Reshaping Teaching for Sustainability in Business Engineering – A Pilot Study on Students' Outlooks and Learning Expectations

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Abstract

In the context of the rapid pace of technological advance, increasing technological interconnection and the shift toward sustainable economies, education is required to provide graduates with knowledge and skills to address the complex challenges posed by the fast-moving, globalized and interconnected world. Engineering education has gained particular importance, going beyond the technical knowledge and preparing students for entrepreneurial actions through the acquisition of hands-on, operative capabilities to drive new business models, integrating complex issues of technological change and digitization, environmental and socio-economic concerns.

The authors have undertaken a quantitative survey aiming at investigating the students' outlook on modern sustainable development concerns and collecting relevant learning needs in a wide range of sustainability-related directions.

The survey results stressed improvement solutions to augment teaching for sustainability in the case of business engineering areas such as a) embedding interdisciplinary topics into existing curricula linked to SDGs instead of creating new disciplines; b) developing and leveraging core shared values of citizenship for further learning across the entire curriculum and emphasizing the interrelatedness of knowledge, skills, attitudes and values; c) facilitating interdisciplinary knowledge for understanding and solving complex business and engineering problems; d) enhancing students' intellectual maturity and critical thinking to act in responsible ways, coping with new realities and demands.

Finally, the authors shared their views on the need to provide tailored content and quality information with differentiated knowledge about topics from different areas which might induce transformational change in local curricula to foster a sustainable mindset of graduates.

Keywords: education for sustainable development, sustainable development goals (SDGs), knowledge, values, quality education

1. Introduction

In the light of the twin challenges of the green and the digital transformation, political and strategic decisions factors of the European Union consider sustainability and individuals' well-being at the forefront of economic policy, in the joint attempt to rethink policies for clean energy supply across the economy, industry, production and consumption, transport, food and agriculture, construction, and social benefits. Likewise, accelerating the shift toward sustainable economies includes concrete measures to protect and restore natural ecosystems, sustainable resources utilization, improve human health,

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and promote and invest in the necessary digital transformation and tools as these are essential enablers of the changes (European Commission COM (2019) 640 final).

A fast-moving, globally connected, and interconnected world presents society with a number of difficult challenges that demand knowledge and skills that education can provide. In this setting, education is necessary to stay current with technology and other social and economic changes. Hence, higher education plays a critical role in empowering students with high-level skills that allow them to boost their professional, social and personal development. According to the European Skills Agenda, higher education institutions must change in order to better align with the economic environment and ensure that graduates have the knowledge and skills needed by the twin transitions since the labour market and societal landscape are changing quickly (European Commission COM (2020) 274 final).

The strategic framework for European cooperation in education and training emphasizes that institutions of higher learning must adapt their organizational growth to take into account the green and digital facets of teaching and learning for sustainability (Official Journal of the EU, C66/01, 2021).

In this view, there is an increasing need to ascertain current students' outlooks and related learning needs, especially in business engineering education since it has acquired a particularly importance arisen of the interdisciplinary character of the academic curriculum, going beyond the technical knowledge and preparing students for entrepreneurial actions as well as the acquisition of hands-on, operative capabilities.

The paper aims to decipher the current knowledge and understanding of a wide range of sustainability-related directions, fully embedded in the Sustainable Development Goals (SDGs), considering the leading role of education, especially higher education, in providing learners with knowledge, skills, values and attitudes that contribute to the culture of sustainable development. The unit of analysis consisted of a sample of undergraduate students enrolled in the business engineering area at a technical university in Romania as future business engineers required to overcome the challenges arising from major changes in the economy due to the shift to the green economy and digital-rich workplace. To this end, the authors have undertaken a quantitative survey aiming at investigating the students' outlook with regard to modern sustainable development concerns and collecting relevant learning needs in a wide range of sustainability-related directions.

Under these conditions, the education area, especially the business engineering education, gains valuable insights because it has to overcome the challenges arising from the interdisciplinary character, going beyond the technical knowledge and preparing students for the future business market requirements, supporting to advance the technological and innovative outputs, driving innovation, competitiveness and growth.

The paper commences with an updated literature review on modern trends related to sustainable development concerns, paying careful attention to the issues and multidimensional nature of education for sustainable development and related core values indispensable for the sustainable development of businesses, and society as a whole. Furthermore, the survey put the thematic focus on the emerging knowledge on economic, social and environmental performance which may enable cross-fertilization among sustainability-related learning topics in the business engineering field, in the attempt to

induce transformational changes toward integration of thematic areas of education for sustainable development into local curricula, teaching and learning practices.

2. Theoretical background

The quest for core values necessary for sustainability as an overarching mindset has drawn particular attention and the leading organizations and strategic decision-making bodies have set up several principles needed to be followed by businesses and society alike. In this view, the UN Global Compact proposed its view on underlying values that support sustainability culture, proving a set of 10 principles that guide all businesses regardless of size, complexity and location. The universal principles have been grouped into four main categories covering the areas of human rights, labour, environment, and anti-corruption which support the coherent endeavour of companies to deliver value for the society in financial, environmental, social and ethical terms. Each category unfolds adequate principles which finally embrace the company's values system and a principled approach to doing business (UN Global Compact, 2014). A broader approach on the matter of baseline values was introduced by the European Pillar of Social Rights and its subsequent action plan that promote 20 principles to further strengthen Europe, by carefully considering climate change and environmental challenges, digitalization, globalization and demographic trends. To increase the sustainable competitiveness of Europe, this framework advocates for core values grouped in three categories (i.e. education, training and lifelong learning, fair working conditions, social protection and inclusion) putting great emphasis on the social side and citizens' well-being rather than considering only the narrow approach of doing businesses side (European Commission COM (2021) 102 final). In this regard, Table 1 presents a blueprint of both visions striving for a sustainable and inclusive growth model that delivers the best for people and the planet.

Notably, both visions are mutually reinforcing and are laying the foundation for implementing the United Nations' 2030 Agenda and sustainable development goals. As outlined in table 2, this framework includes 17 indivisible, interconnected goals that balance the economic, environmental, and social facets of sustainable development. Looking at the education and training area, more exactly to quality education (SDG 4), teaching and learning for sustainability are carefully addressed by subsequent target 4.7 in terms of "by 2030 all learners acquire the knowledge and skills needed to promote sustainable development" (UN 2030 Agenda, 2015).

Table 1. The blueprint with baseline principles for sustainability

United Nations Global Compact – focused on core values for sustainable businesses	European Pillar of Social Rights – focused on core values for a sustainable society
1. Human rights: - ensuring that there is no complicity in violations of human rights; - supporting and respecting the preservation of internationally recognized human rights.	**1. Education, training and lifelong learning:** - education, training and lifelong learning; - gender equality; - equal opportunities; - active support to employment.

2. Labour: - the eradication of all types of coercive and compulsory labor; - the effective outlawing of child labor; - the freedom of association and the effective acknowledgement of the right to collective bargaining; - the prohibition of discrimination and respect for employment and occupations.	2. Fair working conditions: - secure and adaptable employment; - wages; - information about employment conditions; - social dialogue and involvement of workers; - work-life balance; - healthy, safe and well-adapted work; - environment and data protection.
3. Environment: - promoting a cautious approach to environmental issues; - launching campaigns to urge the highest level of environmental responsibility; - promoting and disseminating eco-friendly technologies.	3. Social protection and inclusion: - child care and support to children; - social protection; - unemployment benefits; - minimum income; - old age income and pension; - health care;
4. Anti-corruption: - combat corruption in all its manifestations, including extortion and bribery.	- inclusion of people with disabilities; - long-term care; - housing and assistance for the homeless; - access to essential services.

Table 2. The framework of SDGs and sustainable development pillars

United Nations Sustainable Development Goals – SDGs	Pillars of sustainable development
SDG1. No poverty	Economic
SDG2. Zero hunger	Economic
SDG3. Good health and well-being	Economic
SDG4. Quality education	Social
SDG5. Gender equality	Social
SDG6. Clean water and sanitation	Environmental
SDG7. Affordable and clean energy	Environmental
SDG8. Decent work and economic growth	Social
SDG9. Industry, innovation and infrastructure	Economic
SDG 10. Reduced inequalities	Social
SDG11. Sustainable cities and communities	Social
SDG12. Responsible consumption and production	Economic
SDG13. Climate action	Environmental
SDG14. Life below water	Environmental
SDG15. Life on land	Environmental
SDG16. Peace, justice and strong institutions	Social
SDG17. Partnerships for the Goals	Social

Current studies devoted their attention to track and measure the achievements of countries with respect to the progress toward sustainable development goals. In this view, the 2022 Report on SDG Index ranking and score, an aggregation of 94 global indicators that provides a comprehensive assessment of distance to SDGs targets, placed Romania in 30th place out of 163 countries, having an overall score of 77.7 out of 100 points, in

comparison with, for example, Finland placed firstly of the country list with an overall score of 86.5 and Italy ranked on 25th place having a score of 78.3. Worryingly, the overall Romania country performance for quality education (SDG4) is decreasing, highlighting major challenges faced by the education system in achieving related targets. However, the report stresses that achieving the SDGs is fundamentally an investment agenda, and policymakers at the local, national, and regional levels should facilitate a significant increase in funding for the SDGs, especially in education, health care, infrastructure (e.g. green energy, digital access, water and sanitation, transport), and environmental conservations (Sachs et al.., 2022).

The issue of sustainability in education has drawn the attention of researchers who have highlighted the special qualities of education for sustainability as a novel concept of changes to educational activity, as a mechanism of realization of strategy of sustainable development, and as an instrument of modernization of educational practice, and as one of the foundations of modern educational quality and continuity standards. They argued that particular attention needed to be dedicated to environmental education viewed as an adequate instrument for the systematic formation of critical thinking, environmental worldview, subjective-value approach to the environment, and eco-cultural values (Karpan et al.., 2020).

In an effort to link the SDGs to educational learning outcomes, other studies contextualized sustainability as a goal for education and built frameworks. A framework for rethinking education as a systemic tool for transformative social change was proposed by Kioupi and Voulvoulis (2019) using the systems thinking approach, taking into account the conceptual framework, institutional capacity, timeline, and resources available to the educational redesign process. They emphasized three stages for a proper connection between the SDGs and educational outcomes, including visioning, developing a participatory vision of the sustainable state, identifying the conditions necessary for the sustainable state, determining the types of competencies citizens must develop to realize that state and the instructional strategies that ought to be used to assist the development of competences, and the monitoring and assessment indicators that will give the system information.

Looking at the role of higher education institutions in the context of the UN 2030 Agenda and the perception of students and educational leaders with regard to the employability skills of graduates, Yusuf and Jamjoom (2022) figured out that curriculums which prioritize technical skills and deemphasize soft skills are unsustainable, and job readiness skills such as communication and interpersonal skills, teamwork, leadership, digital fluency, and creativity emerged as critical aspects of achieving sustainable employability. Also, the study argued that all stakeholders should partake in the development of initiatives and programs that intensify transversal employability skills, and the inputs from industry leaders can be especially useful as they often have first-hand experience.

The concern for having well-prepared teachers for education for sustainability was also addressed by the current studies which stressed the need to shape the necessary characteristics of teachers, more adapted to the needs of sustainable development of value-cognitive. Galtseva et al. (2020) revealed the lack of needs and values of teachers and value-methodological principles of integration of environmental and humanistic values into the education process. The institutional framework of education for sustainable development

may be standardized and organizationally designed, which would enable far more effective steps to realign the educational process to foster new values and social ties at the national and regional levels.

The role of quality assurance in education for sustainability was analyzed, being considered as an underexplored area that requires particular attention in the attempt to achieve the ambitious goals of Agenda 2030 which include a call for transformational learning and quality. The scholars found little support for transformative learning for sustainable development in most quality assurance frameworks, with the explicitly support only in the case of the United Kingdom, and to a lower extent in the case of Estonia, Romania, Sweden, Switzerland and Ukraine. The study highlighted the need for a paradigm shift in how sustainable development can be accomplished, moving beyond the limited use of "student-centred learning" and "active learning" as the primary tools for approaching transformative learning, and additional self-reporting framework for measuring sustainability performance shall be used (Janssens et al., 2022).

The current scientific literature also embodies the quest for engineering education in the context of sustainable development concern. Nikolić et al. (2021) found out that the number of technical faculties dedicated to the holistic development of engineering competencies for sustainable development is still limited, despite greater recognition of the need and the importance to integrate the concept into the engineering curricula. They advocated for an integrative approach which implies that sustainable development becomes an integral part of the entire curriculum, and a wider intertwining of sustainable concepts as a notion with the regular courses offers greater opportunities for students through raising awareness and responsibility for the environment and the societies.

Albeit multiple studies in the literature have been dedicated to exploring different facets of education in the pursuit of integrating all bottom lines of sustainable development into the current academic practices, there is a considerable need for further inquiries into educational contexts that are responsible for both sides of specializations i.e. technical and business, providing students with knowledge, skills, and attitudes needed to drive new business models that integrate complex issues of technological change and digitization, environmental and socio-economic concerns.

3. Research methodology

The methodological flow comprised of research objectives with respect to capturing the opinion and expectations regarding sustainability-related concerns in the attempt to ascertain the reaction of learners and their customized learning needs for economic, environmental, and social themes. The research variables and subsequent operational components were defined and the measurement scales and related scaling techniques were considered to accomplish the research objectives as per: a) measuring the perception of sustainable development concerns; b) assessing the degree of knowledge related to sustainability in terms of tacit and explicit knowledge; c) quantifying the students learning needs for enhancing the understanding of cross-disciplinary views on economic, environmental, and social themes.

In this regard, Table 3 depicts the structure of the survey with the linkage between research objectives, research and operational variables, and related measurement scales and

techniques. The questionnaire was built on 9 (nine) questions considering the nominal scale and 6 (six) questions based on ordinal (Likert) scale.

The nominal scale was used to measure the extent to which students are aware of SDGs and related economic, environmental, and social performance of businesses striving to achieve excellence in their operations as well as to quantify the tacit knowledge related to major sustainability-related criteria to be used when choosing the employer. The transition to emerging job opportunities requires students to prioritize job offers based on major criteria such as manufacturing and/or selling sustainable products and/or services, running responsible operations, philanthropic engagement in the local community, building partnerships for the SDGs, and disclosure of non-financial information as part of the employer commitment toward sustainable development (Global Survey on Sustainability and SDG, 2020).

To properly assess the students' commitment toward a sustainable lifestyle, a set of core values was used as a baseline that fosters a sustainability mindset and responsible behaviour and promotes responsible actions. The following values were selected to be analyzed since these play a crucial role in personal development, disposing individuals to be open to learning and change (Sala et al., 2020; Official Journal of the EU, C326/02, 2012):

• the respect for human rights and freedoms – in terms of dignity, justice, citizen's rights, etc.;

• the respect for fundamental EU freedoms – in terms of free movement of goods, capital, services, and labour;

• valuing cultural diversity - respect for how ideas and meaning are creatively expressed and communicated in different cultures;

• democracy in the society – that reflects the commitment to equal rights, freedom of speech and a fair trial and tolerance view of minorities;

• social justice – the fairness in relations between individuals in society and equal access to wealth, opportunities, and social privileges;

• fairness of educational/working systems – as the basis of responsible education and fair working conditions;

• the principles of equality and solidarity – equality in terms of law, cultural diversity, non-discrimination; solidarity as a fundamental right of collective bargaining and action;

• gender equality as a fundamental human right offering equal opportunities for both men and women to compete for professional opportunities;

• the rule of law – in terms of accountability, stability, equality and access to justice for all.

Table 3. The framework of the research process

Research objectives	Research variables	Operational variables	Measurement scales & scaling technique
O1. To measure the perception of sustainable development concerns	Awareness	17 SDGs (Sustainable Development Goals)	Nominal scale & distribution of frequency
		Economic, Environmental and Social performance	
O2. To assess the degree of knowledge related to sustainable development	Tacit knowledge	The core values as the baseline for sustainability	Interval scale & Likert technique
		The relevance of major sustainability-related criteria in choosing the employer	Nominal scale & distribution of frequency
	Explicit knowledge	The degree of adoption of sustainability measures for leaving a more sustainable	Interval scale & Likert technique
O3. To quantify students' learning needs on sustainable development	Self-expectation on economic themes	Sustainable procurement practices; competition, fair-trade regulations and practices; green business, finances and investments; resource efficiency through sharing economy; sustainable consumption and production; innovation & product responsibility; etc.	Interval scale & Likert technique
	Self-expectation on environmental themes	Environmental compliance; supplier environmental assessment; circular economy – green production; circular economy – green consumption	
	Self-expectation on social themes	Green jobs and community engagement; sustainable employments; social and labour protection; occupational health and safety; diversity and equal opportunities; sustainable lifestyle and education	
Demographic of the sample	Gender	Masculine, feminine	Nominal scale & distribution of frequency

To further analyze the measures adopted by respondents in their pursuit to live more sustainable, a set of concrete actions were used to evaluate the degree of promoting responsible behaviour in both professional and personal decisions as follows: buying goods and services, choosing the employer, making financial decisions, adopting education decision, choosing the energy provider, political voting, food and nutrition decisions,

transport decisions, and leisure activities. To this end, the Likert scale was used to yield the highest level of information feasible.

The survey logic was further linked to the critical role of higher education to equip students with the knowledge they need to conduct themselves responsibly in the workplace and to embrace sustainability in all aspects of their daily lives as students, consumers, employees, and cirizens. Higher education is inextricably linked to sustainability in this area thanks to the disciplines that are integrated throughout the curriculum.

As acknowledged by the 2030 Agenda for Sustainable Development, the quality education (SDG4) and its related target 4.7 address the need of learners to acquire knowledge and skills for promoting sustainable development, the sustainability education is then viewed as a critical enabler for transformative learning and for fulfilling all the other goals (SDGs) and targets. Notably, the achievement of sustainable development is possible only with the integrated and balanced approach of all three dimensions of economic, environmental, and social aspects (UN 2030 Agenda, 2015).

In the attempt to address the complex challenges of teaching and learning for sustainability, the survey puts the thematic focus on a broad range of topics/subjects needed to be taught to business engineering students since they are required to integrate concepts and practices to innovatively solve the world issues. This lead to the need to empower students with a broader understanding of evolvable sustainability issues and their complexity, to make connection among different concepts, ideas, facts and figures to complete comprehend reality in connection to various contexts (local, national, global) and environment, social, economic, and cultural concerns.

The concern for a coherent body of knowledge is essential for facilitating sustainable development and has been approached by a range of scientific studies and literature which are thoroughly concentrated on the content of Global Reporting Initiative standards (GRI, 2016). To this end, corresponding subjects were selected to find out how the students understand the quest to integrate the economic, environmental, and social themes into the sustainable development concept. They were asked to judge the utility of each of the following subject topics for a better understanding of sustainability-related directions:

- *Economic performance* – sustainable procurement practices; competition, fair-trade regulations and practices; green business, finances and investments; resource efficiency through sharing economy; sustainable consumption and production; innovation & product responsibility; corporate social responsibility; social entrepreneurship.
- *Environmental performance* - environmental compliance; supplier environmental assessment; circular economy – green production; circular economy – green consumption.
- *Social performance* - green jobs and community engagement; sustainable employments; social and labour protection; occupational health and safety; diversity and equal opportunities; sustainable lifestyle and education.

Although the scope of the survey is limited to the students' self-expectations with regard to the learning needs on sustainable development, it might induce useful insights on reshaping the necessary subjects to be taught in the attempt to foster a sustainability mindset through a holistic approach.

4. Results and discussions

The survey was based on a questionnaire designed for the target group population consisted of students in the business engineering area within the envisaged technical university. The pull of data was collected through an online survey distributed to a sample size of 100 students in the third year of the study program, based on volunteer self-selection criteria and not probabilistic and just 67 of them responded to the survey. As regards the gender balance, the sample structure was rather unbalanced with 34% masculine and 66% feminine which is a relatively usual representation in this field of study. The authors used MS Office software program for statistical analysis and elaboration of graphs.

Analysis of the degree of awareness concerning SDGs shows that the most frequently known goals for the students in the business engineering field are quality education (SDG4 –known by 85.71%), responsible consumption and production (SDG12 – known by 85.71%), and climate action (SDG13 –known by 78.57%) whereas the least frequently known goals seem to be zero hunger (SDG2 – rather unknown by 64.29 %), life below water (SDG14 – rather known by 64.29%), no poverty (SDG1 – rather unknown by 57.14%) and partnership for the goals (SDG17 – rather unknown by 57.14%) (figure 1). These results shed light that significant work remains to be done to raise awareness of the SDGs in the joint attempt to achieve all seventeen goals of sustainable development. Accordingly, higher education institutions are required to provide customized content and quality information on the value of SDGs goals for the benefit of students, individuals, organizations, and society as a whole.
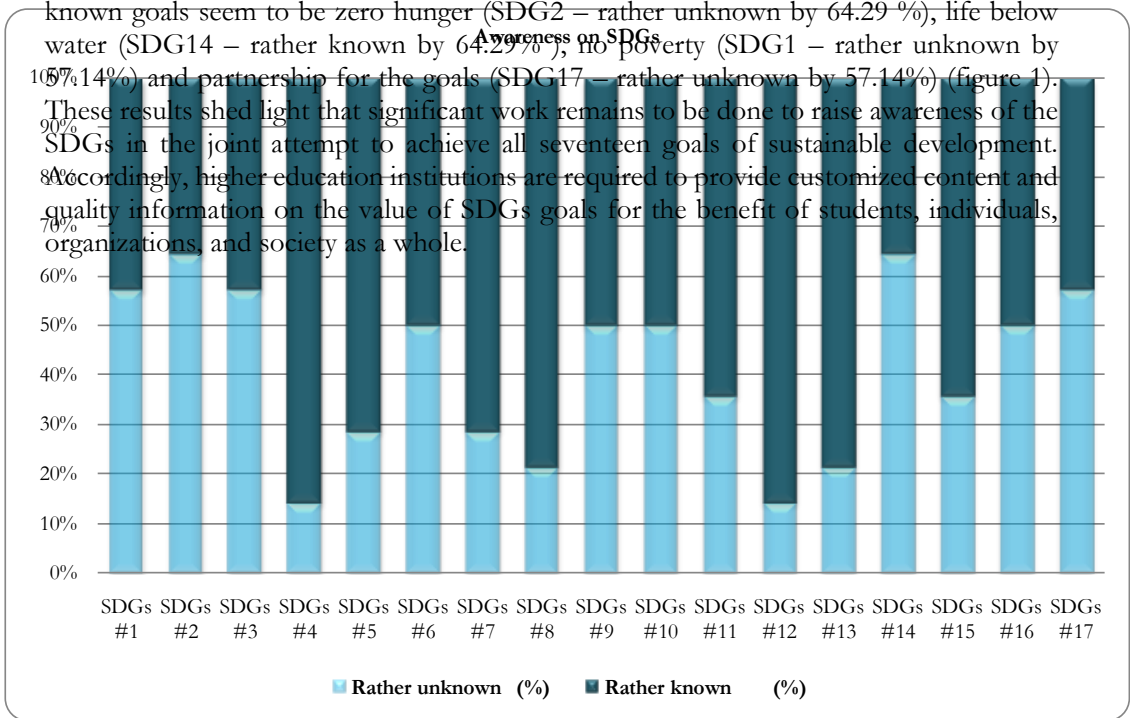

Fig. 1. The students' awareness of SDGs
Source: Authors analysis based on the survey collection data

Looking at the pillars embraced by the sustainable development concept, the students were asked to mention their degree of exposure to economic, environmental, and social performance topics during their academic period. The results reveal that 88% of students were exposed to economic performance concepts, followed by social performance marked by 87% of them whereas the environmental performance was selected by 70% of the

sample (figure 2). The results are explained by the content of the business engineering curriculum designed in favour of business and economic disciplines whilst the issues with preserving and repairing natural ecosystems and resource sustainability and preservation of the natural environment are less approached. Therefore, careful attention shall be paid to the potential trade-offs between learning objectives for the economy, society, and environment concerns since all these dimensions are closely related and mutually supportive.

The student's awareness of the goals and dimensions of economic, social, and environmental performance is of utmost importance for understanding the interrelationships between information, events and actions and how they influence present and future goals and objectives. Also, their awareness is critical for comprehending the complex linkages between people, places and events, and therefore sustaining the sense-making of ambiguous situations of high complexity and uncertainty. In this view, researchers linked the awareness with the dynamic and uncertain nature of knowledge, arguing that knowledge exists along a continuum between tacit knowledge (knowing-how) and explicit knowledge (knowing- what) and these forms of knowledge are mutually constituted, and their level depends on what is communicated in any dialogue or discussion. Moreover, even though knowledge is the output of learning, the dynamic nature of knowing facilitates the transformation process of tacit knowledge to explicit knowledge and vice versa to create new knowledge (Jashapara, 2011).
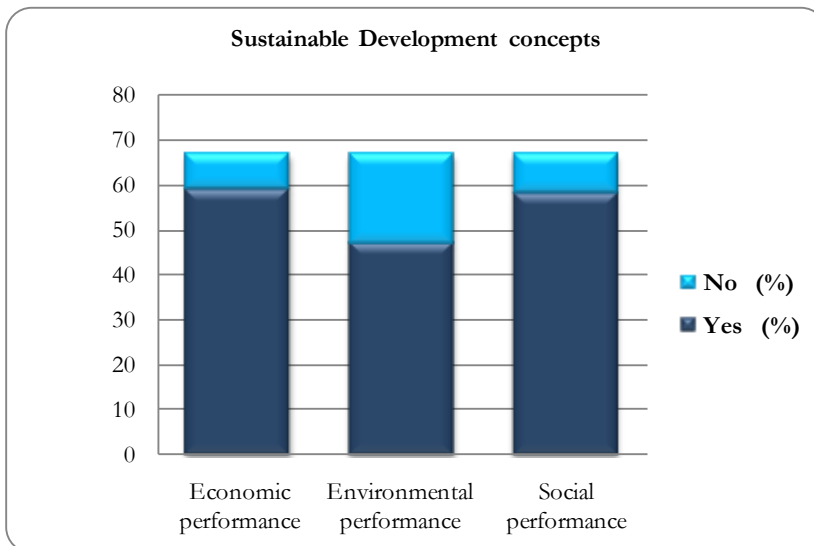

*Fig. 2. The students' exposure to major concepts embedded in sustainable development*
Source: Authors analysis based on the survey collection data

In this light, the assessment of the level of tacit knowledge for core values for sustainability shed to light that business engineering students averagely weigh firstly the respect for fundamental EU freedoms (2.72), and secondly the fairness of the education system and the principles of equality and solidarity (2.72), as data revealed in table 4. These findings imply that the inclusion of values like equality, solidarity, justice, and the free flow of capital, labor, and goods into the curriculum serves as a foundation for what people consider to be significant when making decisions in all spheres of private and public life.

Table 4. The students' core sustainability values – weighted scores.

Core values	Unimportant (1 pct.)	Indifferent (2 pct.)	Important (3 pct.)	weighted scores
The respect for human rights and freedoms (i.e. dignity, justice, citizen's rights, etc.)	7	2	49	2.36
The respect for fundamental EU freedoms (i.e. free movement of goods, capital, services, and labour)	8	3	56	**2.72**
Valuing cultural diversity	8	7	52	2.66
Democracy in the society	6	10	51	2.67
Social justice	10	6	51	2.61
Fairness of educational/working systems	7	2	58	**2.76**
The principles of equality and solidarity	6	4	57	**2.76**
Gender equality	7	7	53	2.69
The rule of law	8	4	55	2.70

The students seem not to appreciate at a fair level of importance the value of respect for human rights and freedoms since it received the lowest weighted score (2.36) as presented in figure 3.
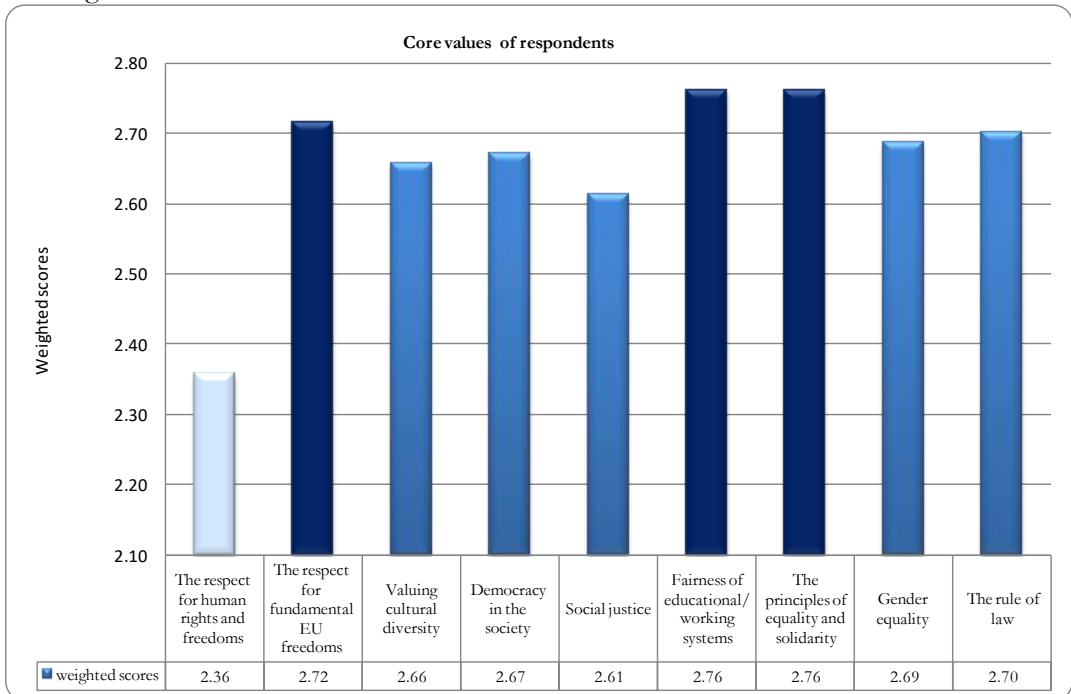
Fig. 3. The students' core sustainability values for personal life fulfillment
Source: Authors analysis based on the survey collection data

The values of human dignity, justice, citizens' rights etc. seem not to be at the centre of their learning framework leading to an unsatisfactory level of intellectual and moral maturity which prevent them to mobilize the acquired knowledge to meet complex demand. However, the development of justice values is critical being an important bridge between moral judgment and moral action to protect the rights of others and is considered a predictor of democratic stability.

As regards the propensity toward judging the jobs offerings and the sustainability involvement of organizations and businesses, when it comes to choosing the future employer, the students place great emphasis on selection criteria like responsible operations (48% of the sample), followed by manufacturing and/or selling sustainable products and/or services (28%) whilst disclosure of non-financial information was chosen by 9% of the sample. Also, the partnership for the SDGs seems not to be considered an important criterion since it was chosen only by7% of the respondents (figure 4). The lack of appreciation of the employment offerings considering the commitment toward establishing partnerships for the SDGs is also explained by the low degree of awareness concerning the corresponding sustainable development goal (SDG 17. Partnership for the goals).
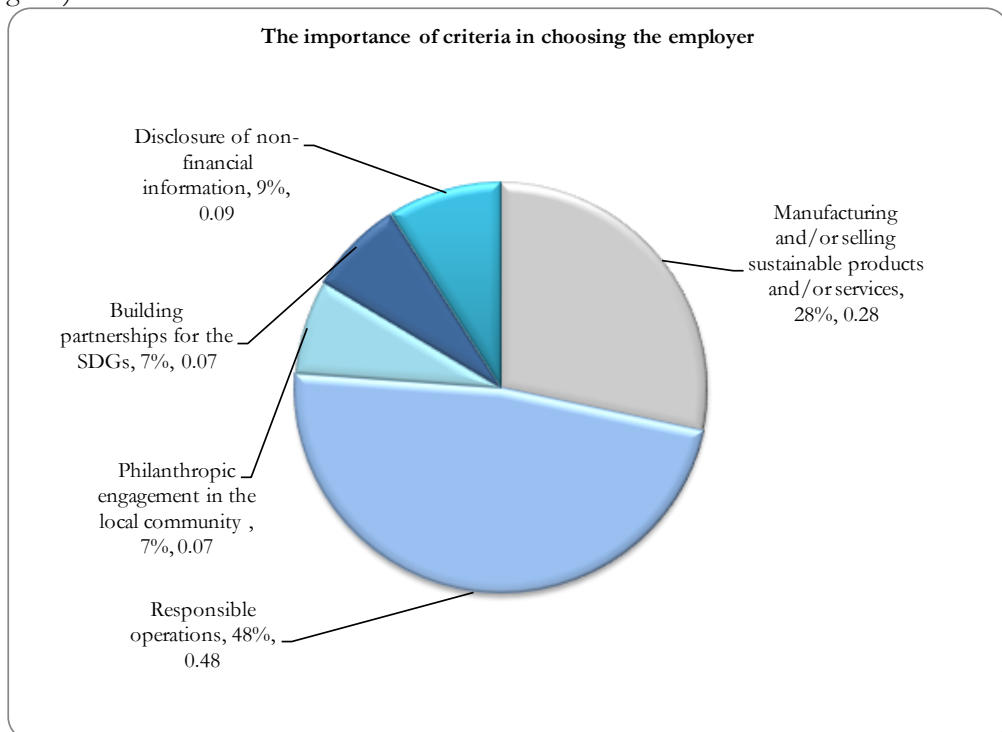

Fig. 4. The relevance of sustainability-related criteria in choosing the employer
Source: Authors analysis based on the survey collection data

The data analysis for assessing the level of explicit knowledge measured in terms of concrete actions adopted to leave more sustainable shows the students placed great sustainability concern when they adopt education decisions (3.16), followed by food and nutrition (3.15) and financial decisions (3.13), according to table 5. On the opposite side, there is a low sustainability concern related to the employer decision with only a 2.16 weighted score.

Table 5. The students' self-assessment of sustainability measures: weighted scores.

Measures to live sustainable	Never (1 pct.)	Rarely (2 pct.)	Sometimes (3 pct.)	Always (4 pct.)	Weighted score
Buying goods and services	1	17	40	9	2.85
Choosing the employer	11	16	28	12	2.61
Making financial decisions	2	11	30	24	**3.13**
Adopting education decisions	4	12	20	31	**3.16**
Choosing the energy provider	10	17	24	16	2.69
Political voting	10	15	21	21	2.79
Food and nutrition decisions	4	8	29	26	**3.15**
Transport decisions	2	20	24	21	2.96
Leisure activities	4	2	48	13	3.04

These results show a shortage of conceptual connections between sustainability concerns and the decision of choosing a future employer. Here, there is more room for improvement because recent studies have recognized the green employment trends and the shift to a green economy that will go beyond the industries and professions more directly related to sustainability and climate change issues, such as waste management, which is sparked by the focus on the circular economy, utilities through increased recycling activities, and electricity supply through increased demand for renewable energy (Cedefop, 2021).

Another major challenge in teaching sustainability is related to developing skills based on knowledge and attitudes to think, plan and act with responsibility. Through knowledge embedded across the curriculum, sustainability and education are inextricably linked on all levels. This supports the acquisition of sustainable development-related competencies needed to channel positive changes at the individual, organizational and social levels through a holistic approach.

In this view, measuring the learning needs about sustainability-related topics may give useful insights on how to improve the teaching and learning processes with differentiated knowledge about different areas to allow learners to analyze the information from alternative perspectives. The data analysis reveals that students in the business engineering area are more like to appreciate the social performance themes (2.58), followed by environmental subjects (2.48), and economic aspects (2.46), as shown in table 6. The choice of themes and contents must enable students in learning to discover interconnection among diverse concepts across disciplines and should not be random.

Students must study core knowledge as a key building block of grasping the notion of sustainable development.

Table 6. The students' self-expectations about sustainable development themes – weighted scores.

Sustainable Development Themes	Not useful (1 pct.)	Somewhat extent (2 pct.)	Very useful (3 pct.)	weighted scores
ECONOMIC themes				**2.46**
Sustainable Procurement practices	2	37	28	2.39
Competition, fair-trade regulations and practices	6	37	24	2.27
Green business, green finance and investments	2	23	42	2.60
Resources efficiency through sharing economy	4	22	41	2.55
Sustainable consumption and production	2	26	39	2.55
Innovation & product responsibility	1	25	41	2.60
Corporate social responsibility	4	35	28	2.36
Social entrepreneurship	1	38	28	2.40
ENVIRONMENTAL themes				**2.48**
Environmental compliance	2	38	27	2.37
Supplier environmental assessment	8	30	29	2.31
Circular economy – green productions	3	17	47	2.66
Circular economy – green consumption	3	22	42	2.58
SOCIAL themes				**2.58**
Green jobs and local community engagement	6	30	31	2.37
Sustainable employments	3	21	43	2.60
Social and labor protection	1	26	40	2.58
Occupational health and safety	2	17	48	2.69
Diversity and equal opportunities, and human rights	3	24	40	2.55
Sustainable lifestyle and education	2	15	50	2.72

Notably, looking inside the economic pillar of sustainable development, the data analysis reveals the most valuable subjects to be learned by students like innovation & product responsibility (2.60) and green business and finance (2.60), followed by sharing economy (2.55) and sustainable consumption and production, as shown in figure 5. As for environmental performance, the students are more likely to learn about the circular economy with a thematic focus on green production (2.66) and green consumption (2.58) as presented in figure 6. The findings highlight the importance of exposing students to pertinent information on cross-cutting issues of the circular economy, including necessary conditions to stop environmentally hazardous products, principles for minimizing waste

and utilizing resources before recycling, and practical steps to lessen the food production and retail industries' effects on the environment by carefully taking into account transportation, storage, packaging, and food waste, as well as new business strategies that use shared and rented items.
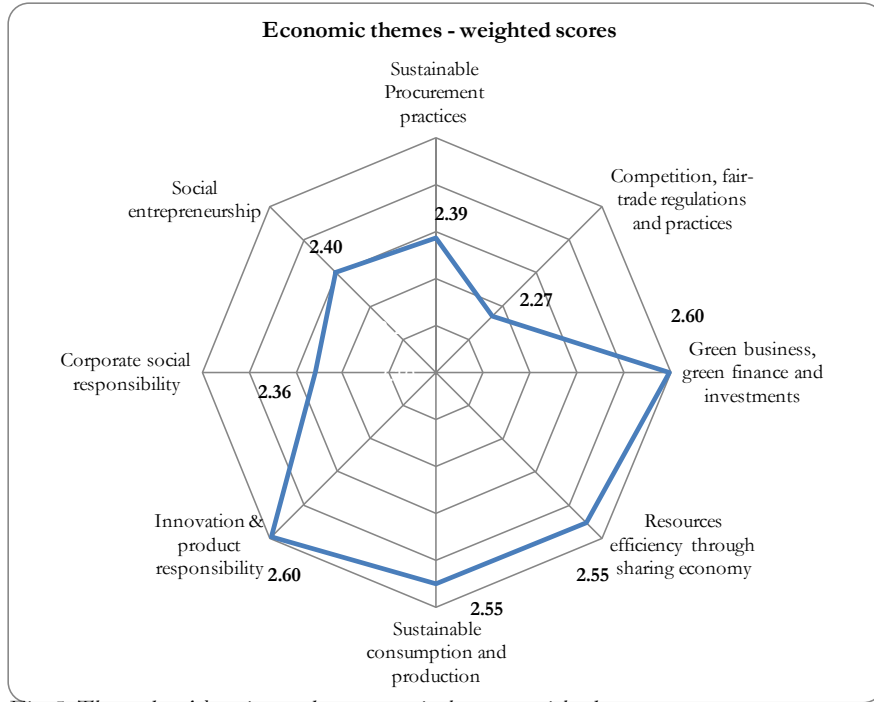

Fig. 5. The students' learning needs on economic themes – weighted scores
Source: Authors analysis based on the survey collection data

Last but not least, the students' expectations regarding social themes of sustainable development are related to knowledge of sustainable lifestyle and education (2.72) and sustainable employment (2.60) as displayed in figure 7.

The results stress the need to provide students with an adequate mix of knowledge on the social side of businesses in which social and labour protection, occupational health and safety, decent jobs and local community engagement tend to become of utmost importance. However, interdisciplinary approaches are needed to help students understand the interconnectedness of economic, social and natural systems.
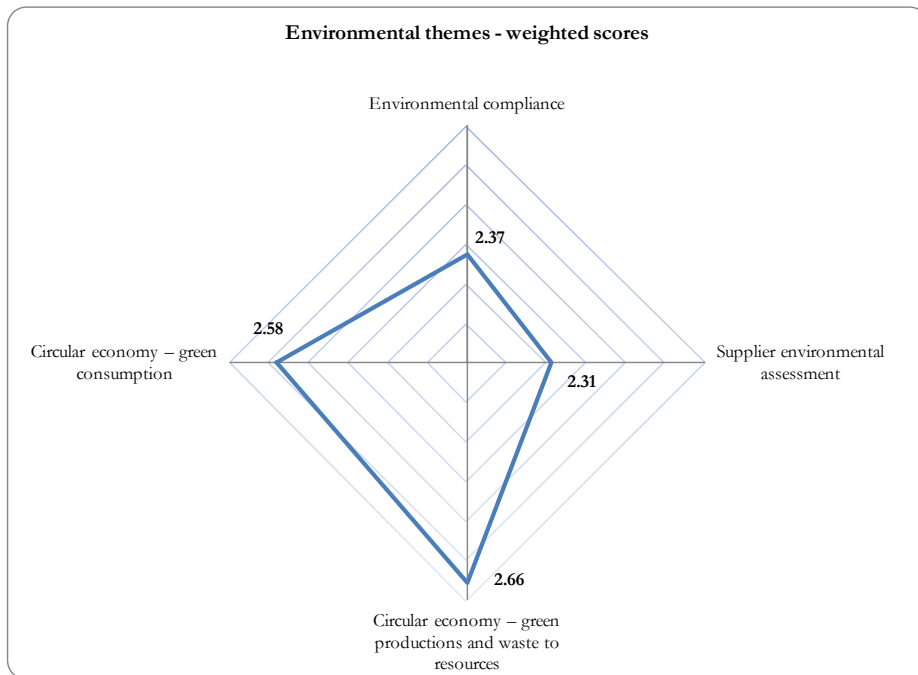
Fig. 6. The students' learning needs on environmental themes – weighted scores
Source: Authors analysis based on the survey collection data
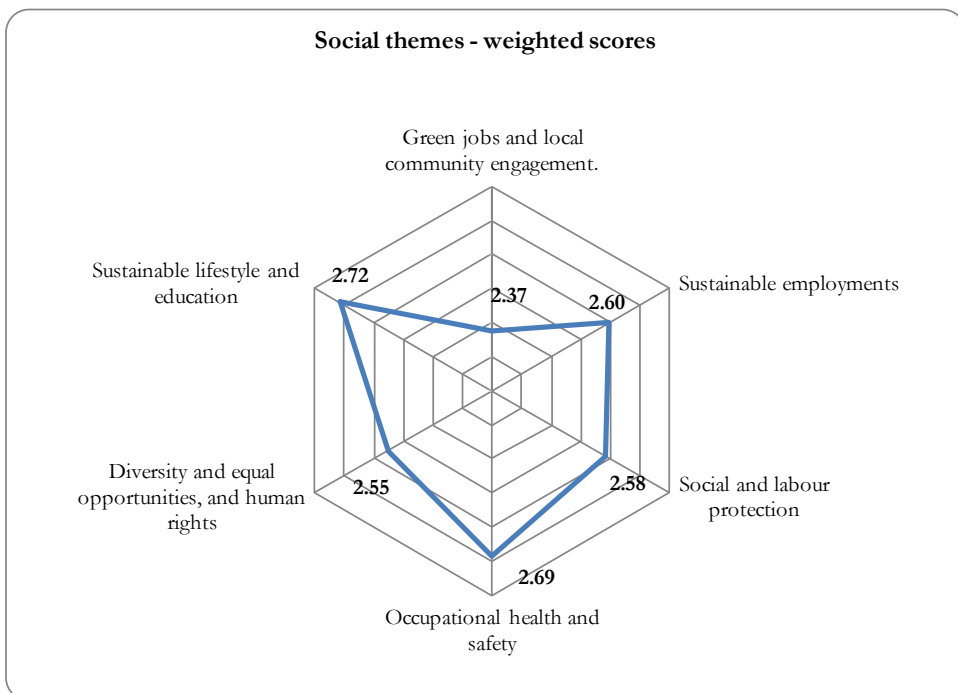

Fig. 7. The students' learning needs on social themes – weighted scores
Source: Authors analysis based on the survey collection data

In summing up, the survey advocates for particular improvement solutions in the attempt to augment teaching for sustainability in the case of business engineering area:

a)   Embedding interdisciplinary topics into existing curricula linked to SDGs and subsequent pillars of sustainable development concepts instead of creating new disciplines;

a)   Developing and leveraging a basic shared citizenship values (respect, fairness, personal and social responsibility, honesty, and self-awareness) to advance learning across the entire curriculum and to highlight the interconnectedness of knowledge, skills, attitudes, and values;

b)   Facilitating interdisciplinary knowledge for understanding and solving complex business and engineering problems which require thinking across disciplines;

c)   Enhancing students' intellectual maturity and critical thinking, especially in the context of accelerated technological advances and the use of digital technology in teaching and learning, to be able to use their knowledge, skills, attitudes and values to act in responsible ways, coping with new realities and demands.

5. Conclusion

The importance of developing attitudes and values through education is an increasing area of concern at the national and international levels and responsible political factors are putting great emphasis on stimulating the willingness to develop sustainability-related skills (European Commission COM (2020) 274 final).

The knowledge and attitudes to drive new business models are also framed by the complex issues posed by technological change and digitization, and environmental and socio-economic concerns. Technology is reshaping the skills needed for work. New technologies tend to replace the workforce for routine tasks while the workers are required to use technology to perform tasks more efficiently which both have implications for the mix of skills people need (OECD, 2019a). These trends are obvious and require reshaping the way in which the skills and capabilities are developed, especially through education and training. The quest for having appropriate knowledge, skills, competencies, and attitudes to deal with societal, economic, and labour market changes gain particular importance, especially for engineers who are expected to cope with complexity, increasing technology interconnection, global market expansion, mobility and migration, and workplace diversity, as successful individuals.

In an attempt to address the complex challenges of teaching and learning for sustainability, the authors have undertaken a quantitative survey aiming at investigating the students' outlook with regard to modern sustainable development concerns and collecting relevant learning needs in a wide range of sustainability-related directions. The survey focused on business engineering education that goes beyond technical knowledge and prepares students for the future business market, supporting to advance the technological and innovative outputs, driving innovation, competitiveness and growth. The thematic encompassed a broad range of topics/subjects that needed to be taught to business engineering students since they are required to integrate concepts and practices to innovatively solve world issues.

The survey results stress the need to provide tailored content and quality information with differentiated knowledge about topics from different areas (i.e. social, environmental,

economic) allowing students to learn about sustainable development goals from alternative perspectives, also suggested by other scholars (Nikolić et al., 2021). Our findings also imply that by organizing certain disciplines for a specific goal, interdisciplinary knowledge can help students in transferring knowledge from one context to another. Despite the widespread acceptance of combining classes or adding additional subjects as a means of preventing curriculum overload, their use appears to be very restricted and is thought to actually increase rather than decrease curriculum loading (OECD, 2019b).

Secondly, our results advocate for interdisciplinary knowledge for understanding and solving complex business and engineering problems which require thinking across disciplines. Instead of developing new subjects, students will learn to recognize the connections between sustainability concepts found in other academic fields. They will also get the chance to explore interdisciplinary topics that represent the complexity of the world they live in.

Designing appropriate measures to integrate the interconnected learning methods into the curriculum seems challenging (OECD, 2019a). Teaching sustainability is complicated requiring interdisciplinary and transferring knowledge to different situations. Teachers have a pivotal role in supporting students to transfer knowledge across different contexts by seeing the more abstract conceptual and structural parallels between prior knowledge and novel settings (Dixon, 2012; Benander, 2018).

Finally, our results advocate for incorporating attitudes and values into the curriculum that can help students take responsible activities that contribute to their own, societies, and the environment's well-being. Attitudes and values are developed interdependently as inspiration for learning and applying skills (Haste, 2018), as framing the priorities for well-being and good citizenship (Killen & Smetana, 2010), as encouraging social capital and societal norms that advance well-being in society (Haste, 2018), and moral responsibility, in the sense of accountability (Berkowitz & Miller, 2018).

To this end, the learning environment must promote the fundamental principles that today's students require to succeed and to help create a better world for everyone with particular regard to respect, fairness, personal and social responsibility, honesty, and self-awareness as shared civic ideals in order to create more inclusive, just, and sustainable economies and societies (OECD, 2019c).

Albeit the scope of the pilot survey is limited to the students' self-expectations with regard to the learning needs on sustainable development, it might induce useful insights on reshaping the necessary subjects to be taught in the attempt to foster a sustainability mindset through a holistic approach. The results may be a useful reference for future improvements of business education curricula to foster the sustainable mindset of graduates. Besides this, the small number of respondents requires further research on a larger sample for more extensive testing and validation of the results and recommendations.

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