratios for all matrices were well within this threshold, confirming the reliability of the expert judgments.

Explanation of the tables and matrices

The results of the pairwise comparisons are presented in Tables 1–3 and they show the relative importance of each SDG indicator, as assessed by the experts. For example:

- A value of one in the table indicates that two criteria are equally important.
- A value greater than one means the criterion in the row is more important than the criterion in the column.
- A value less than one indicates that the criterion in the row is less important than the criterion in the column.

Table 1 presents the typical sample of a pairwise comparison matrix, while Table 2 displays the pairwise comparison average values from the expert evaluations. Note that in both of these tables, diagonally, the value is always one, as each criterion is compared to itself, while in every other cell, the values differ, showing the relative importance of one criterion to the other. The color coding in the tables is included for ease of visualization and does not carry further significance.

The weight of importance of each indication, as estimated by the application of AHP, is displayed in Table 3. We employed the geometric mean (GM) approach, as advocated by Saaty (1980), to combine the pairwise comparison judgment matrices from each evaluator. The normalized weights, along with the overall consistency ratios of the pairwise comparison judgment matrices (both individual and combined), were within the recommended threshold of 0.10, ensuring robustness in the analysis. It is worth noting that using the geometric mean instead of the eigenvector method in AHP for criteria calculation can yield slightly different results. However, the disparity in this instance was minimal and did not alter the main findings.

Context-specific evaluation

It is important to note that the results of this study are context-specific to the Greek higher education

Table 1. Typical sample of pairwise evaluation of the indicators.

	1	2	3	4	5 & 8	6	7	9	10	11	12	13	14	15	16	17
SDG	No poverty	Zero hunger	Good health and well-being	Quality education	Gender equality & decent work and economic growth	Clean water and sanitation	Affordable and clean energy	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	Partnerships for the goals
1	1.00	1.00	2.00	0.11	0.20	0.14	0.14	0.14	3.00	0.25	2.00	0.50	3.00	3.00	3.00	1.00
2	1.00	1.00	2.00	0.11	0.20	0.14	0.14	0.14	3.00	0.25	2.00	0.50	3.00	3.00	3.00	1.00
3	0.50	0.50	1.00	0.25	1.00	3.00	1.00	1.00	3.00	1.00	2.00	1.00	3.00	3.00	3.00	1.00
4	9.00	9.00	4.00	1.00	5.00	5.00	3.00	3.00	9.00	7.00	3.00	9.00	9.00	9.00	9.00	1.00
5 & 8	5.00	5.00	1.00	0.20	1.00	0.20	0.20	0.50	1.00	0.20	0.20	1.00	1.00	1.00	1.00	1.00
6	7.00	7.00	0.33	0.20	5.00	1.00	2.00	2.00	6.00	6.00	7.00	7.00	7.00	7.00	7.00	1.00
7	7.00	7.00	1.00	0.33	5.00	0.50	1.00	3.00	5.00	3.00	3.00	2.00	3.00	1.00	5.00	1.00
9	7.00	7.00	1.00	0.33	2.00	0.50	0.33	1.00	2.00	0.25	3.00	1.00	1.00	1.00	3.00	1.00
10	0.33	0.33	0.33	0.11	1.00	0.17	0.20	0.50	1.00	0.50	3.00	1.00	1.00	1.00	1.00	1.00
11	4.00	4.00	1.00	0.14	5.00	0.17	0.33	4.00	2.00	1.00	2.00	1.00	1.00	1.00	3.00	1.00
12	0.50	0.50	0.50	0.33	5.00	0.14	0.33	0.33	0.33	0.50	1.00	3.00	3.00	3.00	2.00	1.00
13	0.33	0.33	0.33	0.11	1.00	0.14	0.33	1.00	1.00	1.00	0.33	1.00	1.00	1.00	1.00	1.00
14	2.00	2.00	1.00	0.11	1.00	0.14	0.50	1.00	1.00	1.00	0.33	1.00	1.00	1.00	1.00	1.00
15	0.33	0.33	0.33	0.11	1.00	0.14	1.00	1.00	1.00	1.00	0.33	1.00	1.00	1.00	1.00	1.00
16	0.33	0.33	0.33	0.11	1.00	0.14	0.20	0.33	1.00	0.33	0.50	1.00	1.00	1.00	1.00	1.00
17	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1,00

Table 2. Average values of pairwise evaluation of the indicators.

	1	2	3	4	5 & 8	6	7	9	10	11	12	13	14	15	16	17
SDG	No poverty	Zero hunger	Good health and well-being	Quality education	Gender equality & decent work and economic growth	Clean water and sanitation	Affordable and clean energy	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	Partnerships for the goals
1	1.00	1.11	0.59	0.44	1.15	1.40	0.65	0.77	1.29	1.13	1.65	0.75	2.17	1.66	0.65	1.03
2	0.90	1.00	0.82	0.45	0.61	1.61	0.65	1.64	1.04	1.03	1.28	0.88	2.50	2.25	0.76	0.81
3	1.69	1.22	1.00	0.52	1.55	2.30	1.29	2.11	1.81	2.23	2.03	1.19	2.60	2.40	0.90	1.86
4	2.28	2.22	1.91	1.00	4.75	5.55	5.10	5.80	5.15	5.60	5.60	4.80	6.35	6.25	3.93	3.00
5 & 8	0.87	1.65	0.65	0.21	1.00	3.17	2.84	3.62	1.92	3.43	3.90	2.30	3.63	3.58	2.12	1.55
6	0.72	0.62	0.43	0.18	0.32	1.00	0.90	1.71	1.35	1.38	1.89	1.81	2.93	2.35	1.95	2.59
7	1.55	1.53	0.78	0.20	0.35	1.12	1.00	1.55	2.02	1.68	1.53	1.32	2.65	2.33	2.15	2.18
9	1.29	0.61	0.47	0.17	0.28	0.58	0.65	1.00	0.77	0.81	1.30	1.14	2.09	2.27	1.87	1.57
10	0.77	0.96	0.55	0.19	0.52	0.74	0.50	1.30	1.00	1.53	2.30	1.83	2.85	2.75	1.11	1.36
11	0.89	0.98	0.45	0.18	0.29	0.72	0.59	1.24	0.66	1.00	1.85	1.08	2.48	2.08	1.61	1.64
12	0.60	0.78	0.49	0.18	0.26	0.53	0.66	0.77	0.43	0.54	1.00	1.00	2.23	2.40	1.25	1.26
13	1.33	1.14	0.84	0.21	0.43	0.55	0.76	0.88	0.55	0.93	1.01	1.00	2.90	2.20	1.34	2.04
14	0.46	0.40	0.38	0.16	0.28	0.34	0.38	0.48	0.35	0.40	0.45	0.34	1.00	1.03	0.44	0.84
15	0.60	0.44	0.42	0.16	0.28	0.43	0.43	0.44	0.36	0.48	0.42	0.45	0.97	1.00	0.43	0.86
16	1.53	1.31	1.11	0.25	0.47	0.51	0.47	0.54	0.90	0.62	0.80	0.75	2.29	2.33	1.00	1.81
17	0.98	1.23	0.54	0.33	0.65	0.39	0.46	0.64	0.74	0.61	0.80	0.49	1.19	1.17	0.55	1.00

Table 3. Final weights of the criteria derived from PriEst software.

SDG 1 No Poverty	0.054	I1	0.784
		I2	0.216
SDG 2 Zero Hunger	0.055	I3	0.580
		I4	0.420
SDG 3 Good Health and Well-Being	0.083	I5	0.663
		I6	0.337
SDG 4 Quality Education	0.210	I7	0.701
		I8	0.299
SDG 5+8 Gender Equality and Decent Work and Economic Growth[7]	0.099	I9	0.193
		I10	0.257
		I11	0.427
		I12	0.123
SDG 6 Clean Water and Sanitation	0.059	I13	0.552
		I14	0.448
SDG 7 Affordable and Clean Energy	0.068	I15	0.580
		I16	0.264
		I17	0.176
SDG 9 Industry, Innovation, and Infrastructure	0.046	I18	1.000
SDG 10 Reduced Inequalities	0.055	I19	1.000
SDG 11 Sustainable Cities and Communities	0.049	I20	0.465
		I21	0.535
SDG 12 Responsible Consumption and Production	0.039	I22	0.291
		I23	0.422
		I24	0.266
SDG 13 Climate Action	0.051	I25	0.589
		I26	0.411
SDG 14 Life Below Water	0.023	I27	1.000
SDG 15 Life on Land	0.025	I28	1.000
SDG 16 Peace, Justice, and Strong Institutions	0.047	I29	1.000
SDG 17 Partnerships for the Goals	0.037	I30	0.241
		I31	0.322
		I32	0.180
		I33	0.114
		I34	0.143

sector, as the specific criteria and weights reflect the priorities of Greek universities. This study serves as a test case for how these indicators can be applied within a national context. Future studies will test and adapt this model to other contexts, ensuring that the framework is flexible enough to accommodate different national and institutional settings so the method can be applied internationally.

Analyzing the priority weights

Analysis of priority weights across various SDGs reveals significant insights into focus areas and strategic priorities of universities (Table 4). After calculating the weights for each criterion and ranking them in descending order, natural breaks or gaps between groups of values became evident. These breaks helped distinguish the higher-priority SDGs from those with lower priority. Based on the distribution of the weights, four distinct clusters of SDGs emerged, each representing a different priority group.

The first high-priority goals group included only SDG 4 due to its high weight value of 0.210, which is significantly higher than the other values. The second group, medium-priority goals, included SDGs with values ranging from 0.091 to 0.054, covering in declining order SDG 5+8, SDG 6, SDG 2, SDG 10, and SDG 1. The third group, low-priority goals, includes SDGs with weights between 0.051 and 0.037. These are SDG 13, SDG 11, SDG 16, SDG 9, SDG 12, and SDG 17. Finally, the very low priority goals group holds SDG 15 and SDG 14, with weights of 0.023 and 0.025, respectively.

Table 4. Priority weights.

SDG	Weight	Priority
SDG 4 Quality Education	0.21	High-Priority Goals (Weights from 0.21 to 0.10): SDG 4
SDG 5 Gender Equality+SDG 8 Decent Work and Economic Growth	0.099	Medium-Priority Goals (Weights from 0.099–0.054)
SDG 3 Good Health and Well-being	0.083	
SDG 7 Affordable and Clean Energy	0.068	
SDG 6 Clean Water and Sanitation	0.059	
SDG 2 Zero hunger	0.055	
SDG 10 Reduced Inequalities	0.055	
SDG 1 No poverty	0.054	
SDG 13 Climate Action	0.051	Low-Priority Goals (Weights: 0.051–0.037)
SDG 11 Sustainable Cities and Communities	0.049	
SDG 16 Peace, Justice, and Strong Institutions	0.047	
SDG 9 Industry, Innovation, and Infrastructure	0.046	
SDG 12 Responsible Consumption and Production	0.039	
SDG 17 Partnerships for the Goals	0.037	
SDG 15 Life on Land	0.025	Very Low-Priority Goals (Weights: 0.025–0.023)
SDG 14 Life Below Water	0.023	

We determined the thresholds for grouping by observing the gaps between the weight values. For example, the significant gap between the weight of SDG 4 (Quality Education) (0.210) and the next highest group (0.091) clearly indicated that SDG 4 should be in a group of its own. Similar gaps between the medium, low, and very low priority SDGs allowed for distinct clusters to be formed. This systematic approach ensured that the SDGs were grouped based on objective criteria derived from their assigned weights, which reflected the importance placed on each goal by the expert evaluators in the context of HEIs.

SDG 4 (Quality Education) stands out with the highest weight of 0.21, which is more than double that of the second highest weight, 0.091, for SDG 5 (Gender Equality) and SDG 8 (Decent Work and Economic Growth), which are treated jointly. This high-weight value highlights the strong commitment of universities to their core mission of shaping future generations through education and research while also addressing societal goals such as poverty reduction and gender equality. Within SDG 4 (Quality Education), indicator I7, emphasizing lifelong learning and inclusive education practices, carries the highest weight of 0.701, underscoring the importance of continuous skill development and inclusive education. Indicator I8, focusing on inclusivity and

accessibility within educational systems, also receives considerable attention, with a weight of 0.291. While both indicators prioritize access to education, the higher weight assigned to indicator I7 suggests a greater emphasis on improving the quality of education and the relevance of practical skill development.

SDG 5 (Gender Equality) and SDG 8 (Decent Work and Economic Growth) follow closely, with a combined weight of 0.091. These goals focus on fostering fairness and inclusivity in higher education, addressing issues such as childcare support, and promoting diversity in academic careers. Within SDG 5 + 8, indicator I11, which emphasizes maternity and paternity policies, receives the highest weight of 0.427, reflecting the importance of practical solutions for promoting gender equality. Indicator I10, addressing nondiscrimination policies, also receives significant attention, highlighting the crucial role of eliminating barriers to equal opportunities and career advancement. Lower-priority weights are assigned to indicator I9 (proportion of senior female academics) and indicator I12 (women's mentoring schemes and graduation rates). These findings align with the context of Greek society, where there is a higher graduation rate for girls, reflecting societal recognition of education's pivotal role in fostering equality and economic independence.

SDG 3 (Good Health and Well-being) ranks third, highlighting its critical role in ensuring the welfare of university members. Within SDG 3, indicator I5 (collaborations with health institutions) receives a higher score, indicating a strong emphasis on addressing diverse health needs through partnerships. In contrast, the lower priority assigned to indicator I6 (shared sports facilities) suggests that providing access to recreational spaces and physical activity opportunities for the local community is considered less critical.

SDG 6 (Clean Water and Sanitation) and SDG 7 (Affordable and Clean Energy) reflected the importance of campus sustainability efforts. SDG 7 received a slightly higher score than SDG 6. Indicator I13 (water consumption per person) received a relatively high score of 0.552 within SDG 6, indicating the commitment of universities to water conservation. Similarly, indicator I15 (plans to reduce energy consumption through building upgrades) within SDG 7 reveals a prioritization of practical actions for energy efficiency.

SDG 2 (Zero Hunger) and SDG 10 (Reduced Inequalities) both received scores of 0.055, reflecting their relevance to the community outreach and social justice efforts of universities. Indicator I3 (campus-food waste per person) demonstrates strong efforts to minimize the unnecessary discarding of food, while indicator I19 within SDG 10 (existence of a university diversity office) highlights the commitment of HEIs to fostering inclusive academic environments.

SDG 1 (No Poverty) ranks seventh with a score of 0.054, emphasizing the focus of universities on social responsibility and community engagement. Indicator I1 (low-income student support) received a significantly higher score of 0.784, showcasing robust efforts to support underprivileged students. Indicator I2 (training programs for improving access to essential services) received less emphasis, likely due to the specific context of Greek society, where financial support for students is prioritized.

In the low-priority goals group, the lower weights are likely due to universities focusing on core functions like education and reducing inequalities. Limited resources and the complexity of certain SDGs contribute to this prioritization. SDG 13 (Climate Action), with a weight of 0.051, ranks highest in this group. Within SDG 11 (Sustainable Cities and Communities), indicator I21 (promoting sustainable urban practices) received a slightly higher weight, emphasizing the importance of inclusive urban environments.

SDG 16 (Peace, Justice, and Strong Institutions) focuses on social justice and conflict prevention, with indicator I29 (providing a neutral platform for dialogue) highlighting the role of HEIs in promoting discussions on societal issues.

SDG 9 (Industry, Innovation, and Infrastructure), with a weight of 0.046, reflected a lower priority for industry collaboration, likely because universities place greater emphasis on education and research.

SDG 12 (Responsible Consumption and Production) has a relatively low weight overall, but indicator I23 (policy on waste disposal) received a higher weight, reflecting the importance of waste-management policies in promoting sustainability. Indicator I24 (proportion of recycled waste) highlighted efforts to reduce environmental impact.

SDG 17 (Partnerships for the Goals), with a weight of 0.037, indicated that universities do not prioritize direct collaboration for achieving all the SDGs. However, indicator I31 (education for the SDGs) dominates with a weight of 0.322, underscoring the perception of education as a primary function in advancing the SDGs.

In the very low-priority goals group, SDG 14 (Life Below Water) and SDG 15 (Life on Land) received low weights of 0.023 and 0.025, respectively. SDG 15 was slightly prioritized over SDG 14, suggesting that universities may perceive terrestrial conservation efforts as more within their realm of influence than marine conservation.

Discussion and conclusion

The integration of the SDGs into HEIs offers a critical framework for addressing global challenges while advancing knowledge and fostering societal impact. However, existing sustainability rankings face significant challenges in accurately measuring the contributions of universities to the SDGs. This study introduces the AHP as an alternative, providing a more transparent, tailored, and context-sensitive process for estimating the weights of SDGs and the indicators used for evaluating the integration of SDGs into HEIs. The proposed AHP framework evaluates each SDG and assigns weights based on expert judgments. This ensures that the contributions of universities to the SDGs are assessed more holistically, incorporating not just operational aspects but also education, research, and community engagement. By broadening the scope of evaluation and ensuring greater transparency, this method provides a more accurate and balanced assessment of the sustainability efforts of HEIs.

The analysis of priority weights within the AHP framework revealed significant insights into the strategic priorities of universities. The study categorizes SDGs into four distinct priority groups – high, medium, low, and very low – showing how universities distribute their efforts and resources. SDG 4 (Quality Education) is the highest-priority goal, demonstrating the importance of education and knowledge dissemination in the missions of HEIs. SDG 5 (Gender Equality) and SDG 8 (Decent Work and Economic Growth) followed closely and are categorized as the second-most important group of SDGs. This prioritization aligns with the roles of universities as incubators for future scientists and professionals, where the academic choices of students shape their career trajectories. HEIs play a crucial role in shaping students' perceptions of labor rights, employment equity, and fair economic opportunities, reinforcing universities as essential drivers of workforce development and societal progress.

Lower-priority goals, such as SDG 13 (Climate Action) and SDG 12 (Responsible Consumption and Production), receive less attention, likely due to resource constraints and institutional focus on core functions. These SDGs entail systemic change rather than targeted initiatives. The proposed structured assessment provides a more balanced view of university efforts, helping HEIs identify areas where they are excelling and where further improvement is needed.

The AHP method deployed in this study offers several advantages as it requires the assessment of a comprehensive set of indicators, which in this case ensures that all SDGs are assessed, offering a more balanced and complete picture of a university's sustainability contributions. The 34 indicators presented in this study encompass operational, educational, and social dimensions, providing a holistic view of HEIs' sustainability commitments. Moreover, AHP employs pairwise comparisons and expert judgment to assign weights transparently, ensuring that the prioritization of indicators is clearly justified.

A key recommendation for future research is to complete the university-ranking framework using the proposed AHP framework, combining it with another MCDM/A approach such as TOPSIS or SAW. This will allow for a thorough validation of the method's effectiveness, assessing its applicability across institutions with diverse sustainability priorities, resource availability, and regional challenges.

By offering a transparent, structured, and context-sensitive evaluation, the AHP framework addresses the gaps in traditional ranking methodologies and provides a more accurate and equitable assessment of HEIs' sustainability efforts. This study underscores the importance of holistic sustainability assessments, moving beyond selective reporting toward a more inclusive, data-driven approach that empowers HEIs to make informed decisions and advance their sustainability commitments effectively.

Additionally, expanding the application of our set of indicators and weights to a broader range of universities, particularly in developing countries, would provide deeper insights into how sustainability initiatives operate in different socio-economic and infrastructural contexts. Identifying and highlighting leading HEIs in sustainability efforts, especially in resource-constrained settings, would offer valuable examples of best practices and scalable models for sustainability integration.

Notes

1. See https://universityrebellion.nl.
2. See https://web.ub.edu/en/web/actualitat/w/ub-cicle-crisi-escosocial.
3. The Times Higher Education (THE) has annually devised the World University Rankings (WUR) since 2004 and it is the only classification system of this type that has been independently audited. In 2019, 1,258 HEIs provided information to THE to devise the WUR, and 1,397 did so in 2020. The WUR is the result of compiling the data that come directly from HEIs' reports on five groups of key performance indicators: teaching, research (volume, income, reputation), citations (research influence), knowledge transfer (industry, income), and international outlook (staff, students, research) (De la Poza et al. 2021).
4. QS World University Rankings conducts comparative college and university rankings. Its first edition was published in collaboration with the *Times*

Higher Education (THE) as Times Higher Education – QS World University Rankings, inaugurated in 2004 to provide independent rankings about universities. In 2009, the two organizations parted ways, the QS World University Rankings and THE World University Rankings. QS's portfolio consists of the QS World University Rankings, the QS World University Rankings by Subject, four regional rankings tables, several MBA rankings, and the QS Best Student Cities rankings. The ranking has been criticized for taking into account subjective indicators and reputation surveys, which tend to differ over time and form a feedback loop. Another criticism centers on the consistency and integrity of the data used to generate the QS rankings (Huang 2012).

5. Identification of the indicators for evaluating the progress of universities toward the SDGs is outlined in detail in Martinis et al. 2024) and was achieved through a multifaceted approach.
6. The final indicators presented in Figure 1 are from Martinis, Kaloutsa, and Kabassi (2024) and this source details the rationale behind each of them.
7. Integration of SDG 5 (Gender Equality) and SDG 8 (Decent Work and Economic Growth) in this evaluation framework is based on their interconnected impact on institutional policies and outcomes.

Ethical statement

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Disclosure statement

The authors declare that they have no affiliations with or involvement in any organization or entity with any financial interest in the subject matter or materials discussed in this manuscript. The authors have declared that no competing interests exist.

Funding

No funding has been provided for this research.

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Data availability statement

Data are available upon request.

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