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The future of European universities on the path to sustainable development

Zbigniew Korzeb
Bernabé Alonso-Fariñas
Ana Isabel Irimia-Diéguez
Felix Jimenez Naharro
Urszula Kobylińska
Filippo di Pietro
Maria Jose Palacin Sanchez
Ewa Rollnik-Sadowska
Danuta Szpilko
Joanna Szydło
Antonio de la Torre Gallegos

Zbigniew Korzeb
Department of Management, Economics and Finance, Faculty of Engineering Management, Bialystok University of Technology, Wiejska 45A, 15-312 Bialystok, Poland
ORCID 0000-0001-9690-3842
Corresponding author:
e-mail: z.korzeb@pb.edu.pl

Bernabé Alonso-Fariñas
Departamento Ingeniería Química y Ambiental, ETS-Ingeniería, University of Seville, Camino de los Descubrimientos s/n, Pabellón Plaza de América, 41092 Seville, Spain
ORCID 0000-0001-9740-3364
e-mail: bernabeaf@us.es

Ana Isabel Irimia-Diéguez
Department of Financial Economics and Operations Management, Faculty of Economics and Business Sciences, University of Seville, Ramón y Cajal 1, 41018 Sevilla, Spain
ORCID 0000-0003-1931-3544
e-mail: anairimia@us.es

Felix Jimenez Naharro
Department of Financial Economics and Operations Management, Faculty of Economics and Business Sciences, University of Seville, Ramón y Cajal 1, 41018 Sevilla, Spain
ORCID 0000-0001-9217-2624
e-mail: fjimenez@us.es

Urszula Kobylińska
Department of Management, Economics and Finance, Faculty of Engineering Management, Bialystok University of Technology, Wiejska 45A, 15-312 Bialystok, Poland
ORCID 0000-0001-9435-7841
e-mail: u.kobylinska@pb.edu.pl

Filippo di Pietro
Department of Financial Economics and Operations Management, Faculty of Economics and Business Sciences, University of Seville, Ramón y Cajal 1, 41018 Sevilla, Spain
ORCID 0000-0003-1573-8553
e-mail: fdi@us.es

Maria Jose Palacin Sanchez
Department of Financial Economics and Operations Management, Faculty of Economics and Business Sciences, University of Seville, Ramón y Cajal 1, 41018 Sevilla, Spain
ORCID 0000-0003-0246-2551
e-mail: palacin@us.es

Ewa Rollnik-Sadowska
Department of Management, Economics and Finance, Faculty of Engineering Management, Bialystok University of Technology, Wiejska 45A, 15-312 Bialystok, Poland
ORCID 0000-0002-4896-1199
e-mail: e.rollnik@pb.edu.pl

Danuta Szpilko
International Department of Logistics and Service Engineering, Faculty of Engineering Management, Bialystok University of Technology, Wiejska 45A, 15-312 Bialystok, Poland
ORCID 0000-0002-2866-8059
e-mail: d.szpilko@pb.edu.pl

Joanna Szydło
Department of Management, Economics and Finance, Faculty of Engineering Management, Bialystok University of Technology, Wiejska 45A, 15-312 Bialystok, Poland
ORCID 0000-0002-2114-4770
e-mail: j.szydlo@pb.edu.pl

Antonio de la Torre Gallegos
Department of Financial Economics and Operations Management, Faculty of Economics and Business Sciences University of Seville, Ramón y Cajal 1, 41018 Sevilla, Spain
ORCID 0000-0001-7839-0385
e-mail: atorre@us.es

ABSTRACT

The article addresses the issue of the future of European universities on the path to sustainable development. The main aim of the article is to describe foreseeable future directions of the sustainable development of universities and ways to achieve Sustainable Development Goals. In effect, the authors identify weaknesses, assess threats and recommend coordinated solutions and alternatives for the sustainable development of universities. This research will contribute to future work by explaining what the future of universities will look like on their sustainability journey. The results of the Delphi study conducted with the participation of 201 experts from 47 countries allowed for the identification of factors shaping the future of universities on the path to sustainable development.

KEY WORDS

university, sustainable development, Sustainable Development Goals, European Green Deal, artificial intelligence, resources, education, Delphi method

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Introduction

For at least a decade, the literature has argued that universities can be the main actors supporting sustainable development through research, education and implementation of solutions in the area of sustainable development in their organizations (Von Hauff & Nguyen, 2014). The future of European universities on the path to sustainable development is a crucial and multifaceted topic that involves various dimensions, such as environmental, social and economic, aiming to contribute to the sustainable develop-

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ment of stakeholders (Deleye 2023; Fisher et al., 2015; Lozano et al., 2010; Velazquez et al., 2006). Various perspectives have emerged on the concept of a sustainable university (Deleye, 2023). One perspective underscores the significance of universities in addressing global environmental challenges through education, research and community engagement, framing it as the idea of a sustainable university (Sart, 2022; Lozano et al., 2013). Another perspective revolves around the concept of an engaged community, where universities actively involve their stakeholders in initiatives promoting sustainable development (Deleye, 2023). Meanwhile, a different discourse introduces the notion of a green-tech campus, emphasizing the incorporation of sustainable technologies and practices into the university's operations (Deleye, 2023; Anthony, 2021). Higher education institutions (HEIs) address sustainable development concerns across various structural and organizational dimensions, as well as aspects related to infrastructure and energy efficiency. They pursue strategic initiatives spanning education, research, knowledge transfer and engagement with stakeholders, including partnerships and community involvement.

In contemporary discourse, universities are integrating elements of sustainable development into their strategic plans, prioritizing such goals as providing high-quality education and establishing resilient infrastructure (Abello-Romero et al., 2023). It is underscored in scholarly works that the inclusion of sustainable development issues in study programs is vital not only for ensuring high-quality education but also for contributing to the realization of the Sustainable Development Goals (Gigauri et al., 2022). The literature emphasizes that universities possess both the knowledge and influence to spearhead the transformation towards a more sustainable world (Sart, 2022; Rotondo et al., 2023).

Based on the above considerations, the aim of the article is describe foreseeable future directions of the sustainable development of universities and ways to achieve Sustainable Development Goals (SDGs).

However, very little attention has been paid to the issue of the future role of universities in sustainable development. In particular, it is important to identify factors that limit and support university activities for sustainable development.

1. Literature review

Sustainable initiatives and activities within Higher Education Institutions (HEIs) are multifaceted, occurring across various domains, as outlined by Fischer et al. (2015) and Lozano et al. (2015). Consequently, HEIs assume a catalytic role in fostering societal engagement with sustainability, as emphasized by Christensen et al. (2009). The realization of Sustainable Development Goals is contingent upon robust partnerships between academia and industry (Bodley-Scott & Oymak, 2022). Collaboratively, universities and the business sector can assume a pivotal role in addressing global environmental challenges through research, education and cooperative efforts, actively seeking ecologically sound solutions (Panait et al., 2022).

The European Union (EU) Commission has reaffirmed its commitment to implementing the 2030 Agenda for Sustainable Development to protect the environment, reduce land degradation and prevent biodiversity loss by reducing its dependence on the use of natural resources (Camilleri, 2020). Several EU policies and initiatives promote sustainable development, and universities may be indirectly influenced or encouraged to align their activities with these principles. Some relevant areas with a focus on sustainability include:

- European Green Deal (Skjærseth, 2021), as a comprehensive set of policy initiatives by the EU aimed at making the EU's economy sustainable. While it primarily focuses on climate action, it encompasses broader sustainability goals. Policies related to education and research may indirectly encourage universities to contribute to sustainable development.
- Erasmus+ Program (Nogueiro et al., 2022). While not explicitly focused on sustainable development, it supports projects and activities that can contribute to broader societal goals, including environmental sustainability.
- Horizon Europe (Lages et al., 2023). The EU's framework program for research and innovation, Horizon Europe, may include themes and calls related to sustainability. Universities participating in research projects funded by Horizon Europe may find opportunities to contribute to sustainable development goals.
- National legislation. The factors of transforming universities towards sustainability can also be considered in the national context, due to the provisions of national law (Dlouhá et al., 2017). National legislation within EU member states may also address sustainability in higher education. Some countries may have specific requirements or expectations for universities to

incorporate sustainable practices into their operations and academic programs.

Certainly, universities are recognized as key players in fostering innovation and contributing to sustainable development (Purcell et al., 2019; Sonetti et al., 2019, Lima et al., 2023, Baker-Shelley et al., 2017; Brundiers & Wiek, 2011, Casado-Aranda et al., 2020; Narasimharao, 2013; Dlouha et al., 2018). Here are several arguments why universities play a fundamental role in creating and developing innovations and products aligned with the principles of sustainable development:

- Research and development – universities are hubs for research and development. They conduct studies, experiments, and investigations across various disciplines, providing the foundation for new ideas and innovations that can contribute to sustainability (Sedlacek, 2013).
- Interdisciplinary collaboration – many sustainability challenges require interdisciplinary solutions. Universities, with their diverse faculties and departments, facilitate collaboration among experts in different fields, fostering holistic approaches to sustainable development (Yarime et al., 2012).
- Education and training – universities educate and train the next generation of professionals, including scientists, engineers, policymakers, and business leaders. By integrating sustainability principles into curricula, universities can instil a mindset of responsibility and innovation among students (Menon & Suresh, 2020).
- Technology transfer – universities often engage in technology transfer, helping to bring academic research into practical applications. This transfer of knowledge and technology can lead to the development of sustainable products, processes and technologies (Lee, 2000).

An important aspect for strengthening universities towards sustainable development is additional financial support. Such support is necessary to achieve the goals of the European Green Deal (Sukiennik et al., 2021). Universities have a key role to play in the innovation pipeline from research to industry, and in connecting academia and society through education (Cini et al., 2023) but universities are also the main centres where the drivers of innovation for sustainability and decarbonization of the built heritage are investigated and developed (Violano & Cannaviello, 2022).

Taking into account the main mission of the university, which is to educate personnel for the needs of the labour market, universities should focus on developing key competencies of students for sustainable development (Kioupi & Voulvoulis, 2019). Education aligns with the broader recognition of the importance of sustainability in various aspects of society, including the job market (Purcell et al., 2019). Here are some ways in which universities may prioritize the development of key competencies for sustainable development in their educational programs: Incorporating Sustainability into Curricula (Tasdemir & Gazo, 2020); Introducing Interdisciplinary Approaches (Zielinski et al., 2018), Ethical Decision-Making (El-Zein et al., 2018), Developing Communication Skills, Innovation and Entrepreneurship (Shu et al., 2020). By focusing on these key competencies, universities can contribute to preparing students for the needs of the future European job market, where there is an increasing emphasis on sustainability and responsible citizenship.

On the path to sustainable development, the university can be supported by artificial intelligence, which has dominated the issues of the future in many sectors in the last few years (Tanveer et al., 2020, Szpilko et al., 2023b). Certainly, technologies based on artificial intelligence (AI) can play a significant role in aiding universities on their path towards sustainable development (Kamalov et al., 2023; Casado-Aranda et al., 2020).

In summary, universities are crucial drivers of innovation and play a pivotal role in creating and developing solutions that align with the principles of sustainable development. Through research, education, collaboration and practical initiatives, universities contribute significantly to addressing global sustainability challenges.

2. Research methodology

The research presented in this article was based on one of the expert methods, the Delphi method. It is widely used in a variety of sectors, including education (Popov et al., 2019, Tran et al., 2020). The implementation of the Delphi study is justified in situations of high uncertainty, in this case – future directions of the sustainable development of universities (Beiderbeck et al., 2021; Niederberger & Spranger, 2020).

2.1. Development of the theses

In the classical approach, the Delphi study is preceded by the formulation of Delphi theses or projections and ancillary questions. The Delphi theses refer to the future description of dependencies between issues arising from the field of the study and a setting determined by the goal of the conducted research (Kuźmicz et al., 2022; Szpilko, 2014; Ejdys & Szpilko, 2023).

The purpose of developing the theses was to describe foreseeable future directions of the sustainable development of universities.

The research process consisted of six stages (Figure 1). It began with a detailed review of the literature on the topic of sustainable universities and their determinants. As a result, at the second stage of the research process, the initial set of 25 theses was identified. Moreover, the literature review allowed for the recognition of 30 contributing factors and 8 barriers. The final list of 5 theses on future directions of the sustainable development of universities together with contributing factors and barriers (6 items each) was prepared at the third stage. Some reductions were made by removing repetitions and eliminating the items with lower significance for the analysed topic.

The next stage covered the realisation of the first round of the Delphi survey by sending it to 6,800 experts. As a result, 207 respondents filled in online surveys. The second round of the Delphi survey allowed for the collection of responses from 201 experts. At the last stage of the research process the data were analysed and the results were developed.

The final list of the theses is presented in Table 1.

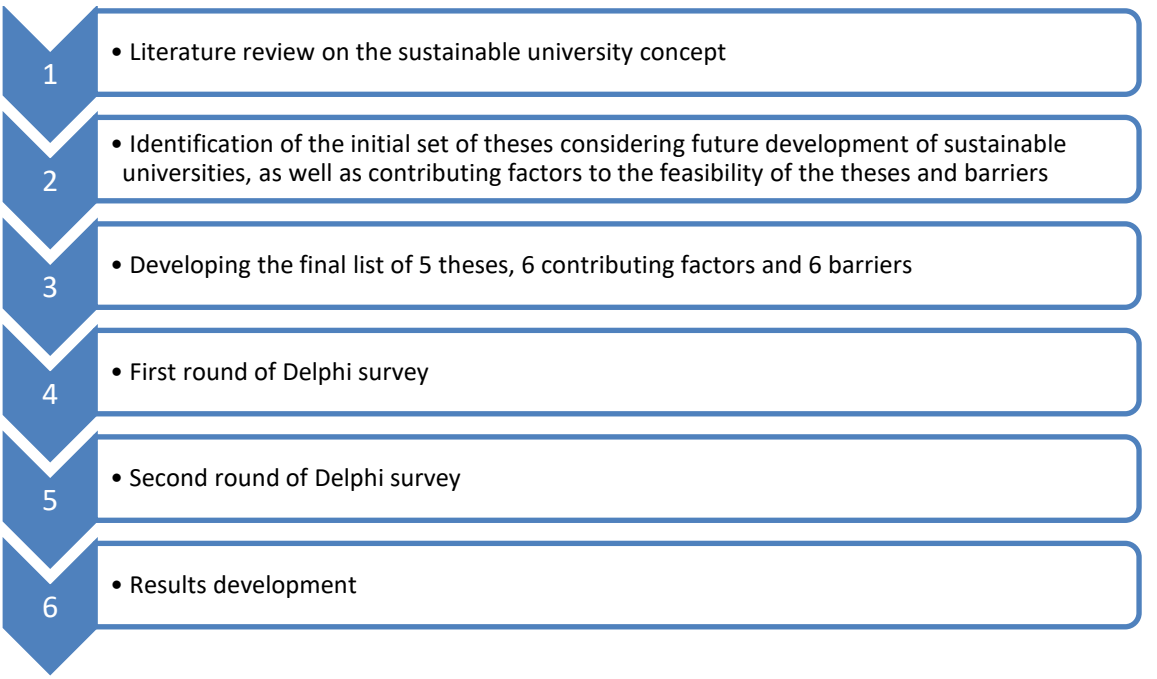

Fig. 1. Stages of research process

Tab. 1. Delphi theses

Symbol of the thesis	Final formulation of the thesis
T1	European Union's policy will obligate universities to implement and monitor the principles of sustainable development
T2	Universities will play a fundamental role in creating and developing innovations and products in line with the principles of sustainable development
T3	European Union countries will invest additional financial resources in the sustainable development of universities to fulfil the objectives of the European Green Deal
T4	In educating students for the needs of the future European job market, universities will focus on developing key competencies for sustainable development
T5	Technologies based on artificial intelligence will aid universities on their path towards sustainable development

The below final set of five theses included in the research process are presented and justified accordingly.

Thesis 1. European Union's policy will obligate universities to implement and monitor the principles of sustainable development

By obligating universities to implement and monitor the principles of global sustainable development goals, the EU aligns with international efforts to address environmental, social and economic challenges (Fernandez-Izquierdo et al., 2019; Sonetti et al., 2019; Szydło et al., 2023). Moreover, embedding sustainable development principles in education prepares students for workforce increasingly focused on sustainability. Graduates will possess the knowledge and skills needed to contribute to sustainable practices in various industries and sectors. What is also crucial is that universities often receive funding and support from the European Union. Compliance with sustainable development principles may become a criterion for eligibility, encouraging universities to align with these principles to access resources and opportunities (Filho et al., 2017).

Thesis 2. Universities will play a fundamental role in creating and developing innovations and products in line with the principles of sustainable development

Universities are centres for research and development. They have the intellectual capital and infrastructure to conduct in-depth research on sustainable technologies, materials and practices (Purcell et al., 2019). Universities as hubs of research and innovation can be encouraged to prioritize research projects that contribute to sustainable development, fostering technological advancements and solutions. Universities employ experts across various disciplines. By leveraging the interdisciplinary expertise of faculty members and researchers, universities can contribute valuable insights to the development of sustainable innovations (Lima et al., 2023). Those innovations can be commercialized and they can reach the market to have a tangible impact on industries. Collaborative efforts between universities and industries can lead to the development of sustainable products. Industry partnerships provide resources, funding and real-world applications for university research (Ávila et al., 2017). Many universities have incubators and innovation centres that support the development of startups and entrepreneurial ventures (Vardhan & Mahato, 2022; Kobylińska & Irimia-Dieguez, 2023). These entities can focus specifically on sustainable innovations, fostering a culture of entrepreneurship in line with sustainable development principles.

Thesis 3. European Union countries will invest additional financial resources in the sustainable development of universities to fulfil the objectives of the European Green Deal

The European Green Deal is a comprehensive strategy aimed at making the EU's economy sustainable. Investing in the sustainable development of universities aligns with the overarching goals of the European Green Deal, making it likely that financial resources will be allocated to support this initiative (Eckert & Kovalevska, 2021). The European Green Deal emphasizes the importance of education and research in achieving sustainability objectives (Szpilko & Ejdys, 2022). Universities, as key players in education and research, are expected to receive increased financial support to contribute to the implementation of the Green Deal. EU frameworks, such as Horizon Europe, the EU's flagship research and innovation program, place a strong emphasis on sustainability. Universities engaging in projects that align with the European Green Deal may access additional funding through these frameworks (Eckert & Kovalevska, 2021).

Thesis 4. In educating students for the needs of the future European job market, universities will focus on developing key competencies for sustainable development

The future European labour market is expected to have a growing demand for professionals with skills and knowledge related to sustainable development. Universities, recognizing this trend, will prioritize the development of competencies that make graduates more attractive to employers in environmentally conscious industries (Brundiers & Wiek, 2011). Competencies related to such sustainable development as eco-design, renewable energy and circular economy principles (Gospodarowicz et al., 2023), will prepare students to adapt to changing work environments and industry expectations. Sustainable development often requires innovative solutions to complex problems. Following that, it is crucial developing students' critical thinking, problem-solving and innovation skills, preparing them to address sustainability challenges in their future careers (Murga-Menoyo, 2014; Rollnik-Sadowska, 2023; Kobylińska & Ryciuk, 2022; Rollnik-Sadowska et al., 2023). As sustainability issues are inherently interdisciplinary, universities should emphasize the development of competencies that enable students to work across disciplines, fostering collaboration and ensuring that graduates can contribute to holistic solutions in various professional settings.

Thesis 5. Technologies based on artificial intelligence will aid universities on their path towards sustainable development

AI technologies can optimize resource allocation and utilization within universities, leading to more efficient energy usage, reduced waste and cost savings. Smart systems powered by AI can help manage campus facilities in a way that minimizes environmental impact. Moreover, AI enables universities to analyse large sets of data to make informed decisions about sustainability initiatives. From energy consumption patterns to waste management, AI-driven analytics provide valuable insights that guide universities in implementing effective and targeted sustainability strategies. Additionally, AI-powered virtual learning platforms can facilitate remote education, reducing the need for physical travel and campus infrastructure (Kamalov et al., 2023; Casado-Aranda et al., 2020; Szpilko et al., 2023a). This not only contributes to sustainability but also increases accessibility to education. AI technologies can also accelerate research in sustainable development by analysing vast amounts of data, simulating complex scenarios and identifying patterns that contribute to the advancement of green technologies and practices.

2.2. Experts selection

In the Delphi study it is crucial to select appropriate experts, which significantly influences the reliability of research results (Schuckmann et al., 2012). In selecting the expert panel for the Delphi study it

Tab. 2. The structure of Delphi experts by category of stakeholder [N=201]

Category of stakeholder	Share
scientists/researchers	75.62%
teachers	52.24%
university staff	26.87%
students	2.99%
companies/industry	2.99%
national policy-makers	1.00%
NGOs	6.47%
special interest groups e.g., volunteer contributors and citizen scientists	3.98%
other	2.49%

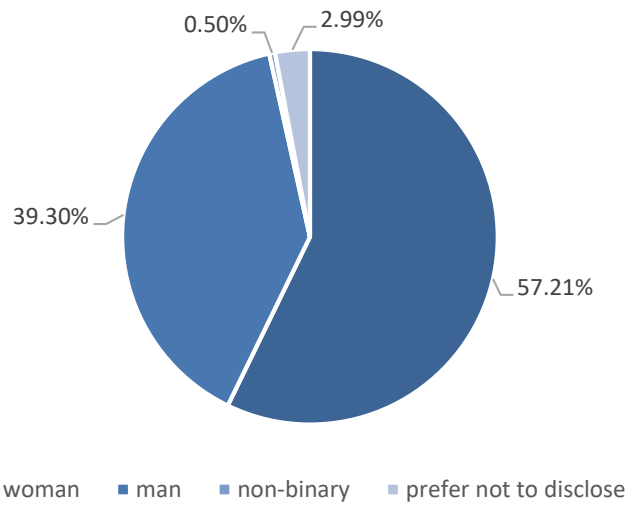

Fig. 2. The structure of Delphi experts by gender [N=201]

Tab. 3. The structure of Delphi experts by country [N=201]

COUNTRY	SHARE		COUNTRY	SHARE
Austria	1.49%		Ukraine	8.96%
Belgium	0.50%		Serbia	2.99%
Bulgaria	1.49%		Norway	1.49%
Croatia	2.49%		Brazil	1.49%
Czechia	1.99%		United Kingdom	1.99%
Denmark	0.50%		Basque Country	0.50%
Estonia	0.50%		Belarus	0.50%
Finland	1.99%		Canada	0.50%
France	1.49%		Ecuador	0.50%
Germany	4.48%		Egypt	0.50%
Greece	2.49%		Iceland	0.50%
Hungary	1.00%		India	0.50%
Ireland	1.00%		Jordan	0.50%
Italy	2.49%		Kosovo	0.50%
Latvia	3.48%		Malaysia	0.50%
Lithuania	2.49%		North Macedonia	0.50%
Netherlands	1.49%		Russia	0.50%
Poland	10.95%		Russian Federation	0.50%
Portugal	9.95%		Switzerland	0.50%
Romania	7.96%		Thailand	0.50%
Slovakia	0.50%		Turkey	0.50%
Slovenia	1.49%		Ukraine and Germany	0.50%
Spain	15.92%		United Arab Emirates	0.50%
Sweden	3.48%			

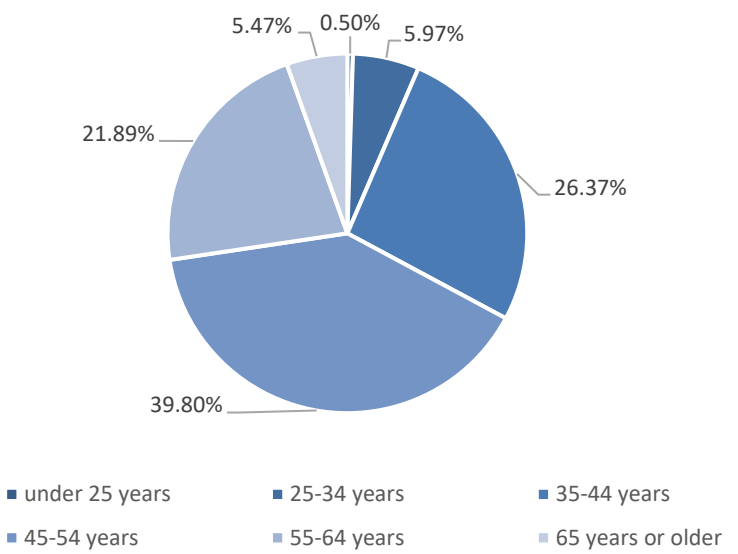

Fig. 3. The structure of Delphi experts by age [N=201]

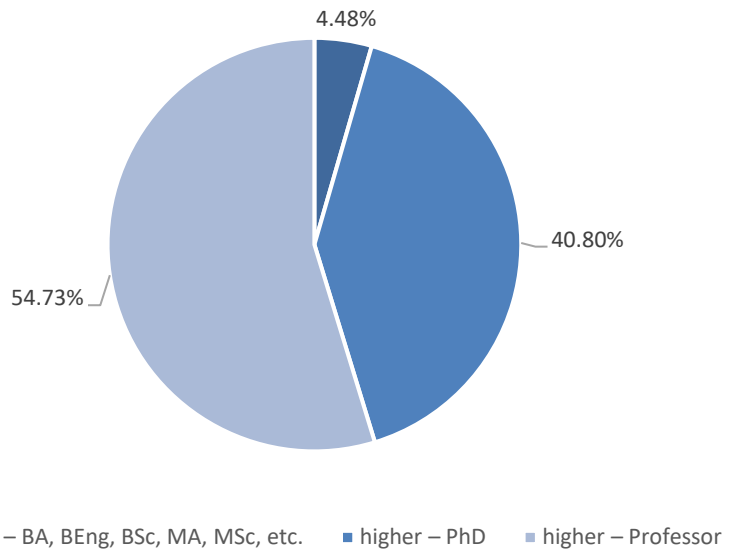

Fig. 4. The structure of Delphi experts by education [N=201]

needs to be stressed not only finding a heterogeneous group willing to participate but also considering their professional background, location and expertise (Melander, 2018). There are different approaches to select Delphi experts, one of them is to invite experts who have at least one international publication in Web of Science/Scopus indexed Journals on the analysed topic (Tran et al., 2020). For that study the experts were identified through the Web of Science database as 6,800 of them are the authors of publications on the topic of sustainable universities.

Experts represented different categories of stakeholders, some of them more than one (Table 2).

The Delphi survey participants came from all over the world (Table 3). However, the biggest shares, exceeding 10% were represented by the respondents from Spain and Poland. The majority of experts (57%) were women (Figure 2). The respondents were diversified by age (Figure 3). The biggest share of experts – 40% were 45-54 years old, 26% were 35-44 and 22% were 55-64.

The experts participating in the study were well-educated as all of them had higher education (Figure 4). The majority of them – 55% – held a Professor's position and 41% – PhD.

2.3. The procedure of conducting the Delphi study

The significance (Si) of the theses for the sustainable development of universities were assessed according to the formula (based on Kononiuk et al., 2021; Ejdys et al., 2023):

$$S_i = \frac{100*n_{VH}+75*n_H+50*n_A+25*n_L+0*n_{VL}}{n} \quad (1)$$

where:
n_{VH} –number of responses 'very high',
n_H – number of responses 'high',
n_A – number of responses 'average',
n_L – number of responses 'low',
n_{VL} – number of responses 'very low',
n – number of responses,
I – number of Delhi round.

The indicator S_i takes values from 0 to 100. The closer the value is to 100, the greater the importance of the thesis for development of sustainable universities.

The experts assessed also the impact of the contributing factors and the barriers on the feasibility of the thesis. The contributing factor indicators (C) and the barrier indicators (B) were calculated according to formula (2) and formula (3) respectively (based on Kononiuk et al., 2021; Ejdys et al., 2023).

$$C = \frac{100*n_{VH}+75*n_H+50*n_A+25*n_L+0*n_{VL}}{n} \quad (2)$$

where:
nVH – number of responses 'very high',
nH – number of responses 'high',
nA – number of responses 'average',
nL – number of responses 'low',
nVL – number of responses 'very low',
n – number of responses.

$$B = \frac{100*n_{VH}+75*n_H+50*n_A+25*n_L+0*n_{VL}}{n} \quad (3)$$

where:
nVH – number of responses 'very high',
nH – number of responses 'high',
nA – number of responses 'average',
nL – number of responses 'low',
nVL – number of responses 'very low',
n – number of responses

3. Results

The study was divided into two rounds. The experts assessed the significance of individual theses for the sustainable development of universities. The conducted analyses were presented in a comparative approach. The significance indicators from both rounds showed high convergence, the focus was on presenting the results of the second round. All five theses were evaluated as important to very important, as evidenced by the value of the significance indicators (Figure 5).

In the analysed set of the theses, the highest significance indicator was recorded for Thesis 3. European Union countries will invest additional financial resources in the sustainable development of universi-

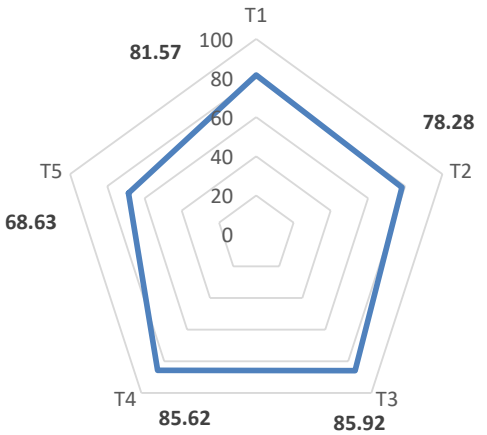

Fig. 5. Significance indicators for the theses in the University Sustainable Development (Round II results)

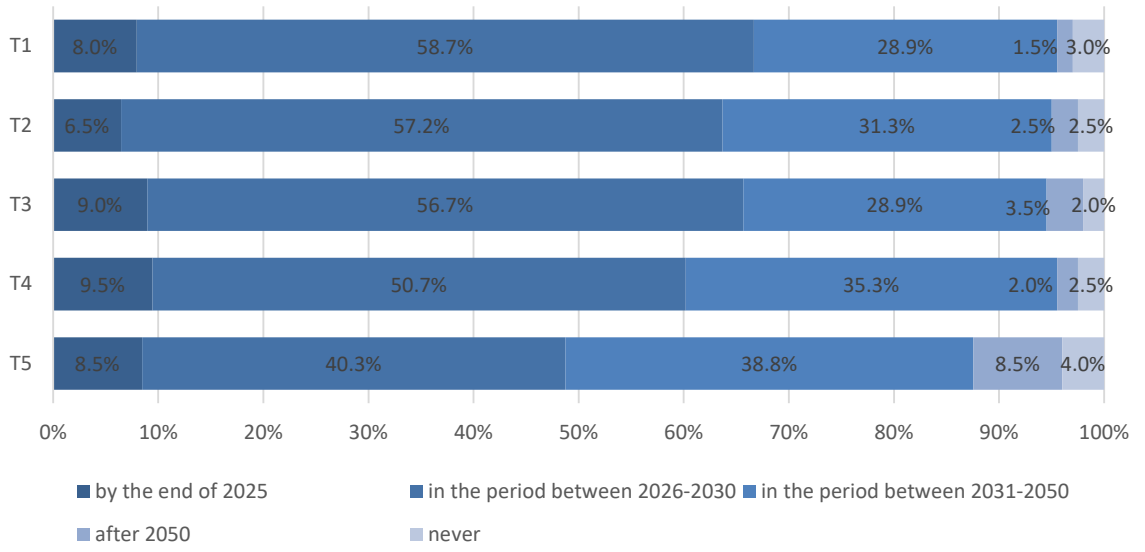

Fig. 6. Time horizon for the implementation of the theses

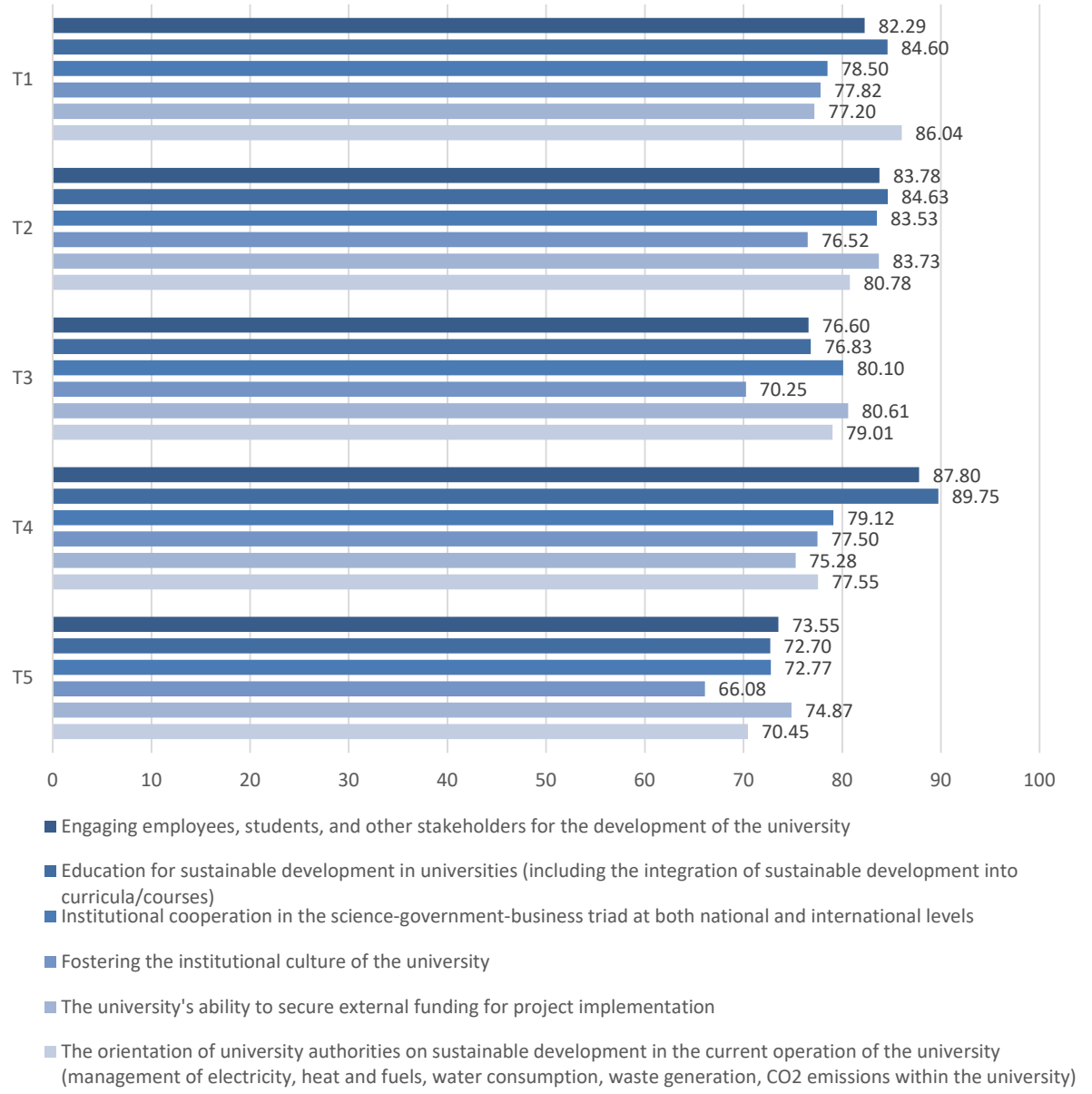

Fig. 7. Indicators of the impact of the contributing factors on the feasibility of the theses

ties to fulfil the objectives of the European Green Deal. The experts concluded that financial support would significantly impact the sustainable development of universities. Another very high indicator was related to Thesis 4. In educating students for the needs of the future European job market, universities will focus on developing key competencies for sustainable development. After the first round, it was 83.45, and after the second round, it increased to 85.62. In this case, the experts emphasized the importance of education. Another high indicator was noted for Thesis 1. European Union's policy will obligate universities to implement and monitor the principles of sustainable development. After the first round, it was 79.86, and after the second round, it increased to 81.57. The experts recognized the validity of implementing sustainable development goals and monitoring the various stages of this process. High indicators were also observed for Thesis 2. Universities will play a fundamental role in creating and developing innovations and products in line with the principles of sustainable development. After the first round, it was 77.54, and after the second round, it increased to 78.28. The experts appreciated this innovative approach by universities to sustainable development issues. The lowest significance indicator, although

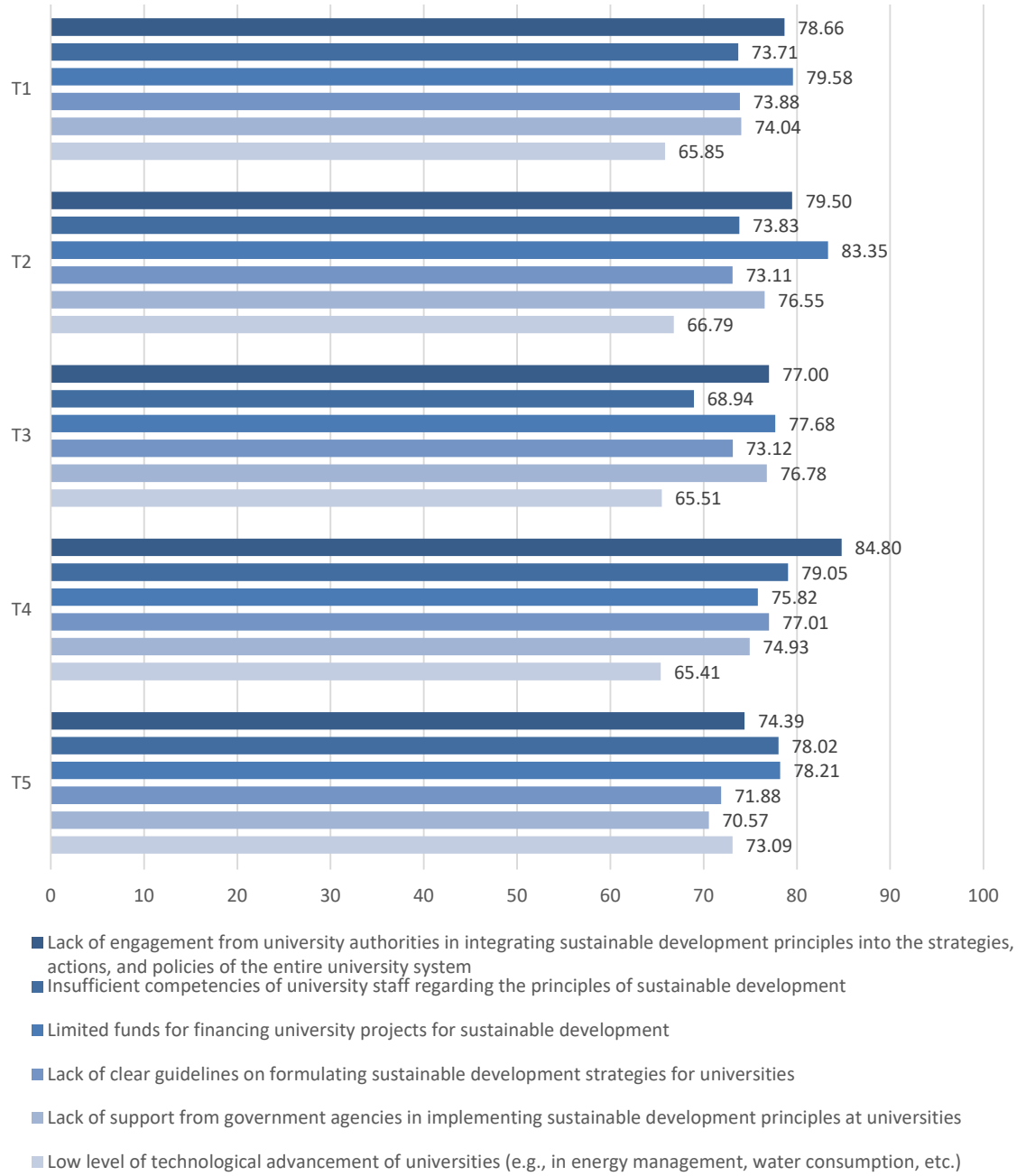

Fig. 8. Indicators of the impact of the barriers on the feasibility of the theses

still relatively high, pertained to Thesis 5. Technologies based on artificial intelligence will aid universities on their path towards sustainable development. After the first round, it was 68.45, and after the second round, it increased to 68.63. The experts took into account the importance of artificial intelligence in supporting sustainable development goals.

In the second part of the survey, the experts gave their opinion on the estimated time of realisation of theses. The implementation time of the theses was evaluated by selecting one of the five responses: 'by the end of 2025,' 'in the period between 2026-2030,' 'in the period between 2031-2050,' 'after 2050' and 'never' (Figure 6). It should be emphasized that the assessment of the schedule for implementing the theses is characterized by a similar pattern of responses, as in the prior case. There were no discrepancies in the results between the two rounds.

In the opinion of the majority of experts (around 80%), the statements included in the theses will be implemented in the years 2026-2030 or in the years

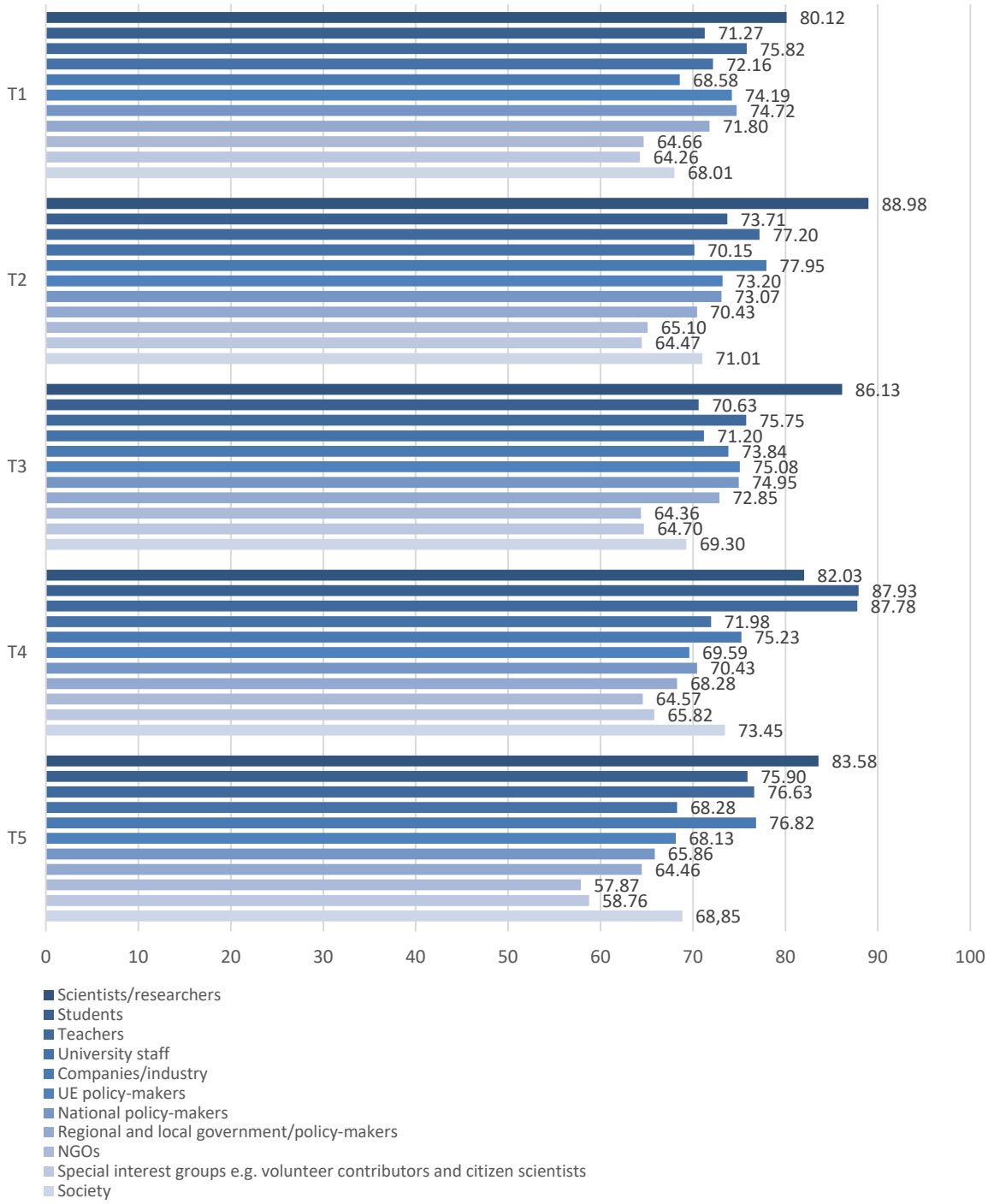

Fig. 9. Stakeholder impact indicator

2031-2050. For T3 and T4, only about 9% of experts believe that they will be implemented by the end of 2025. Regarding T1 and T5, about 8% of the experts share this view, while for T2, the percentage of the experts is slightly lower (6.5%). As for a longer time perspective, only in the case of T2, just over 8% of the respondents believe that the assumptions of the thesis will be implemented after 2050. In other cases (T1-T4), considerably fewer respondents believe this to be the case (about 2%). Analysing the data presented in Figure 6, it can also be observed that a low percentage of the experts (between 2-4%) claim that the relationships described in theses T1-T5 will never occur.

The next stage focuses on factors that support the implementation of the thesis. The results are presented in Figure 7.

Regarding Thesis 1. European Union's policy will obligate universities to implement and monitor the principles of sustainable development, the most supportive factor is I6 – the orientation of university authorities on sustainable development in the current operation of the university (management of electricity, heat and fuels, water consumption, waste generation, CO2 emissions within the university) (indicator value: 86.04). Other significant factors include I2 – education for sustainable development in universities (including the integration of sustainable development into curricula/courses) (indicator value: 84.60) and I1 – engaging employees, students and other stakeholders for the development of the university (indicator value: 82.29). The remaining factors proved to be only slightly less important than those mentioned earlier. These include I3 – institutional collaboration in the science-government-business triad at both national and international levels (indicator value: 78.50), I4 – fostering the institutional culture of the university (indicator value: 77.82) and I5 – the university's ability to secure external funding for project implementation (indicator value: 77.20).

For Thesis 2. Universities will play a fundamental role in creating and developing innovations and products in line with the principles of sustainable development, four out of the six factors proved to be very important: I2, I1, I3, and I5 (indicator values: 83.53-84.63). Slightly less significant were factors I6 (indicator value: 80.78) and I4 (indicator value: 76.52).

Analysing the results related to Thesis 3. European Union countries will invest additional financial resources in the sustainable development of universities to fulfil the objectives of the European Green Deal, the most supportive factors were I5 (indicator value: 80.61) and I3 (indicator value: 80.10), while the least supportive factor was I4 (indicator value: 70.25).

For Thesis 4. In educating students for the needs of the future European job market, universities will focus on developing key competencies for sustainable development, the most supportive factor is I2 (indicator value: 89.75). It is worth noting that this is the highest value in the entire study. Another significant factor is I1 (indicator value: 87.80). The remaining indicators have values below 80.

Regarding Thesis 5. Technologies based on artificial intelligence will aid universities on their path towards sustainable development, all factors had values below 75. The most important factor was I5 (indicator value: 74.87), and the least significant factor was I4 (indicator value: 66.08).

According to the experts' opinions, 'engaging', 'education', and 'institutional cooperation' are considered to contribute the most to the feasibility of the majority of the theses (T1-T4).

A summary of the respondents' assessment of the barriers to the feasibility of the thesis is presented in Figure 8. The values of indicators vary in the range from 65.41 to 84.80.

In relation to Thesis 1. European Union's policy will obligate universities to implement and monitor the principles of sustainable development, the most significant barrier is B3 – limited funds for financing university projects for sustainable development (indicator value: 79.58). Another obstacle to the thesis implementation may be B1 – lack of engagement from university authorities in integrating sustainable development principles into the strategies, actions, and policies of the entire university system (indicator value: 78.66). Other barriers include: B5 – lack of support from government agencies in implementing sustainable development principles at universities (indicator value: 74.04), B4 – lack of clear guidelines on formulating sustainable development strategies for universities (indicator value: 73.88) and B2 – insufficient competencies of university staff regarding the principles of sustainable development (indicator value: 73.71). The least burdensome barrier might be B6 – low level of technological advancement of universities (e.g., in energy management, water consumption, etc.) (indicator value: 65.85).

For Thesis 2. Universities will play a fundamental role in creating and developing innovations and products in line with the principles of sustainable development, the most significant barrier may be B3 (indicator value: 83.35). It is important to note that B1 may also be of significant importance (indicator value: 79.50). Similar to Thesis 1, barrier B6 might be the least significant (indicator value: 66.79).

Analysing the results related to Thesis 3. European Union countries will invest additional financial resources in the sustainable development of universities to fulfil the objectives of the European Green Deal, the most burdensome factors also turned out to be B3 (indicator value: 77.68) and B1 (indicator value: 77.00). B4 obtained a similar indicator value.

The implementation of Thesis 4. In educating students for the needs of the future European job market, universities will focus on developing key competencies for sustainable development undoubtedly can be hindered significantly by B1 (the highest indicator in the study: 84.80), and the least by B6 (indicator value: 65.41).

In the case of Thesis 5. Technologies based on artificial intelligence will aid universities on their path towards sustainable development two barriers are particularly significant: B3 (indicator value: 78.21) and B2 (indicator value: 78.02).

According to the experts' opinions, 'lack of engagement from university authorities,' 'insufficient competencies of university staff' and 'limited funds' are considered to be the most significant factors that can hinder the implementation of all the theses.

The implementation of sustainable development principles in universities largely depends on the attitude of authorities, the willingness of staff to develop, the ability to collaborate with various entities, and the acquisition of funding. These factors can be both the greatest support and the greatest constraint in achieving Sustainable Development Goals. The experts also emphasize this in their comments: 'universities should create a conducive atmosphere for research, provide financial support, and collaborate with businesses for technology transfer. International cooperation: participation in international exchange programs and collaboration with universities from other countries expand opportunities for students and faculty, fostering the exchange of knowledge and ideas.' Literacy and competencies are essential to enable critical thinking on effective action. This combined with external and internal policy drivers with implementation timelines and funding support then buoys the universities forward.

The universities must create a culture of sustainable development. 'University leaders should be pushed towards personal development: getting touch with themselves, their personal needs and personal values. After that they should be trained in upholding their ethical values in their working environment. They should be supported to a nurturing team surrounding them. Such micro-communities could change university culture so the sustainable development process might be taken in a fair and just way.' For the sustainable development of universities, it is necessary to take a number of actions covering various aspects of university activities: development and implementation of a development strategy.

The study also assessed the strength of the theses' impact on stakeholders (Figure 9). The values of indicators vary in the range from 57.87 to 88.98.

Regardless of the statements presented in the theses, it is clear that the highest values of the indicators were obtained for the impact of the theses on scientists/researchers who are among the main stakeholders of the implemented research. High scores for the theses' impact indicators were also obtained for teachers, students as well as companies and industries. In contrast, the lowest indicator values, regardless of the thesis, were obtained for NGOs and special interest groups, e.g., volunteer contributors.

The experts acknowledge that sustainable development is essential for universities to establish responsible and resilient academic institutions capable of meeting the needs of present and future generations. Achieving sustainable development in universities necessitates a long-term and comprehensive commitment to environmental, social and economic responsibility. 'Universities play a vital role in educating future leaders and can influence positive change in society through their own sustainable practices and the values they instil in students and staff.' Building relationships with decision-makers at various levels is also important.

University researchers, academic staff and students should work in partnership with citizens, the private and the public sector, co-creating in this way knowledge to produce solutions required for sustainable development.

4. Discussion

The expert study shows that the main priorities of sustainable development – operating responsibly and with future generations in mind – are part of the basic objectives of higher education. It is not surprising, then, that the argument that sustainable development can be seen as the fourth mission of Higher Education Institutions (HEIs) is often cited in the literature (Hueske et al., 2022; Ozdemir et al., 2020; Bien & Sassen, 2019). Universities, as leaders of intellectual social and economic life, can set the course for activities conducive to the implementation of the Green Order strategy on many levels: didactic, scientific, organisational, as well as being centres of innovation, culture, awareness and social activity (Cuesta-Claros et al., 2022; Berchin et al., 2021; Szydło & Grześ-Bukłaho, 2020).

The respondents to the survey underline that sustainable development at universities is a continuous process that requires commitment, collaboration and a holistic approach covering different aspects of university activities: academic, financial, administrative, social, campus operations etc. To ensure the sustainable development of universities, it is necessary to take a number of actions and measures

that will contribute to improving the quality of education and the competitiveness of educational institutions.

It is therefore not surprising that the results of the study unequivocally confirm theses T1 – T3. Parr et al. (2022) observe that 'if universities do not embrace the 2030 Agenda, it will be difficult, even impossible, to achieve.' Although the institutional context recognizes the importance of the role of HEIs in achieving the Sustainable Development Goals (SDGs), the respondents point to the expectations of higher education institutions regarding the implementation of the new regulatory framework by the European Union, which on the one hand will force action in this area in HEIs, and on the other hand – will create new rules for financing higher education. The study thus shows that real efforts to implement the SDGs are lagging behind in many academic centres which are waiting for the establishment of new guidelines and new funding rules. Thus, previous studies indicating that HEIs are predominantly in the early stages of SD are confirmed. For instance, Aleixo et al. (2018), assuming five stages of implementing SD: (i) innovators, (ii) early adopters, (iii) early majority, (iv) late majority and (v) laggards, claims that the majority of Portuguese higher education facilities are currently at the stages: laggards and late majority. They also add that although universities are beginning to consider all dimensions of sustainable development in their strategic and communication plans, the majority of practices related to these dimensions still remain in the planning stages. It seems, therefore, that HEIs themselves should undertake broader actions to accelerate their transition towards sustainable development. As noted by Hueske and Guenther (2021), international and national institutions can be both drivers for the implementation of SDGs in HEIs, but on the other hand, they may contribute to the creation of new legislative barriers and inefficiencies in the allocation of public funds.

The experts also unanimously confirm thesis T4. As Sady et al. (2019) indicate, 'there is a consensus among researchers that universities play an important role in meeting the challenges of sustainable development through education.' The majority of academic literature explorers highlight the role of education as a tool for the implementation of SDGs (Serafini et al., 2022).

Still, a relatively lowest number of responses 'very high significance' concerned thesis T5. Although it was confirmed, the experts were divided on the scope of using technologies based on artificial intelligence (AI) in achieving SDGs. This can be explained by the research by Vinuesa et al. (2020), who observe that AI might impact – both positively and negatively – all aspects of sustainable development. They find that AI can enable the accomplishment of 134 targets agreed in the 2030 Agenda for Sustainable Development across all the 17 SDGs, but it may also inhibit 59 targets. However, that add that 'the fast development of AI needs to be supported by the necessary regulatory insight and oversight for AI-based technologies to enable sustainable development. Failure to do so could result in gaps in transparency, safety, and ethical standards.' This does not change the fact that current and future managers of HEIs must be prepared to understand and leverage opportunities related to the use of modern technologies as a supporting tool for SDGs (Goralski & Tan, 2020).

The respondents of the study also point out the main barriers to the implementation of sustainable development, which are: i) lack of engagement from university authorities in integrating sustainable development principles into the strategies, actions and policies of the entire university system, ii) limited funds for financing university projects for sustainable development, but also iii) lack of clear guidelines on formulating sustainable development strategies for universities. This is confirmed by Hueske and Guenther (2021), who also identify these barriers as crucial to improve sustainability implementation strategies in institutions of higher education. The results of the study also correspond to previous findings by Blanco-Portela et al. (2018, 2017). Many scientists conclude that HEIs, as slow-moving institutions, are resilient to change (Hueske & Guenther, 2021; Filho et al., 2019; Lozane et al., 2013).

Therefore, the authors of this paper wish – based on additional comments and suggestions of the experts – to propose the Framework of implementation of SDGs in HEIs (Figure 10).

The authors propose a framework by identifying four main areas.

1. Institutional framework:
    - Regulatory support:
        - modernization of the entire education system in terms of implementing SDGs and making education and research for sustainable development a priority;

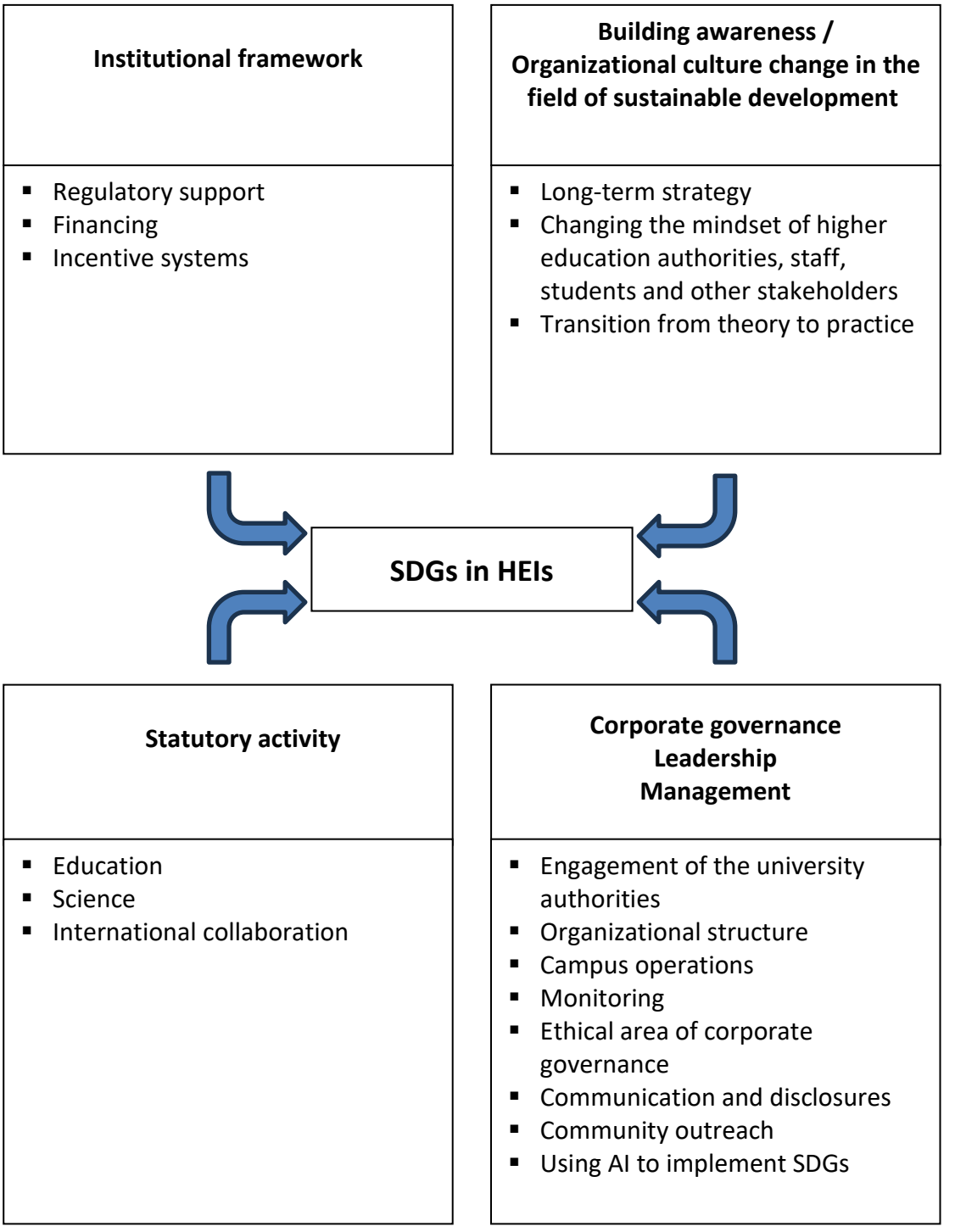

Fig. 10. Framework of implementation of SDGs in HEIs
Source: own study based on the comments of the experts.

- limiting funds for actions contrary to the sustainable development goals of universities.

- Financing:
  - funding universities in their three core activities: teaching, research and knowledge transfer;
  - assigning funding sources to actions for sustainable development.
- Incentive systems:
  - creation and implementation of dedicated programs and supportive tools for supporting sustainable development;
  - development of programs supporting the green transformation of HEIs, especially in terms of infrastructure;
  - establishment of funds or grants supporting sustainable development projects initiated by scientists, educators and students.

2. Building awareness / Organizational structure change in the field of sustainable development:
   - Long-term strategy:
     - reclaiming the role of the university as an active entity in the necessary ecological-social transformation of European society;
     - defining a strategic plan tailored to achieve sustainable development goals;
     - establishing a roadmap for reducing the emission balance of HEIs by 2050.
   - Changing the mindset of university authorities, staff, students and other stakeholders:
     - supporting a culture of sustainable development through awareness campaigns, events and initiatives conducted by both the academic staff and students;
     - developing skills in the field of sustainable development and climate change as well as basic competencies enabling effective action for sustainable development (e.g., future-oriented thinking, systemic thinking, etc.).
   - Transition from theory to practice:
     - practical application of knowledge, skills, and research conducted for sustainable development;
     - involvement of all employees (from top to bottom), students and external stakeholders in the implementation of SDGs.
3. Statutory activity:
   - Education:
     - continuous professional development for lecturers and the entire university staff (a significant portion of academic teachers may have never received formal education related to sustainable development);
     - creating spaces for employee development (training and education, support for development);
     - integrating SD concepts into a wide range of university programs in curricula, syllabi and learning outcomes;
     - adopting a holistic approach to teaching methodology;
     - implementing modern teaching methods;
     - introducing new subjects into educational programs related to education for sustainable development (e.g., sustainable development economics, innovation management for sustainable development etc.).
   - Science:
     - promoting and stimulating scientific research and research projects aimed at expanding knowledge about sustainable development and their transfer to society;
     - supporting research and innovation focused on energy-efficient technologies, ecological materials and sustainable practices;
     - ensuring closer interdisciplinary collaboration;
     - creating a motivational system that includes the awarding of rewards for research achievements with SD themes.
   - International collaboration:
     - participation in international programs fostering the exchange of experiences, the application of best practices and ideas in the implementation of sustainable development. Inspiration can be drawn from several advanced universities that educate and apply the principles of sustainable development.
4. Corporate governance / Management / Leadership:
   - Engagement of university authorities:
     - convincing employees that changes in strategies to achieve SDGs are essential;
     - coordinating actions in the process of implementing the strategy;
     - setting and monitoring sustainable development goals, regularly assessing progress and continuously improving actions for sustainable development;
     - reducing tension and resistance to change.

- Organizational structure:
  - optimization of the organizational and competency structure for sustainable development;
  - creating dedicated units and positions in the organizational structure, e.g., Chief Sustainability Officer.
- Campus operations:
  - efficient management of existing resources;
  - implementation of measures to reduce the consumption of utilities (electricity, water, heat, natural gas, fuel, etc.), typical office materials (paper, toner, etc.) and minimizing the generation of municipal waste and air-polluting emissions;
  - creation and maintenance of green areas on campus, promotion of biodiversity, and education of students and staff on local ecosystems;
  - construction and renovation of buildings in accordance with principles of green and sustainable design, including efficient insulation, renewable energy, and green roofs.
- Monitoring:
  - incorporating environmental indicators in performance assessment and managerial reporting;
  - implementing procedures for collecting and aggregating data, including identifying data sources as well as control mechanisms to monitor the effectiveness of processes aimed at achieving SDGs.
- Ethical area of corporate governance:
  - maintaining the principle of diversity, tolerance and non-discrimination regarding the employment structure at every level of the organization and in relation to salaries;
  - conflict of interest management;
  - charitable activities;
  - efforts towards transparency in managerial processes and the application of objective criteria within them.
- Communication and disclosures:
  - developing a process for communicating information to stakeholders about the university's activities and outcomes in environmental, social and management areas;
  - establishing standards and reporting cycles for issues related to sustainable development.
- Community outreach:
  - collaboration with other universities, non-governmental organizations, government agencies and partners to leverage resources, share best practices and promote sustainable development;
  - collaboration with local communities.
- Using AI to implement SDGs:
  - increased involvement in the development of artificial intelligence technologies in the activities of universities, including the implementation of sustainable development;
  - improvement of material and technical infrastructure for the implementation of AI technologies;
  - developing stronger IT skills and future-oriented thinking in education and management (e.g., in the design of teaching programs, evaluation).

It should be noted that – in addition to indications of drivers of SDGs – the responses of the experts also included statements suggesting caution in the uncritical implementation of SDGs in HEIs. The experts pointed out that sustainable development, while crucial, should not be the sole determinant guiding the evolution of the university system and its adaptation to contemporary challenges. Many experts emphasized that the fundamental principle should be a thorough explanation of the advantages and disadvantages of the applied solutions in the field of SD, and the creation of a balance between potential benefits and risks. In their view, the benefits arising from the implementation of SD principles in one area should not be offset by losses in other areas. The role of HEIs should therefore be to reduce information noise related to SDGs, counteract the particular interests of the green business, prevent greenwashing, and, above all, counteract the waste of resources: time, effort, energy, and financial resources allocated to often centrally imposed solutions.

Conclusions

In summary, the future of European universities on the path to sustainable development involves a comprehensive and integrated approach that encompasses education, research, campus practices, international collaboration and societal engagement. It requires a commitment to fostering a sustainable

mindset among students, faculty and staff, and actively contributing to the broader global efforts toward a more sustainable future.

The article addresses the incorporation of SDGs into higher education. This research will contribute to the foreseeable future directions of the sustainable development of universities. The results obtained by this study indicate that transformations of universities are necessary. In this study, based on expert recommendations, the authors outline the framework for the implementation of SDGs in HEIs, relying on four key factors: Institutional framework, Building awareness / Organizational culture change in the field of sustainable development, Statutory activity, and Corporate governance / Leadership / Management. The uniqueness of our holistic approach lies in specifying the elements of successful achievement of sustainable development goals in HEIs, covering strategic, operational and functional areas. The authors of this study also emphasize that one of the most crucial determinants of SDGs implementation is changing the attitudes of all stakeholders of HEIs – both internal and external – and creating incentive systems at the institutional and individual levels.

This study aims to present an integrated view of higher education in the context of sustainable development actions and identify key factors for success in implementing SDGs. The proposed concept can serve as a guide for university managers who wish to implement or enhance the status of sustainable development in their academic institutions. It serves as a reference point in identifying drivers and barriers of sustainable development in universities, aiming to inspire and support the former while effectively addressing the latter. It may also assist in identifying and planning targeted actions at the university level to make the transition to sustainable development more evolutionary. The results of this study suggest significant implications for controlling departments at universities and individuals involved in developing new strategies. The article can also contribute to increasing awareness among researchers about sustainable development actions and stimulate them to address research gaps observed in the subject matter.

The study also has its limitations. The presented analysis represents the perspective of selected experts, individuals involved in this field. The perception of this issue by other stakeholders may be drastically different. While the employed research methods aim to minimize the subjectivity of expert assessments, it cannot be ruled out that the obtained results in this study might differ when applied to different respondents. Another limitation – and simultaneously a suggestion for future research – is the lack of stratification of the studied sample based on the type of HEIs: universities, technical universities, academies of applied sciences, etc., and on public and private institutions. It also seems reasonable to conduct similar studies in the future, taking into account the respondents' prior involvement in SD issues at their respective institutions.

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