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Higher Education and Sustainable Entrepreneurship: the state of the art and a look to the future

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Abstract: The integration of sustainable entrepreneurship education in higher education is important as part of efforts to step towards equipping future leaders with the knowledge, skills, and mindset needed to address global sustainability challenges through innovative and entrepreneurial solutions. This approach involves a multidisciplinary, holistic education model that combines the principles of sustainability with entrepreneurial practices. This paper, which entails a case studies approach, examines the current initiatives being undertaken by a sample of higher education institutions located in Asia, Africa, North America, South America, and Europe, with the aim of fostering sustainable entrepreneurship. It concludes by proposing a series of measures with respect to sustainable entrepreneurship that higher education institutions may deploy, to address the environmental, social, and economic dimensions of the global sustainability challenges.

Keywords: Sustainability; Entrepreneurship; Education; Solutions; Holistic education.

1 The relevance of entrepreneurship education

It is widely recognized that fostering entrepreneurship is a primary responsibility of higher education institutions (HEI). Upon examining the academic literature, various definitions of 'entrepreneurship education' emerge. Generally, these definitions aim to cultivate behaviors, attitudes, engagement, skills, and capabilities in students to equip them for their entrepreneurial careers (Di Paola et al., 2023). Vivekananth et al. (2023) and Thomas (2023) underscore the significance of entrepreneurial education for all nations, facilitating the continual revitalization of actors within the entrepreneurial ecosystem.

Miço and Cungu (2023) note that in the recent past, educators in this field primarily provided lectures and small-scale events for students. However, they now

recognize that students require more comprehensive support, including the development of competencies and conceptual understanding. These competencies encompass opportunity identification, creativity, business value aggregation, ethics, sustainable thinking, effectiveness, motivation, perseverance, resource allocation, risk analysis, teamwork, and lessons learned, among other factors (Miço & Cungu, 2023). Rojas et al. (2024) also highlight specific characteristics emphasized by universities when focusing on social entrepreneurship, such as emotional intelligence. Listyaningsih et al. (2023) broadly corroborate the aforementioned information, affirming that entrepreneurial education furnishes valuable knowledge and skills for entrepreneurial endeavors while also fostering social well-being.

However, a significant challenge is that curricular structures often fail to adequately address all the aforementioned skills, and educators may sometimes lack preparation in this regard (Miço & Cungu, 2023). Rojas et al. (2024) argue that continuous evaluation of entrepreneurial education programs in universities is necessary to enhance them and support students in achieving their goals.

In addition to formal coursework, entrepreneurial education is increasingly enriched by extracurricular activities, voluntary participation, and informal initiatives (Overwien et al., 2024). Di Paola et al. (2023) emphasize the significance of entrepreneurship laboratories as vital university environments for supporting entrepreneurial education. Typically established through collaborations between companies and universities, these laboratories yield significant outcomes. Ripollés and Blesa (2023) also highlight the potential of voluntary activities within universities and their contribution to student development. Ribeiro et al. (2023) employed Structural Equation Modeling in their study to assess the impacts of formal and non-formal activities on entrepreneurial education. Their findings indicate that activities initiated by students (non-formal activities) are equally crucial as those organized by institutions (formal activities) in preparing future entrepreneurs.

Peña Hita et al. (2023) underscore that while entrepreneurial education is widespread across HEIs, its manifestation varies among students. They note a higher inclination among technology and science students to consider entrepreneurship as a career path compared to students in other disciplines, such as education. However, the authors highlight the presence of numerous entrepreneurs in the field of education and advocate for greater emphasis on entrepreneurship within these courses.

Research dedicated to comprehensively understanding entrepreneurial education has seen significant growth in recent years. This research now encompasses not only curricular components and classroom activities but also extracurricular elements, educational policies, and various behavioral and contextual factors (Di Paola et al., 2023). The exploration of entrepreneurial education extends to different subgroups, allowing for the identification of numerous subtopics, including digital entrepreneurship, social entrepreneurship, and behavioral aspects, among others.

In the realm of entrepreneurial education, particularly with a focus on digital entrepreneurship, significant studies shed light on various aspects of skill development and technology integration. González Calatayud et al. (2022) introduced a quantitative instrument aimed at assessing university students' skills in digital entrepreneurship competencies, categorized into four primary groups: opportunities identification, action plan, initiative and collaboration, and management and security. Concurrently, Voronov et al. (2023) delved into the contributions of artificial intelligence to enhancing students' understanding of digital entrepreneurship.

In parallel, research extends beyond technological domains to encompass social and behavioral entrepreneurship, exploring the motivations and rewards associated with venturing into socially impactful initiatives. Singh et al. (2023) conducted a study examining the motivations of professionals who transitioned from conventional employment to pursue endeavors aligned with social entrepreneurship, emphasizing rewards that extend beyond financial gain.

Moreover, research endeavors seek to elucidate the correlations between entrepreneurial education and future professional attributes or actions. Aliedan et al. (2022), for instance, examined the impact of entrepreneurial education on entrepreneurial characteristics, providing insights into how educational interventions shape entrepreneurial mindset and behaviors. This complements bibliometric studies such as that conducted by Sinha et al. (2024), which aimed to discern the influence of entrepreneurial education on creativity and innovation through the analysis of a wide range of scholarly articles.

The multifaceted landscape of entrepreneurial education within HEIs encompasses a diverse array of approaches, challenges, and opportunities. While significant strides have been made in integrating entrepreneurship into academic curricula and extracurricular activities, there remain gaps in addressing the full spectrum of skills and competencies needed for entrepreneurial success. Continuous evaluation and

refinement of entrepreneurial education programs are imperative to better support students and enhance their entrepreneurial endeavors. Moreover, as research in this field continues to expand, it not only sheds light on the intricacies of entrepreneurial education but also provides valuable insights into its broader societal and economic impacts, paving the way for a more sustainable and innovative future.

2 The role of sustainable entrepreneurship in higher education

2.1 Importance and definition of sustainable entrepreneurship

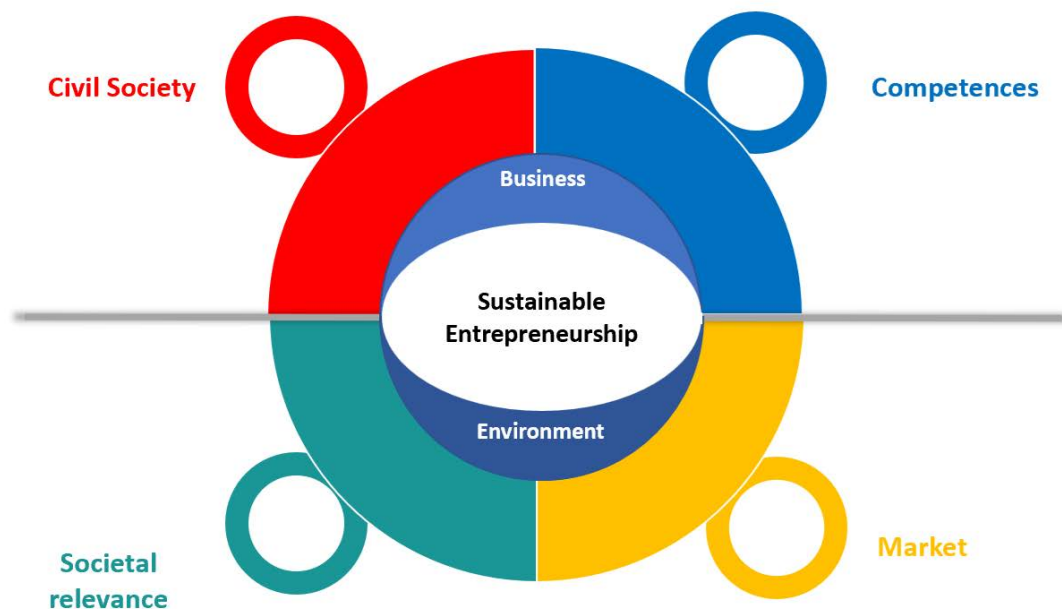
There are numerous academic definitions of sustainable entrepreneurship. For example, Shepherd and Patzelt (2011, p. 137) suggest it is “the preservation of nature, life support, and community in the pursuit of perceived opportunities to bring into existence future products, processes, and services for gain, where the gain is broadly construed to include economic and non-economic gains to individuals, the economy and society”. For the purpose of this research, however, it is defined as the educational and institutional process that prepares and empowers individuals to identify, create, and manage ventures that simultaneously address economic viability, environmental stewardship, and social equity (Wagner et al., 2021). This concept integrates the principles of sustainability into the entrepreneurial mindset and activities, aiming to develop solutions that contribute to the United Nations Sustainable Development Goals (SDGs) or similar frameworks (Cai & Ahmad, 2023; Costa et al., 2023; Shabbir, 2023; Vladimirova & Le Blanc, 2016).

Although entrepreneurship has been seen as having the potential to address the sustainability challenge its impact has been limited and both academics and practitioners have long been “exploring whether modified and completely new business models can help maintain or even increase, economic prosperity by either radically reducing negative or creating positive external effects for the natural environment and society” (Schaltegger et al., 2016, p. 4). As Ogachi et al. (2021) have acknowledged such research has led to new business models, products, and services that address the sustainability challenge. These have included social enterprise (Defourny & Nyssens, 2017), sustainopreneurship (Verma, 2021), ecopreneurship (Rodríguez-García et al., 2019), and humane entrepreneurship (Kim et al., 2018). To date they have failed to ameliorate significantly the sustainability challenge and entrepreneurship may be seen to have contributed to the challenge if not having been responsible for it. Accordingly, researchers have introduced

an innovative concept, Harmonious Entrepreneurship (Kirby, El-Kaffass, et al., 2022; Kirby & El-Kaffass, 2021), which is based on general systems theory and which specifically addresses the sustainability challenge. It produces a triple bottom line business model (Elkington, 1997) and rejects the Friedman doctrine that the responsibility of business is to its shareholders and “making as much money as possible”.

Figure 1 presents an overview of some of the issues which permeate sustainable entrepreneurship, highlighting how higher education impacts society, the market and the training of human resources.

Figure 1. Some of the elements associated with sustainable entrepreneurship.



Source: Authors' own creation.

In higher education, the role of sustainable entrepreneurship is multifaceted and increasingly recognised as important for addressing the global challenges associated with sustainability, such as climate change, biodiversity loss, and social inequalities (Kirby, El-Kaffass, et al., 2022; Volkmann et al., 2021). There are several key aspects of this role. For instance, in the field of curriculum development, many HEIs are integrating sustainable entrepreneurship into their curricula to equip students with the knowledge and skills needed to start and manage sustainable businesses. This includes teaching the principles of sustainability, environmental management, social entrepreneurship, and ethical business practices (Fanea-Ivanovici & Baber, 2022) and allowing the students to learn experientially (Kirby, 2022).

Additionally, HEIs can foster innovation through incubators and accelerators that support sustainable startups and they can play a key role in community engagement, working with local businesses, governments, and NGOs to promote sustainability (Karahan, 2024). Through partnerships, they can facilitate the exchange of knowledge, provide students with practical experience, and drive regional sustainable development (Tehseen & Haider, 2021; Wagner et al., 2021).

Universities can also demonstrate sustainable entrepreneurship through their operations. This might involve adopting sustainable practices in energy use, waste management, and procurement. By acting as role models, they can inspire students and the community to adopt similar practices (Yi, 2021).

A further, important aspect, is related to student empowerment. By fostering a culture that encourages sustainable entrepreneurship, HEIs can empower students to become future leaders in sustainability (Said Ahmad et al., 2023). This includes providing them with opportunities to engage in sustainable business practices, participate in competitions, and launch their sustainable ventures (Pereira et al., 2023).

Moreover, using the transformative power of networking, HEIs can benefit from and contribute to global networks focused on sustainable entrepreneurship (Karahan, 2024). Such collaboration can facilitate the sharing of best practices, joint research initiatives, and international student exchange programs, thereby enhancing the global reach and impact of sustainable entrepreneurship education (Nave & Franco, 2019; Schaltegger et al., 2018).

Sustainable entrepreneurship in higher education not only prepares students to be future leaders who can address environmental challenges but also contributes to the broader goal of sustainable development by fostering a new generation of businesses that prioritise social and environmental responsibility alongside economic viability (Cai & Ahmad, 2023; Volkmann et al., 2021). In this context, HEIs are pivotal in fostering sustainable entrepreneurship, given their role in educating future leaders, generating new knowledge, and serving as exemplars of sustainable practices. There are a variety of means to implement this (Betáková et al., 2020).

For instance, HEIs may integrate sustainable entrepreneurship into their curricula, offering courses and programmes that combine entrepreneurship principles with sustainability (Fanea-Ivanovici & Baber, 2022). This integration helps students understand the complexities of creating ventures that are not only economically viable but also environmentally friendly and socially inclusive. Also, sustainable

entrepreneurship education often requires an interdisciplinary approach (Martins et al., 2023), combining insights from business, environmental science, social sciences, and more. This broad perspective helps to address the multifaceted nature of sustainability challenges (Sigahi & Sznelwar, 2023).

Furthermore, HEIs may research sustainable entrepreneurship, which may advance an understanding of it, including success factors, challenges, and impacts. This research informs both educational content and a broader societal understanding of how entrepreneurship can contribute to sustainability goals (Fichter & Tiemann, 2018).

Also, many HEIs host incubators and accelerators that focus on sustainable ventures, providing resources, mentorship, and funding to support the development of innovative solutions to sustainability challenges. Others often collaborate with businesses, government entities, and non-profit organisations to promote sustainable entrepreneurship (Karahan, 2024). These partnerships can provide students with real-world experience and create opportunities for sustainable ventures (Tehseen & Haider, 2021; Wagner et al., 2021).

2.2 Barriers to sustainable entrepreneurship

While sustainable entrepreneurship is gaining traction in higher education, several barriers can hinder its full integration and effectiveness. One of them is the lack of a standard definition of what entrepreneurship is. Recently, Ratten (2023) carried out an extensive review of the literature and proposed a definition of entrepreneurship as the identification of business-related opportunities through a process of using existing, new or a recombination of resources in an innovative and creative way. Despite the attempt to reach a definitive concept, there are different understandings in the literature. For some, it is about new venture creation, for others it has to do with innovation, while for others the focus is on mindset development (Prince et al., 2021; Ratten, 2023). Hence for many academics and students alike it has no relevance and is resisted.

Similarly, not all students, faculty, or administration are necessarily fully aware of what sustainable entrepreneurship entails or its importance. Without a deep understanding of sustainability principles and how they can be integrated into entrepreneurship, there can be less motivation to pursue or support sustainable ventures (Hsu & Pivec, 2021). Also, sustainable entrepreneurship may not be adequately integrated into the curriculum across all disciplines. It may be confined to specific courses or departments, limiting the exposure of students to sustainability concepts and how they

can be applied in entrepreneurial endeavours (Agu et al., 2021). In addition, developing and implementing sustainable entrepreneurship programs can require significant resources, including funding, faculty with the right expertise, and support services for student entrepreneurs. Limited resources can restrict the ability of institutions to offer comprehensive programs or support for sustainable startups (Alvarez-Risco et al., 2021; Hermann & Bossle, 2020; Soomro et al., 2020).

A further barrier is related to institutional cultures and structures, which can sometimes be resistant to change. Introducing new concepts like sustainable entrepreneurship may face resistance if they are not aligned with the institution's traditional values or operational practices (Markard et al., 2020). This resistance can slow down the integration of sustainable practices into educational and operational frameworks (Hueske & Guenther, 2021). Also, sustainable entrepreneurship often requires a cross-disciplinary approach that combines insights from business, environmental science, social sciences, and more. However, siloed departmental structures in higher education can limit collaboration and the development of a holistic approach to sustainability (Ávila et al., 2017).

There are also market challenges. Students and faculty may be discouraged by perceived or actual market barriers to sustainable entrepreneurship, such as higher costs, limited consumer demand, or regulatory challenges (Butkouskaya et al., 2020; Daub et al., 2020). These perceptions can affect the enthusiasm and support for integrating sustainable entrepreneurship into education and practice. Furthermore, the success of sustainable entrepreneurship initiatives is often hard to measure, especially in the short term. Academic institutions may lack the evaluation frameworks or incentive structures to recognize and reward efforts in sustainable entrepreneurship, which can dampen enthusiasm and commitment (Lu et al., 2021; Wagner et al., 2021).

Addressing these barriers requires concerted efforts from educational institutions, policymakers, industry partners, and the broader community to create an ecosystem that supports sustainable entrepreneurship in higher education.

3. Methods

To answer the research question, a bibliographical research was deployed, a method which consists of an extensive review of the body of existing literature on a specific topic, in order to understand its historical development, scope, and the key contributions made by various scholars (Berchin et al., 2021; Shabbir, 2023).

This approach catered for the investigation of various concepts and initiatives outlining the importance of entrepreneurship education, which were useful in the subsequent analysis of the results of the case studies on entrepreneurship for sustainability. To gather data, we selected 36 scientific documents from the database Scopus. In conducting our bibliographical research, we have strategically selected sources from a range of publication dates to ensure a comprehensive understanding of the topic. The chosen timeframe spans from the early 2000s to the present. This period was selected to capture both the foundational studies that have shaped the current understanding of the subject matter of sustainable Entrepreneurship. and the most recent advancements and insights. Early sources provide the necessary historical context and theoretical frameworks, while recent publications offer updated data, new methodologies, and current trends. By incorporating a blend of older seminal works and contemporary research, we aim to provide a well-rounded and robust analysis, ensuring that our findings are both relevant and grounded in the established body of knowledge.

Our primary focus was on the actions taken in the case studies that could help train graduates capable of working in sustainable organisations. Due to its nature, this study can be categorised as applied (exploratory) research. It describes and analyses results without proposing any new theories. As Gil (2015) stated, exploratory research aims to delve deeper into the topic of interest by conducting a bibliographical survey and analysing examples that aid understanding.

The initial search used the following string: (TITLE-ABS-KEY (sustainab* AND entrepreneur*) AND TITLE-ABS-KEY (education OR universit* OR teaching OR class* OR course* OR discipline* OR program*) AND TITLE-ABS-KEY ("case stud*")) which yielded 637 results.

A sequence of filters was used to reach the sample of articles that were analysed. The first filter was applied to limit the document type to "ar", "ch" or "cp" resulting in 579 results. The second filter involved screening the titles and abstracts, which reduced the number of documents to 54. Finally, the third filter involved a more in-depth analysis where the full text of the remaining 54 documents was read. This resulted in 36 selected cases. Ten documents were excluded because they did not present cases or were outside the scope. Eight documents were excluded because we did not have access to them, including six chapters, one conference, and one magazine.

The 36 papers left after the screening process described were analysed via an Inductive Content Analysis according to guidelines proposed by Elo and Kyngäs (2008).

In this kind of analysis, the steps to perform are: (i) open coding, through which headings are created while the material is read to establish coding sheets and categories from this data; (ii) grouping data, which requires the establishment of headings of higher order for the categories previously created; (iii) abstraction, in which a description of the categories created are developed. Finally, the results are reported and discussed. After conducting the inductive content analysis described, and based on the information collected, guidelines are proposed to foster sustainable entrepreneurship.

The steps involved to improve the transparency and reproducibility of the research included the definition of the research plan and hypotheses before data collection started, to support a selective reporting of the results. Also, the raw data was shared among other researchers, to verify the findings. Moreover, the research materials are available so others can replicate the study. These will be shared on repositories such as Symplectic. Finally, we clarified the timeframe of the sources chosen for the bibliographical research, which helps establish the relevance and currency of the sources used, thereby strengthening the foundation of our arguments.

4 Results and discussion

This section presents and discusses the results gathered. First of all, it is relevant to report on the 36 case studies which were selected, as examples of works on sustainable entrepreneurship. These are presented in Table 1.

Table 1. Cases selected presenting initiatives to foster sustainable entrepreneurship.

#	Reference	Context	Type of publication	Source
1	Koch (2005)	Germany	Journal article	International Journal of Sustainability in Higher Education
2	Dobers et al. (2008)	Sweden	Journal article	International Journal of Innovation and Sustainable Development
3	Amatucci et al. (2013)	USA	Journal article	New England Journal of Entrepreneurship
4	Klapper and Farber (2016)	Peru	Journal article	International Journal of Management Education
5	Bikse et al. (2016)	Latvia	Journal article	Journal of Teacher Education for Sustainability
6	Abdulwahed (2017)	Qatar	Journal article	Sustainability (Switzerland)
7	Cincera et al. (2018)	Europe	Journal article	Journal of Cleaner Production
8	Fabregà (2018)	Spain	Book chapter	World Sustainability Series

9	Fichter and Tiemann (2018)	USA and Germany	Journal article	Journal of Cleaner Production
10	Tiemann et al. (2018)	USA and Germany	Journal article	International Journal of Entrepreneurial Venturing
11	Er et al. (2019)	Malaysia	Journal article	International Journal of Business and Society
12	De Jong et al. (2019)	Netherlands	Book chapter	The Role and Impact of Entrepreneurship Education: Methods, Teachers and Innovative Programmes
13	Wyness and Jones (2019)	UK	Journal article	Journal of Small Business and Entrepreneurship
14	Agu (2021)	Nigeria	Journal article	Small Enterprise Research
15	Verdugo and Villarroel (2021)	Chile	Journal article	Heliyon
16	Hsu and Pivec (2021)	Austria and Taiwan	Journal article	Sustainability
17	Asikainen and Tapani (2021)	Finland	Journal article	Sustainability
18	Del Vecchio et al. (2021)	Europe	Journal article	International Journal of Entrepreneurial Behaviour and Research
19	Hagebakken et al. (2021)	Norway	Journal article	Sustainability
20	Gheorghiu et al. (2021)	Romania	Journal article	Economic Computation and Economic Cybernetics Studies and Research
21	Ashari et al. (2021)	Malaysia	Journal article	Sustainability
22	Azcárate and García (2022)	Spain	Journal article	International Journal of Humanities Education
23	Hermann et al. (2022)	Brazil and Norway	Journal article	Educational Action Research
24	Andruk and Altinay (2022)	USA	Journal article	Journal of Small Business and Enterprise Development
25	Zahrani (2022)	Saudi Arabia	Journal article	Frontiers in Environmental Science
26	Zhong et al. (2022)	China	Journal article	Asia Pacific Education Review
27	Al-Azab and Zaki (2023)	Egypt	Journal article	Journal of Hospitality and Tourism Insights
28	Dieguez (2023)	Portugal	Book chapter	Leadership and Governance for Sustainability
29	Isac et al. (2023)	Romania	Journal article	Sustainability
30	Jebsen et al. (2023)	Denmark	Journal article	International Journal of Management Education
31	Lopes et al. (2023)	Angola	Journal article	Journal of Cleaner Production
32	De Bronstein et al. (2023)	Germany	Conference paper	Procedia Computer Science
33	Dupret (2023)	Denmark	Book chapter	Ethical Economy

34	Poza-Vilches et al. (2023)	Spain	Journal article	Journal of Teacher Education for Sustainability
35	Kuikka (2023)	Finland	Conference paper	Annual Conference of the European Society for Engineering Education
36	Karahan (2024)	Germany	Journal article	Small Business Economics

Source: Authors' own creation.

Based on this sample, an inductive content analysis (Elo & Kyngäs, 2008) was performed, resulting in ten guidelines (G1 to G10) organised into five categories (Table 2).

Table 2. Guidelines to fostering sustainable entrepreneurship and their categories.

Category	Guidelines for fostering sustainable entrepreneurship
Curriculum integration and academic programs	G1: Integrate sustainability principles into entrepreneurship education curricula to ensure students develop skills in both areas.
	G2: Establish specialised academic programs or courses focused on sustainable entrepreneurship to provide students with targeted education in this field.
Innovation and stakeholder engagement	G3: Encourage innovation and entrepreneurship among students by fostering collaboration with stakeholders from various sectors.
	G4: Create platforms or programs that support student entrepreneurs in developing sustainable solutions to real-world problems.
Awareness and behaviour development	G5: Organise educational programs and activities to raise awareness about sustainability and entrepreneurship within the campus community.
	G6: Incorporate sustainability examples and practices into teaching materials to promote the development of entrepreneurial behaviour among students and staff
Policy and organisational support	G7: Implement supportive policies and initiatives at the institutional level to foster sustainable entrepreneurship within the university.
	G8: Transform traditional universities into entrepreneurial hubs by establishing incubators and support mechanisms for student-led environmental businesses.
Institutional partnerships	G9: Foster collaboration between HEIs nationally and internationally to share best practices and experiences in fostering sustainable entrepreneurship.
	G10: Identify key competencies and skills needed for sustainable entrepreneurship education through institutional analysis and partnerships.

Source: Authors' own creation.

The following sections introduce and each category, and discuss how the cases selected to support them.

4.1 Curriculum integration and academic programs - G1 and G2

The integration of sustainability principles into entrepreneurship education curricula (G1) and the establishment of specialised academic programmes focused on sustainable entrepreneurship (G2) are widely regarded as essential steps in preparing students to tackle contemporary global challenges. However, a critical examination of existing literature reveals both the potential and limitations of these initiatives.

Beginning with G1, proponents like Amatucci et al. (2013) argue for the transformative power of incorporating sustainability into entrepreneurship curricula. They suggest that such integration can reshape students' perspectives and practices towards more sustainable business models. Asikainen and Tapani (2021) echo this sentiment, emphasising how sustainability integration can foster transformative learning experiences. However, while these arguments hold promise, the actual implementation and effectiveness of such curricular changes remain uncertain.

Azcárate and García (2022) contribute by highlighting the integration of Creative Economy approaches, aiming to equip students with skills that bridge entrepreneurship and sustainability. While innovative, the extent to which these approaches address the complexities of sustainable entrepreneurship remains unclear. Similarly, Cincera et al. (2018) stress the importance of integrating Education for Sustainable Development (ESD) into higher education curricula. However, challenges such as disciplinary silos and resistance to change within academia may hinder the successful implementation of such integrative efforts (Sigahi & Szelwar, 2022; Wraae et al., 2024).

Meanwhile, discussions around specialised academic programmes focused on sustainable entrepreneurship (G2) also present opportunities and challenges. De Jong (2019) showcases a specialised Master's program tailored to sustainable entrepreneurship, emphasising the importance of targeted education. However, questions arise regarding the scalability and accessibility of such programs, particularly in regions with limited resources or institutional capacity.

Del Vecchio et al. (2021) offer insights from a cross-case analysis of programmes focused on the Circular Economy, highlighting the potential of specialised education in circular entrepreneurship. Yet, concerns persist regarding the narrow focus of such programmes and their ability to address the broader spectrum of sustainability challenges (Kirby & Healey-Benson, 2024).

While there is consensus on the importance of integrating sustainability into entrepreneurship education and establishing specialised programmes, critical considerations are needed to address implementation challenges and ensure effectiveness.

Moving forward, a nuanced approach that addresses the interdisciplinary nature of sustainable entrepreneurship and navigates institutional barriers will be crucial for realising the full potential of these initiatives in preparing students for a sustainable future.

4.2 Innovation and stakeholder engagement - G3 and G4

In exploring collaboration with stakeholders to foster innovation and entrepreneurship among students (G3), several cases shed light on practical implementation and positive outcomes. Andruk and Altinay (2022) observed student entrepreneurs engaging with campus stakeholders, yielding improvements in campus sustainability and enriching entrepreneurial and sustainability education. Similarly, Bikse et al. (2016) delved into the evolution of traditional universities into Entrepreneurial Universities, emphasising collaborative efforts among HEIs, local governments, and entrepreneurs to promote entrepreneurship and sustainability. Hagebakken et al. (2021) underscored the role of entrepreneurship education in accelerating start-ups, stressing the significance of stakeholder collaboration in supporting student entrepreneurs.

Moreover, Karahan (2024) detailed initiatives within HEIs aimed at fostering social entrepreneurship among students, illustrating how partnerships with social enterprises and stakeholders nurture innovation aligned with sustainability objectives. Kuikka (2023) highlighted the essential role of stakeholders in shaping curriculum design within universities, ensuring entrepreneurship education effectively tackles real-world challenges through collaborative approaches.

Turning to the creation of platforms supporting student entrepreneurs in developing sustainable solutions (G4), the references provide valuable insights into the importance of student-led initiatives and conducive environments. Andruk and Altinay (2022) showcased student-run environmental businesses as platforms for sustainable solutions, contributing to campus sustainability and providing students with entrepreneurial experience. Similarly, Bikse et al. (2016) explored the transition of universities into Entrepreneurial Universities, offering students access to supportive ecosystems via business incubators and collaborations with local entities.

Hagebakken et al. (2021) accentuated universities' role in supporting student entrepreneurs through accelerator programs, providing platforms for developing sustainable solutions to real-world challenges. Additionally, Karahan (2024) outlined various activities within HEIs fostering social entrepreneurship among students, offering platforms for developing sustainable solutions through fellowship and grant programs.

Overall, these cases underscore the importance of collaborative endeavours and supportive platforms in promoting innovation and entrepreneurship aligned with sustainability goals.

4.3 Awareness and behaviour development - G5 and G6

The integration of sustainability and entrepreneurship within HEIs hinges on effectively implementing guidelines aimed at raising awareness and fostering entrepreneurial behaviour among students and staff. Several studies offer insights into supporting these objectives outlined in guidelines G5 and G6.

For G5, which emphasises organising educational programmes and activities to raise awareness about sustainability and entrepreneurship on campus, Agu (2021) underscores the role of attitudes and subjective norms in driving sustainable entrepreneurial intention among Business and Science students. This underscores the need for educational initiatives that shape students' perceptions of sustainability and entrepreneurship (Srivastava et al., 2023). Similarly, Barrera Verdugo and Villarroel (2021) highlight the potential of social media in enhancing awareness about sustainability and entrepreneurship, suggesting its use as a formal learning tool. Additionally, Er et al. (2019) discuss the impact of campus education programmes focused on recycling initiatives, illustrating how such initiatives can increase awareness and foster a culture of sustainability and entrepreneurship.

Shifting to G6, which advocates for incorporating sustainability examples and practices into teaching materials to promote entrepreneurial behaviour, Al-Azab and Zaki (2023) demonstrate how green entrepreneurship examples positively influence sustainable development among students in tourism and hospitality programmes. By integrating such examples into teaching materials, institutions can inspire sustainable practices and entrepreneurial behaviour. Likewise, Dieguez (2023) explores how Portuguese HEIs are instilling sustainability awareness among future professionals through the integration of sustainability principles into teaching materials, fostering an entrepreneurial and innovative mindset focused on sustainability.

These studies collectively underscore the importance of educational initiatives and the integration of sustainability principles into teaching materials in promoting awareness and entrepreneurial behaviour related to sustainability and entrepreneurship within the campus community. Such efforts align with the objectives of guidelines G5

and G6, contributing to the broader integration of sustainability and entrepreneurship within HEIs.

4.4 Policy and organisational support - G7 and G8

The cases and contributions discussed shed light on the potential strategies universities can employ to promote sustainable entrepreneurship within their institutions (G7) and transform into entrepreneurial hubs (G8) by fostering student-led environmental businesses through various initiatives.

Beginning with G7, Abdulwahed's (2017) emphasis on cross-disciplinary programs like technology innovation, design, and entrepreneurship highlights the importance of integrating diverse skill sets crucial for innovation and commercialization. While such programs may appear promising, critical questions arise regarding their effectiveness in truly instilling a sustainable entrepreneurial mindset and addressing the complex challenges of sustainability.

Zhong et al. (2022) draw attention to the role of sustainable universities in advancing the Sustainable Development Goals (SDGs), linking sustainability and entrepreneurship. However, the alignment between institutional commitment to sustainability and actual outcomes remains questionable, as many universities struggle to translate lofty aspirations into tangible actions and impact.

Tiemann et al. (2018) highlight the increasing acknowledgment of entrepreneurship in public policy for fostering sustainable economic growth. While policy recognition is a positive step, it often falls short of addressing the systemic barriers that hinder the integration of sustainability into entrepreneurial initiatives within universities, such as funding constraints and entrenched academic structures.

Transitioning to G8, Zahrani (2022) underscores the importance of entrepreneurship education in equipping students with the skills for success. However, there is a need for a critical examination of whether current entrepreneurship education adequately addresses sustainability challenges or perpetuates conventional economic paradigms that prioritise profit over environmental and social well-being.

Dobers et al. (2008) discuss institutional entrepreneurship within higher education, illustrating collaborative efforts to advance sustainability initiatives. While these initiatives are commendable, questions arise regarding their scalability and long-term impact, as many sustainability initiatives within universities struggle to gain traction beyond small-scale pilot projects.

Furthermore, Fichter and Tiemann (2018) advocate for embedding sustainability into university support systems for entrepreneurship. However, the extent to which sustainability is truly integrated into these systems remains uncertain, as universities often face challenges in balancing economic imperatives with sustainability goals.

Whereas the cases discussed offer valuable insights, there is a pressing need for critical reflection on the effectiveness and sustainability of initiatives aimed at promoting sustainable entrepreneurship within universities. This involves addressing systemic barriers, reimagining entrepreneurship education, and ensuring genuine integration of sustainability principles into institutional policies and practices.

4.5 Institutional partnerships - G9 and G10

The references provided offer valuable perspectives on fostering institutional partnerships (G9) and identifying key competencies and skills through these collaborations (G10) within HEIs.

Gheorghiu et al. (2021) delve into the role of innovative universities in propelling entrepreneurial initiatives within conducive business environments. They emphasise universities' potential as catalysts for sustainable economic development through entrepreneurship. However, it's crucial to critically assess whether these partnerships genuinely benefit communities and prioritise sustainability over purely economic interests.

Additionally, Fabrega (2018) underscores the significance of location and entrepreneurship topics in HEIs for sustainable development. While advocating for local partnerships between HEIs and stakeholders, it's essential to evaluate the power dynamics inherent in these collaborations. Ensuring genuine community involvement in decision-making processes and addressing local needs and priorities are essential considerations.

Shifting focus to G10, Wyness and Jones (2019) highlight the potential for collaboration between disciplines like ESD and Entrepreneurship Education. While these partnerships can enhance educational practices, it is important to critically examine the underlying assumptions and values guiding these collaborations. It should be further discussed whether these partnerships are promoting a comprehensive approach to education that prioritises sustainability, or reinforcing existing power structures and ideologies within academia.

While the cases offer valuable insights into fostering partnerships and identifying key competencies, a critical perspective is necessary to ensure that these collaborations

genuinely promote sustainable development within HEIs and beyond. This entails scrutinising power dynamics, prioritising community engagement, and challenging assumptions about the role of universities in driving entrepreneurship and sustainable development.

5 Conclusions

This research has aimed to examine the contribution that higher education is making to the global sustainability challenges, through the teaching of sustainable entrepreneurship. It reveals that much is being done but much more is needed. Despite increased awareness of the sustainability problems that the planet is facing entrepreneurship appears to have had only limited success in addressing the crisis and indeed might be perceived as having contributed to, if not created, the problem. However, it does have the potential to ameliorate the crisis if not resolve it completely (Villar & Miralles, 2019) and is seen by some as offering a panacea.

The problem is that the world is very different from the mid 20th century when entrepreneurship education was first introduced and certainly very different from the 18th century when Jean Baptiste Say coined the concept. Currently, it is about saving the planet, which it is not doing so despite the introduction of new forms of entrepreneurship intended to address the environmental and human/social problems the planet is facing. To do so will require a radical change in both the teaching of entrepreneurship and the role and purpose of higher education.

While there remains confusion over what entrepreneurship for sustainability is, it is important that all students are introduced to the concepts, and not only those who intend to become self-employed and launch their own new ventures. In the global knowledge economy that characterises the 21st century, the world needs pro-active young people, who are capable of identifying and implementing creative solutions to the many environmental and social problems the world is facing, irrespective of whether they work for themselves or others. Similarly, they need to be aware of the issues relating to sustainability and how, by being less focused on “making as much money as possible” and more concerned to create a caring, sharing society (Ahsan, 2020), they can help to address them.

This requires not just a change in the curriculum but that HEIs in which young people are educated, also change their attitudes towards entrepreneurship, especially sustainable entrepreneurship, and pursue it more pro-actively. Our students cannot be

expected to be entrepreneurial and to address the sustainability issues the planet is facing if the colleges and universities they are attending are not themselves doing so.

This paper has some limitations. The first is the fact that it was based on a bibliographical research, which reviewed the body of existing literature on the topic but did not undertake an assessment of study programmes. The second limitation is that the focus was on literature on sustainable entrepreneurship, and not on areas such as innovation. This narrow scope may result in a limited understanding of how innovation intersects with and influences sustainable entrepreneurship, potentially missing key insights and developments in the broader entrepreneurial landscape. Finally, the study was limited to literature available in English and did not consider other languages. Despite these limitations, the study provides a welcome addition to the literature since it sheds some light on the current thinking on sustainable development and entrepreneurship, and has identified some areas where action is needed.

5.1 Recommendations

There are some measures that universities may deploy, in order to further promote the cause of sustainable entrepreneurship:

- Offer courses and degree programmes focused on sustainable entrepreneurship, which covers topics such as sustainable business practices, social entrepreneurship, and environmental management, among others.
- Encourage cross-disciplinary programmes that integrate business education with environmental science, engineering, and social sciences to provide a holistic understanding of sustainability challenges and solutions.
- Provide grants and funding opportunities for research in sustainable entrepreneurship and related fields.
- Establish or support business incubators and accelerators specifically focused on sustainable enterprises, offering mentorship, resources, and networking opportunities.
- Collaborate with companies and nonprofits that are leaders in sustainability. This can provide students with internships, apprenticeships, and real-world projects focused on sustainable practices.

Moreover, a greater engagement with local communities to address real-world problems may be pursued, which can lead to the development of sustainable business solutions that students can learn from and contribute to.

Further research is needed on how to operationalise the introduction of sustainable entrepreneurship in study programmes. Also, works are needed on appropriate methods and tools, to motivate students to engage on the topic. Here, provisions for training of educators may help (Persson et al., 2023), so they feel prepared to engage more on the topic.

There is also a need for trying out and monitoring new, innovative approaches to the subject, while the universities themselves need to reassess their role and purpose including how they are conventionally structured particularly in single silo disciplines. As Einstein recognised “we cannot solve our problems with the same thinking we used when we created them”.

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