Irish Journal of Management • 43(1) • 2024 • 59-70
DOI: 10.2478/ijm-2024-0009

Irish Journal of **Management**

Developing entrepreneurial mindset through sustainability-informed entrepreneurial education

Research Article

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Received: 11 February, 2024; Accepted: 11 January, 2025

Abstract: There is a growing social demand for educational systems to lead towards more sustainability-informed entrepreneurial education, to help enhance entrepreneurial mindsets. Entrepreneurial education emerges as critical in ensuring the development of academic and professional training that brings sustainability changes to existing business models - integrating the development of sustainability-informed critical thinking, problem-solving and problem-framing skills attune to current and emerging business challenges. To help prepare future entrepreneurs, this paper explores the traditional knowledge practices of the entrepreneurial mindset and the importance of identifying alternative approaches to reduce the disconnection between traditional learning theories, educational systems and models that allow entrepreneurs to innovate, and to respond to the business demand for sustainability-informed teaching and learning practices. The essential roles of entrepreneurs and the paths of their mindset development are explored to help unfold their potential to support and develop sustainability-informed entrepreneurship.

Keywords: *Sustainability; entrepreneurial mindset; entrepreneurship; education; sustainable development*

INTRODUCTION

The world economies are facing significant challenges as economic and political leaders try to balance economic growth and its implications for access and exploitation of the planet's natural resources and their usage as part of business activities (Jones, 2018). There is a need to acknowledge the importance of providing entrepreneurs with the skills and capabilities to manage current and future sustainability challenges as we progress with the United Nations (UN) vision of sustainable development as outlined in the UN 2030 Agenda (UN, 2015). The benefits of higher education are multifaceted, as the educational system is responsible for providing optimised learning frameworks for individuals to actively contribute to the demands of rapidly evolving and complex socio-economic and environmental systems (Hägg and Gabrielsson, 2020; Jones, 2018).

By engaging with the road map outlined by the UN sustainable development goals (SDGs) to enable the provision of education for sustainable development, higher education Institutions can help 'ensure inclusive and equitable quality education and promote lifelong learning opportunities for all', as captured by SDG 4. Sustainability-informed entrepreneurial education (EE) also aligns with SDG 8, aiming to ensure that all learners acquire the knowledge and skills required to facilitate and support decent work, inclusive economic growth and sustainable development. Sustainability-informed EE is an essential link between current students and the entrepreneurs of tomorrow; therefore, equipping students with relevant knowledge and providing actionable guidelines and responses to engage with the sustainability agenda will help to strengthen the business sector (OECD, 2022).

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Higher Education Institutions (HEIs) have an essential role to play in developing resilient economic and business systems, but in parallel they face major hurdles as they have to innovate and update teaching and learning models that are supported by cutting-edge research and that foster proactive learning and teaching environments more connected to the demands of entrepreneurs (Hägg and Gabrielson, 2020; Hermann et al., 2022). Additionally, sustainability challenges require the integration of lifelong learning and continued professional development for business innovators. Sustainability-informed EE can help students engage in more proactive and integrated learning processes, through different approaches to teaching, learning, and by doing research that can be considered as part of business training processes and integrated through alternative pedagogies that are agile and adaptable (Ashari et al., 2022; Leal et al., 2023).

However, to engage with pressing sustainability needs and demands, it is important to acknowledge the reality of a business sector guided by wealth maximation and profit motives amidst the pressures of the sustainability agenda (Hermann and Bossle, 2022). This requires an active reassessment of the best approach to support and guide the transformation of EE models and the existing educational offering. Innovative, agile, adaptable and flexible processes that enable changing and reshaping existing EE curricula require much effort to bring forward learning and training processes and activities that align with the reality of contemporary problems that require cost-efficient solutions (Joensuu-Salo et al., 2023). Sustainability-informed EE, as an active, collaborative, and experiential process, can help implement a multidisciplinary approach that facilitates and supports the integration of diverse learning concepts, aiming to form an alternative theoretical and practical pedagogical framework capable of supporting future entrepreneurs (Lackéus, 2015; Rodrigues, 2023).

Drawing on these insights, this paper focuses on the development of a sustainability-informed EE framework, that promotes entrepreneurial mindset expansion to include a sustainable development ethos. The research question asks: How can sustainability-informed entrepreneurial education promote entrepreneurial mindset expansion to include a sustainable development ethos?

The remainder of the paper offers insights into Ireland as the specific context addressed in this paper. It explores the importance of sustainability-informed entrepreneurial education, and offers insight into an alternative mindset and learning perspectives before proposing a sustainability-informed EE framework. The paper concludes with a critical assessment of sustainability as a key component of EE programmes, and as a driver of innovation.

Entrepreneurial education and its importance for the Irish economy

Entrepreneurial education is still evolving despite its historical context, which can be traced back to the 1940s. Nowadays, the content of EE programmes can be categorised as; programmes on how to create a new venture or start-up, how to operate and run a small business while growing, and how to develop entrepreneurial skills and abilities (Jones, 2018; Hägg and Gabrielsson, 2020). To support the resilience of businesses and high competitiveness in the global market, it is critical to invest in the educational sector and to enable supports that help HEIs to design EE programmes that provide entrepreneurs with the necessary skills to succeed and consolidate their business activities, at each stage of development. Investment attraction, technology implementation, sustainability-driven activities, and management skills emerge as critical aspects that can be integrated into the development of students' competencies that freshly graduated entrepreneurs lack (OECD, 2023). However, the required skills are not limited to new graduates or established businesses. The entrepreneurial sector faces high competition and challenges in each stage of business development regarding the generation of business ideas, the implementation phases, resource attraction, and working in a fast-changing and very demanding labour and competitive markets. Therefore, entrepreneurs benefit from lifelong learning support as they form a robust entrepreneurial mindset, highlighting the significance for universities to keep updated, flexible and adaptable curriculum design and content to support entrepreneurial education (Smith et al., 2022; OECD, 2022).

This paper considers the Irish context when contemplating the exploration of sustainability-informed EE. The nature and defining principle of the Irish economic model – a small open economy supported by the country's strategic geographical location and political stability, a qualified labour force and attractive tax system – provides an interesting context to rethink the role that EE can play in diversifying its economy (Joensuu-Salo et al., 2023; Winborg and Hägg, 2022). Promoting EE is critical for Ireland since the country's economic model is heavily dependent on external factors, such as the significant representation of American multinationals, combined with an open economic model driven by the export market and its success in attracting foreign direct investment (OECD, 2022; Skilling, 2022). However, the country's overreliance on the United States multinationals represents a major risk and requires urgent reconsideration of economic diversification to minimise risk exposure towards external and internal shocks within a global system defined by increasing levels of risk and uncertainty.

The Irish government has long since recognised the need for economic diversification and provides consistent and stable support to small and medium sized enterprises (SMEs), aiming to ease dependency on multinationals. Government and state agencies offer significant support to entrepreneurs and small business activities through a myriad of support mechanisms, schemes and funding programmes (Enterprise Ireland, 2023). Evidence suggests that this approach works well, as SMEs represent 99.5% of all Irish businesses (CSO, 2022) and add significant value to the economy's employment capacity, equal to 68% of private sector employment, and create critical conditions for stable economic growth and revenue generation (CSO, 2022; Azadnia et al., 2022; OECD, 2022).

However, the current business landscape reveals how business owners and SMEs are experiencing challenges in implementing and reporting SDG compliance, and adherence to the UN Sustainability Agenda is identified as a major hurdle for entrepreneurs (Hägg and Gabrielsson, 2020). The SDGs and the UN 2030 Agenda are stuck at the mid-way point due to significant challenges as half of the targets demonstrate moderate or severe deviations from the trajectory due to insufficient efforts to stay on track and progress further (UN, 2023). Thus, HEIs have a role to play in promoting sustainable development within EE pedagogical frameworks, notwithstanding the under-funded HEI system in Ireland and the resultant challenges it faces in meeting SDG 'quality education' ambitions (OECD, 2024).

Promoting sustainability-informed EE has therefore gained significant attention and has been identified as a global trend. Different research studies examining EE indicate that it is an essential driver of social prosperity and well-being (Joensuu-Salo et al., 2023; GEM, 2022; Winborg and Hägg, 2022). EE is also promoted at policy level by the European Union (EU), which created guiding EE documents to equip all learners from primary school to HEIs with the required entrepreneurial skills (OECD, 2022; European Commission, 2022). However, the recommendations provided by the EU have a limited scope as they act in a supportive role with the requirement for an actionable plan that connects universities and entrepreneurs.

Although Ireland received the EU recommendations in 2016, the strategy of EE implementation has been bounded by primary and secondary schools and free online EE resources characterised by their limited impact (Department of Enterprise, Trade and Employment, 2016). Thus, HEIs are responsible for the decisions to embed EE into their curriculum and for making efforts to move the EE agenda forward. This increase in the importance of EE has determined the number of varied mechanisms embedded in HEI's curriculum: incubators, accelerators and entrepreneurial centres aiming to develop critical and design thinking skills (Azadnia et al., 2022). Interaction between HEI's administration, teachers, students, and industry has become a critical link in promoting, evaluating, and improving EE transfer between HEIs, industry, government and communities to support regional economies by ensuring well-educated entrepreneurs (Joensuu-Salo et al., 2023; Winborg and Hägg, 2022).

Developing EE programmes, revising curricula, ensuring continuous professional development for staff, and increasing student attraction have become high priorities for all third-level institutions in Ireland (National Access Plan, 2022-2028) and the European Commission. EE courses and modules offered by Irish HEIs have become quite popular among students and educators due to the action-oriented and practical teaching approaches (Hägg and Gabrielsson, 2020; Jones, 2018). The success of the programmes can be explained by the fact that entrepreneurship can be learned like other disciplines therefore education, training, and development become essential for future entrepreneurs, the economy, and society. Additional aspects for consideration are how entrepreneurship education emphasises theoretical knowledge with creativity and innovation, while EE brings more emphasis to practical aspects, such as motivation and business skills, which influence entrepreneurial performance (Jones, 2018; Hägg and Gabrielsson, 2020). This differentiation is particularly important, as entrepreneurship education does not show a significant relationship between received entrepreneurship knowledge and intention to start the business (Smith et al., 2022).

A closer look at the case of Ireland and its strategic economic planning shows efforts seeking to launch and support new venture creation, and emphasising the role of entrepreneurial or enterprise education, which targets developing skills essential for an entrepreneurial mindset (Cui and Bell, 2022; Daspit et al., 2023). Moreover, entrepreneurial programmes can become a trigger in attracting highly qualified students worldwide to support the Irish Economy in its leading strategy; to achieve sustainable economic growth. The economy can consider the value generated by a diverse workforce, bringing to businesses various skills, experiences, and mindsets (OECD, 2023), supported by the latest OECD report findings claiming that 77% of migrants are looking for employment in Ireland.

Additionally, government policy for entrepreneurship in Ireland requires HEIs to be innovative and entrepreneurial in education and research, in order to become organisations capable of delivering high-quality programmes and providing mechanisms that facilitate engaging various businesses in the educational process (OECD, 2022). This strategy will help to mitigate detachments between academic research and professional practice thereby helping

to better embed theory into business operational routines and everyday practice (Kuratko et al., 2005; Kuratko and Morris, 2018; Kuratko and Covin, 2025). From the academic side, strong emphasis is placed on continuous support for teachers with professional development activities and attracting high-potential entrepreneurial students to the university environment. The reality shows that countries with more favourable policies in attracting, retaining, and supporting international students benefit from the accelerating skills shortages experienced by economies (OECD, 2023). It is this form of entrepreneurial education that is the focus of this paper.

Proposing a sustainability-informed entrepreneurial mindset

An important aspect to consider relates to the lack of consensus among researchers about what an entrepreneurial mindset is, with the reviewed literature offering insights into entrepreneurial mindsets' diversity of definitions. An entrepreneurial mindset is associated with skills, competencies, and knowledge which lead to entrepreneurial success (Davis et al., 2016; Daspit et al., 2023). For example, Mawson et al. (2023) states that entrepreneurial mindset is "a set of learnable cognitive and emotional competencies conducive to developing and enacting behaviours to support value creation activity" (p. 483). Entrepreneurship scholars engaged in cognitive research define entrepreneurial mindset as "a fully engaged thinker who has multiple cognitive strategies available and chooses among them based on goals, motives, and needs" (Fiske and Taylor, 1991: 13). Considering that entrepreneurs have to operate in a highly uncertain, novel and dynamic environment (Haynie et al., 2010), Ireland et al. (2003) define entrepreneurial mindset as "the ability to rapidly sense, act, and mobilise, even under uncertain conditions" (Ireland, 2003: 967). Under this definition, knowledge of how to identify opportunities, consider alternatives, and overcome dynamism will become a solution to address these challenges. At the same time, an entrepreneurial mindset differs from a management mindset (Haynie et al., 2010); however, moving from a managerial to an entrepreneurial mindset can be twofold, as creating advantages in company performance and creating challenges in switching from one way of thinking to another. This paper will be guided by the following definition, which emerged as a synthesis of the above insights,

> Entrepreneurial mindset is a combination of entrepreneurs' cognitive, behavioural and emotional aspects, which help entrepreneurs think, feel and behave to achieve success and innovation in an uncertain environment.

Guided by this definition, EE can benefit from embedding learning theories as part of the pedagogical context due to their prominence in enabling the development, design and implementation of adequate learning environments that foster students' understanding and ability to collaborate, co-create and engage in the knowledge-sharing process. Within this domain, behaviourist, cognitive, humanism, constructivism, and connectivism learning theories can provide a more in depth understanding of the learning process, helping to define and understand the focus of learning and outline educational strategies, approaches to entrepreneurial mindset development strategies, and the teacher's role (Kuratko et al., 2005; Howorth and Moro, 2012; Kuratko and Morris, 2018).

To aid in this understanding, an overview of each learning theory will help to evaluate its applicability to developing an entrepreneurial mindset (Table 1).

Based on the insights gleaned from Table 1, employing relevant learning theories will help to address the sustainability-informed entrepreneurial mindset aim of the EE curriculum. Table 2 represents the main concepts that form our understanding of the entrepreneurial mindset and its component parts, and how they reflect the identified learning theories (Table 1). These can be explored as educators revisit their approach towards sustainability-informed entrepreneurial mindset development.

Entrepreneurial mindsets can be linked to learning theories according to individual or venture level, depending on the demand of a specific set of skills, competencies, feelings, meaning-making, or knowledge construction (Table 2).

Behaviourist theory mainly provides a practical approach to entrepreneurial education, targeting a positive change in entrepreneurs' behaviour in the proactive actions of venture creation. The role of cognitive theory in entrepreneurial education involves extensive and rapid acquisition of new knowledge to convert previous experience into valuable expertise. The humanist perspective is crucial for entrepreneurial learning as it includes feelings of entrepreneurs, emphasising the necessity of emotional competencies and considering them when receiving feedback from the environment for future actions.

In adapting the relevant elements of constructivist learning theory in their teaching and learning strategies, EE educators consider previous participants' experiences, try to embed learning in a social context, and are flexible in

Table 1. The role of learning theories in EE

Theory	Description	Relevance to EE	Supporting Literature
Behaviourist Theory	Involves positive reinforcement of the entrepreneur's behaviour in discussing the nature of the problems, looking for possible solutions, and testing the outcomes of actions by facilitating a critical and analytical feedback process that contributes to assessing impact and potential corrections.	Behaviourism helps learners to form a basis of *"hard"* or technical skills and become a part of the practical approach to entrepreneurial education, as everything taught has to lead to taking opportunities and actions of venture creation and development.	Bates, (2015); Thorndike, (1999)
Cognitive Theory	Aims to explain how learners can learn and focus on thinking and problem-solving.	Integration of this concept in the EE is essential so that new knowledge is based upon prior experience and helps to improve critical thinking and problem framing and solving strategies. These skills are valuable competencies in entrepreneurship that can be achieved by sharing experiences and expertise.	Bruner, (1971); Gagne et al. (1992); Lewin, (1951)
Humanism Theory	This theory considers humans as an essential part of the learning process, and believes in an individual's potential for learning, self-determination and freedom to choose.	Humanism, mainly focused on personal growth and the full development of individual potential, contributes to EE by developing intellectual, emotional, creative, and physical skills and monitoring the learner's progress thus forming a foundation of a lifelong learning approach.	Bates, (2015)
Constructivist Theory	People construct knowledge instead of receiving it. As an active participant in the educational process, the learner stays operational, applies existing knowledge, reflects and assesses the outcomes, and then starts the cycle again thereby connecting to the cycles associated with action learning and the circularity of knowledge.	The integration of Constructivist principles benefits current enterprise demands by developing students' problem-solving, collaborative, networking, and self-awareness skills to succeed in a constrained socio-economic and environmental context.	Piaget, (1970)
Connectivism Theory	Addresses the interaction where people can exchange knowledge, information, skills, and experiences and learn from each other.	Connectivism theory can add value to EE by promoting participation in the learning community, and distributing knowledge through the network.	Cui and Bell, (2022)

Source: Authors' Own.

learning approaches. Learners can benefit from applying constructivism theory through deep engagement in the EE process, developing social and communication skills, and owning what has been learned, which contributes to building lifelong learning strategies and skills (Archambault et al., 2022). Considering that constructing knowledge leads to meaning designing and interpretation (Cui and Bell, 2022; Mawson et al., 2023), all these techniques will allow learners to develop their problem-solving, collaborative, networking, and self-awareness skills (Smith and Worsfold, 2013), which form an entrepreneurial mindset and influence professional development.

Within this trajectory, as the learning process is continuous and cyclic, sharing knowledge through networks is designed similarly to the hierarchy of the Internet and social networks, therefore connectivism theory helps to design large-scale learning communities within and outside the company (Cui and Bell, 2022; Mawson et al., 2023). The principle of connectedness supports developing critical competencies, including entrepreneurial self-efficacy, system thinking, problem-solving, innovation, interdisciplinarity and sustainability awareness, which helps in understanding complex global problems and then adjusting behaviour according to the different learning environments involved, moving from individual level of skills and competencies to an enterprise, or venture, level (Hermann et al., 2022; UNESCO, 2018), as exhibited in Table 2.

Entrepreneurial education: Integrating learning theories

The reviewed literature points to EE actively using the components of experience-based learning with embedded practice-oriented tasks linked to core learning theories: connectivism, cognitivism, constructivism and their approaches (Hägg and Gabrielsson, 2020). Moreover, learning theories support knowledge circularity and become a basis for critical entrepreneurial skills development, as they help to receive and build knowledge for system thinking and problem-solving competencies development, change behaviour to become more effective, and raise sustainability awareness (Kuratko and Morris, 2018).

The individual component in entrepreneurship learning has been embedded in the social context (Table 2) to emphasise the importance of the human-centred approach added by humanist theorists (Lackéus et al., 2015).

Table 2. Entrepreneurial Mindset and Learning Theories

Entrepreneurial Mindset (EM) Concepts	Learning Theory	Authors
Individual Level		
• Entrepreneurial and management mindsets differ. • EM includes thinking, skills, and motivation, which lead to success. • There is no general definition, and the process is ongoing. • The main features of EM are value creation, the ability to recognise and act on opportunities, adaptability and resilience, cognitive perspective, decision-making with limited information, and uncertain and complex conditions.	Behaviourism - change of behaviour, set of skills and competencies Cognitivism - knowledge construction Humanism - self-awareness, feelings	Daspit et al. (2023)
• Definition is elusive • Innovations and technologies are central to entrepreneurship. • EM allows to come up with new ideas, generate creative ideas and take up opportunities.		Audretsch et al. (2015); Kuratko et al. (2021)
• EM is the ability to rapidly sense, act, and mobilise, even under uncertain conditions • Insights in thinking and behaviour and cognitive adaptability leading to flexibility. • Leads to adaptable decision-making • EM influences individual and venture level		Haynie et al. (2010); Ireland et al. (2003)
• EM increases student motivation to become entrepreneurs • The role of EM in entrepreneurship intention, level of school instead of university • EM focuses not only on capability but also on knowledge, experience, problem-solving, seeking opportunities, beliefs • EE helps students to identify career paths to work, focusing on knowledge, skills and experiences • EE encourages students to interact with teachers and peers to solve issues and receive feedback		Handayati et al. (2020)
• EE is a cognitive function therefore linking thinking to other entrepreneurial competencies will support in taking action. • Effective entrepreneurs can use means they already have to generate new means to deal with high level of uncertainty. • Feedback from the environment is highly important for future actions and plans	Behaviourism - change of behaviour, set of skills and competencies Cognitivism - knowledge construction Humanism - self-awareness, feelings Constructivism – meaning-making, exploring knowledge constructions	Kuratko et al. (2021); Mawson et al. (2023); McMullen and Shepherd, (2006); Morris et al. (2013)
• Behaviour, which leads to action, plays a central role in entrepreneurship. • Focusing on individual role and missing making connections necessary for every business creation.		Cui and Bell, (2022)
VENTURE LEVEL - Connectivism theory (networks, interaction and communication)		

Source: Authors' Own.

Research studies offer evidence on how EE focuses not only on venture creation or the development of entrepreneurial skills and abilities (Jones, 2018; Lackéus et al., 2015). It also considers insights from a humanistic perspective and how the learner can generate new knowledge through previous experience while solving practice-oriented tasks. In applying this pedagogical approach to sustainability-informed EE, the learner will be able to define and identify features to consider when addressing the challenges and, more importantly, the opportunities posed by the UN 2030 Agenda (UN, 2015).

Sustainability as a driver of entrepreneurial programmes

The UN introduced an ambitious agenda in 2015, aiming to address our world's most pressing challenges and frame them in the context of sustainability (UN, 2015). The United Nations Development Programme (UNDP) launched the 17 Sustainable Development Goals (SDGs). These goals are set to be met by 2030 and cover a wide range of social, economic, and environmental issues, addressing critical global challenges (Krayneva et al., 2021). Altogether, goals and indicators already represent a complex task for businesses in identifying and implementing a relevant one, and it is more daunting to engage with all of them and their different goals and targets due to the significant financial efforts that are required to support the required levels of investment to progress with the very ambitious SDGs agenda.

However, a lack of awareness and/ or an onerous identification process may hinder SMEs from adapting SDGs to their operational practices and impact their performance. Implementation of a working framework for universities' curriculum will allow them to embed sustainability goals in their programmes, incorporate them as part of EE, and equip future entrepreneurs with the relevant knowledge, skills, and techniques to address these challenges.

The framework for addressing sustainability challenges in the EE can be based on the cognitive, behavioural and connective principles described through the learning objectives in the UNESCO competencies framework (UNESCO, 2018). In turn, an educational offer will contribute to students' understanding of existing sustainability challenges and their implications for business activities and more specifically for the entrepreneurial working context. Additionally, considering experience-based practices in teaching specific practical skills will help to prepare students for entrepreneurship (Winborg and Hägg, 2022).

To implement sustainability into working practices, the first step for universities can include raising awareness about sustainability demands and practices and to offer sustainability components in current programmes in the framework of EE. Part of raising awareness among their faculty and students can be the development of sustainability literacy (Winborg and Hägg, 2022). Based on recent trends, many HEIs have started to play their role in embedding sustainable development into their academic curriculums, research, operations, and community engagement to promote and share ideas with future generations. HEIs can integrate sustainable practices in their own campuses and teaching programmes and promote them (Krayneva et al., 2021), and also ensure the availability of academic and professional training.

The educational system also faces increasing demands of the labour market to fulfil the creation of a socio-economic and environmental system that is more sustainable, equitable, diverse, and inclusive in alignment with equality, diversity and inclusion principles (Abdigapbarova and Zhiyenbayeva, 2023). Human resources in such an environment emerge as a critical element as they drive change and articulate required mechanisms that support sustainable development and create entrepreneurship opportunities through the launching of new ventures. Furthermore, the challenges associated with stable employment put significant pressure on supporting a resilient and updated entrepreneurial sector (Krayneva et al., 2021; Abdigapbarova and Zhiyenbayeva, 2023). As a result, EE has become a crucial element of the educational system.

As reported by the Higher Education Authority in Ireland (HEA, 2021), to implement Education for Sustainable Development, HEIs can offer valuable opportunities through different channels not limited only to the curriculum but also integrating innovative research, student engagement and activism, industry engagement and international networks, and emphasising the role of EE in forming EM (HEA, 2021). Incorporating sustainability-related subjects into the curriculum across all disciplines will enhance interdisciplinary skills relevant to all learners' general education and help them better understand the importance of sustainability and its impact on achieving the SDGs. Including students in the dialogue with academics, researchers, industry, and other relevant stakeholders will present opportunities to foster further learning and understanding, strengthening the student-centred approach to acquiring the necessary knowledge and skills for the future entrepreneurial path.

The transformation in higher education towards sustainability will need to encourage working in multidisciplinary, interdisciplinary and transdisciplinary contexts. In their recent work, Liu et al. (2022) and Grierson and Munro (2018) mention that multidisciplinary and interdisciplinary education and incorporation of sustainability-focused insight into SDGs provide complementary approaches to enhancing learners' knowledge-sharing process and developing sustainability competencies. Therefore, to become effective SDG advocates, HEIs aim to equip students with cross-cutting skills and key competencies related to the SDGs. These key competencies include; systems thinking, critical thinking, self-awareness, integrated problem-solving, and anticipatory, normative, strategic, and collaborative competencies; creativity, entrepreneurship, curiosity, and learning skills; design thinking, social responsibility, partnership competencies; and being comfortable in interdisciplinary settings (UNESCO, 2018). These skills can be developed as a part of the entrepreneurial mindset for future business leaders, aiming to develop their cognitive abilities to change behaviour concerning their feelings (Table 2). Aligning the entrepreneurial mindset necessary to consider thinking, feeling, and behaving (Kuratko, 2005; Kuratko and Morris, 2018) with learning approaches that offer learning theories through experience-based learning in combination with multidisciplinary learning should lead to understanding the sustainability challenges about the environment, society, and the economy.

Further aspects to be considered are how entrepreneurship is directly linked to SDG 4 (Quality Education) and SDG 8 (Decent Work and Economic Growth) through education and allows the development of an entrepreneurial mindset. In this sense, entrepreneurship is linked to education through learning processes that nurture the passion for creating and implementing new business ideas that support the sustainability agenda and its associated goals and targets. However, entrepreneurs are not limited by the HEIs programmes. They can use such frameworks such as EntreComp, GreenComp, and DigComp, all designed by the European Commission to help businesses identify required entrepreneurial competencies and learn them in a simple way. These frameworks offer a range of starting points depending on the individual level and moving towards the expert level, taking into account the growing pressure of environmental response, and as a part of a lifelong learning strategy, promoted by the

European Union (McCallum et al., 2018; Bianchi et al., 2022; Vuorikari et al., 2022). Key elements, offered by these frameworks, include system and critical thinking with the ability to frame the problem and find solutions, representing critical features of entrepreneurial mindset development. Developing entrepreneurial skills through enhancing an entrepreneurial mindset to include sustainability-informed insights helps students recognise opportunities, take action, and build necessary knowledge constructions, such as knowledge, skills, and behaviour, which are crucial to future entrepreneurs' and businesses' success.

Sustainability-informed Entrepreneurial education as a driver of innovation

Entrepreneurship is one of the leading drivers that can help countries promote and sustain their economic growth and development in uncertain and unpredictable conditions that define the globalisation and innovation landscape (Ashari et al., 2022; Hermann and Bossle, 2020; Jones, 2018). Integrating entrepreneurial principles in education to raise understanding and build skills required to address sustainability and environmental challenges will help to reshape future business model structures and support the shift to a new circular teaching, learning and research model (Morales et al., 2022). Expanding the EE curriculum from a business-focused to a multidisciplinary approach to entrepreneurial mindset growth guided by sustainability requests will make EE more transformative by seeking a balance between profit-oriented business mindsets and rational use and allocation of resources without sacrificing society's and environmental needs (Hermann and Bossle, 2020).

To achieve SDG goals, universities can promote lifelong learning as an essential part of the EE (Ashari et al., 2022). Universities can create learning spaces driven by innovative ways of delivering their entrepreneurship programmes aligned with regional, national, and sustainable development goals (Ashari et al., 2022; Hermann and Bossle, 2020; Jones, 2018). At the same time, entrepreneurs aiming to balance economic growth and environmental preservation are considered the most critical drivers of the SDGs (Hermann and Bossle, 2020; Jones, 2018). Developing entrepreneurial mindset through critical and creative thinking consistently from the first years of undergraduate programmes up to Master's level and Doctoral education will help create a solid EE base in alignment with the UN 2030 Agenda. This approach offers robust opportunities for real-life student experiences and effective lifelong learning, which is an essential component of stable economies with highly innovative interventions.

The most important indicators influencing a high level of innovation include the population within tertiary education, indicators of lifelong learning, attractive research systems, and companies' investments in research and development. Ireland has a strong comparative position in terms of innovation, which is evidenced by the European Innovation Scoreboard (EIS) report 2023. This scoreboard provides a comparative analysis of the innovation performance of all EU countries and regional neighbours (European Commission, 2023), while conclusions are based on the 32 indicators framework under 12 dimensions. The main strengths of the Irish innovative sector that allowed the state to achieve such effective results are; the large, highly qualified population with tertiary education, the high employment rate in the innovative and technological sectors, so-called knowledge-intensive sectors (European Commission, 2023). Despite an evident decrease in the level of investment in research and innovation spent by businesses, the overall high innovative potential remains strong in Ireland (Table 3).

Innovation is a driving force of a country's economic development and, driven by the qualified professional people, the economy can achieve its ambitious goals. While Ireland remains in the Strong Innovators score due to the smart government support of tertiary education and the rise of expenditures on research and development,

Table 3. Main EIS indicators in Ireland

Ireland	Performance relative to EU in 2023	Performance change 2016-2023	Performance change 2022-2023
Human resources			
Population with tertiary education	217.3	**3.6**	**3.6**
Lifelong learning	99.0	**−19.8**	**−19.8**
Investments and support			
Government support for business R&D	114.8	**−61.8**	**0.1**
R&D expenditures in the business sector	54.9	**−18.5**	**−5.4**
Employment impacts			
Employment in innovative enterprises	104.8	**−25.4**	**56.5**
Innovative expenditures per employee	148.3	**52.8**	**18.0**

Source: Adapted from European Innovation Scoreboard, Country profile Ireland, (2023)

sustainability-informed EE would help to overcome the drop-down in life-long learning. It would also enhance entrepreneurial mindset-driven decisions of starting new businesses, which is becoming essential in knowledge-intensive sectors, complementing the overall economic growth (Leal Filho et al., 2023).

CONCLUSION

The development of an entrepreneurial mindset as a combination of entrepreneurs' cognitive, behavioural and emotional aspects helps enterprises to innovate and operate successfully in an uncertain environment of ever-changing economic and political conditions. To remain relevant, and in consideration of sustainable, responsible entrepreneurial actions, HEI EE programmes require insights from researchers, educators, students, and the business sector to facilitate the co-creation of learning contexts and to enable the circularity of knowledge. Thus, entrepreneurial learning, being active, collaborative, experiential and guided by a multidisciplinary approach, includes various learning concepts such as experiential, cognitive, and constructivist learning targeted to change behaviour and being human-centred (Lackéus, 2015; Rodrigues, 2023). This approach represents a changing and evolving process of knowledge creation that is built on the construction, co-design, participation and sharing dynamic and proactive process where the learner-educator-researcher interacts. In adopting this pedagogy, it should be possible to develop the critical competencies required to expand the entrepreneurial mindset to include; sustainability, entrepreneurial self-efficacy, system thinking, problem-solving, innovation, and transdisciplinarity (OECD, 2022; World Economic Forum, 2018).

Despite the fact that entrepreneurial education plays a crucial role in bridging today's students and entrepreneurs of tomorrow, it can also be received outside the HEIs walls. There is a vast cohort of self-made entrepreneurs who gain and develop their skills, competencies and experiences while contributing to the operational elements of their enterprises by facing problems, making errors and solving them accordingly. Learning by trial and error, and addressing problems within dynamic and evolving environments form the basis of the learning experience. Experiential learning aligns with the primary learning theories employed by HEIs (Table 1) to embed pedagogical approaches in EE programmes and decrease the detachment between short professional training and academic programmes that seek to provide a robust learning space (Howorth and Moro, 2012).

To maintain consistency in the level of EE and mitigate detachments between academic standards and professional demands, teaching practices have to better incorporate theory into business operational routines and everyday practice. Sustainability-informed EE can help future entrepreneurs position the driving force of their business, whether it be a profit or sustainability-driven company. Looking at the sustainability component, companies can seek more energy efficiency and effective use of natural resources (Hermann and Bossle, 2020; Jones, 2018). However, in cases where these practices require more investments than the company can afford, they will likely be ignored. To balance demands between sustainability and a profit-driven approach, embedding a social component, representing a commitment to rights, equal opportunities, and a focus on community will ease this complex task for a new venture (Leal Filho et al., 2023).

To address the specific competencies development, such as critical thinking, problem framing and solving, and to meet the demands of enterprises, research findings suggest that EE can employ relevant learning theories, targeting the development of specific skills in line with forming a life-long learning approach, which is an essential component of a stable economy with a high level of innovation. Such an approach can help address the growing pressures identified by the UN Agenda, as well as include in the EE curriculum various disciplines guided by the principles of multidisciplinary and interdisciplinary approaches. Additionally, the extensive further integration of learning theories and multidisciplinary skills into EE curriculum across all disciplines can enhance interdisciplinary skills relevant to all learners' general education and help them better understand the importance of sustainability and its impact on achieving the SDGs. Notably, multidisciplinarity plays a significant role in connecting necessary content with skill development and simultaneously encourages student-centred approaches in teaching, emphasising the circularity of the roles in the educational process (Lackéus et al., 2015).

Future research is required to explore the extent to which integrating entrepreneurial principles in education can raise understanding and build skills required to address sustainability and environmental challenges, which can encourage students to start their businesses and improve their understanding of the balance between profit-driven and sustainability-driven models. However, sustainability practices require significant investments to evaluate the cost of embedding social or environmental components, topics that require further exploration.

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