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Greater than the Sum of Its Parts: Combining Entrepreneurial and Sustainable Competencies in Entrepreneurship Education

Sebastian Planck ^{1,*}, **Sonja Wilhelm** ², **Johanna Kobilke** ¹ and **Klaus Sailer** ¹

¹ Strascheg Center for Entrepreneurship, HM Munich University of Applied Sciences, 80797 Munich, Germany; johanna.kobilke@sce.de (J.K.); klaus.sailer@sce.de (K.S.)

² Social Entrepreneurship Akademie, Strascheg Center for Entrepreneurship, HM Munich University of Applied Sciences, 80797 Munich, Germany; sonja.wilhelm@hm.edu

* Correspondence: sebastian.planck@sce.de

Abstract: Discussions about sustainability and entrepreneurship are often an “either/or” discourse. Many higher-education institutions offer sustainability education programs with the aim of enabling students to think and act sustainably without concrete tools for change. Similarly, many offerings in entrepreneurship fail to address sustainability issues. This article assumes a qualitative, constructivist, systems thinking approach to theorize and analyze the relationships between entrepreneurship and sustainability competencies and makes three contributions to theory and practice. First, it provides a thematic analysis of two important European competence frameworks—for sustainability (GreenComp) and entrepreneurial competencies (EntreComp)—and delineates their relationships. Second, through a case study of an experiential educational format, it offers three educational tools that integrate sustainability and entrepreneurial competencies. Third, it contributes to the growing field of research that combines sustainability and entrepreneurship education. The results of this paper are relevant for policymakers who want to combine sustainability and entrepreneurship in education, as well as for educators looking for methods to combine both competence frameworks.



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1. Introduction: Sustainability or Entrepreneurship?

Higher-education institutions (HEIs) find themselves in a time of multiple crises. Besides demographic changes, accelerating digital transformation, and new expectations of HEIs in relation to society, industry, and politics, sustainable transformation is yet another driving force for academic organizations to adapt to and to question their habitus [1,2]. Integrating sustainability in a systemic way into all levels of HEIs remains a challenge, but a necessity [3,4].

In this conceptual study, we shed light on one way of incorporating sustainability, understood here as a regenerative combination of social and economic processes that are respecting ecological boundaries (A1 in Appendix A), within university structures. As a conceptual and practice-oriented contribution, we first offer a theoretical overview and context of the two realms of sustainability and entrepreneurship from the literature, and then offer practical insights for policymakers and actionable methods for educators on how to merge sustainability and entrepreneurship in education. Our research question addresses the issue of how entrepreneurship and sustainability competencies can be integrated. We thus focus on HEIs in their enabling role to foster a sustainable mindset and skill set and hence focus on educational ways of combining sustainability with entrepreneurship education, mainly focusing on competencies, since their development could be seen as the major goal of HEIs. In order to bridge the gap between theory and practice and to provide concrete steps of integrating this into daily teaching practices of educators, we offer three tools that combine both sustainability and entrepreneurial competence development. For

us, this combination marks one of many potential vehicles for a sustainable transformation of HEIs into “sustainable entrepreneurial universities,” that is, institutions that emphasize social responsibility and support sustainable development and social innovation [2] (A2 in Appendix A).

One of the major challenges of sustainability remains the knowledge–action gap. We have known about climate change and the need for sustainable deep transitions for more than 50 years [5]. Action towards balancing our economies and societies within sustainable thresholds like the SDGs or doughnut economics have nevertheless remained not far-reaching enough. Similar knowledge–action gaps remain in the field of education for sustainable development (ESD) [6]. In a systematic review of research on the impact of ESD, O’Flaherty and Liddy showed that the positive impact of ESD remains in the realm of cognitive competencies [7]. While learners do acquire important knowledge through theoretical concepts about sustainability, the aim of this article is to show how experiential entrepreneurship education [8] may teach sustainability through entrepreneurship, which may develop learners’ competencies for sustainable action, what Arjen Wals and colleagues [9] call “praxis-oriented sustainability”. We offer methods and tools that may support learners in developing a mindset and toolset for sustainable action.

In entrepreneurship education research, the concept of “teaching through entrepreneurship” is well established [10,11]. This approach has to be differentiated from “teaching about entrepreneurship,” which concerns learning opportunities that delve into theories about entrepreneurship, or other aspects of business venturing. Accordingly, approaches of “teaching for entrepreneurship” see the founding of a company as the ultimate result of the learning occasion. The “teaching through entrepreneurship” approach amplifies pedagogies, processes, methodologies, and tasks from the area of entrepreneurship not primarily with the goal of starting a business, but rather to develop overarching competencies (A3 in Appendix A). Just as teaching through entrepreneurship is not primarily about entrepreneurship, nor is it solely about sustainability, but nevertheless offers the potential to synergistically develop entrepreneurial and sustainability competencies.

In the following section (Sustainability and Entrepreneurship), we provide an overview of the theoretical underpinnings of our study (sustainable entrepreneurship and systems thinking), including a review of the literature on sustainability and entrepreneurship competencies. We then depict how sustainability and entrepreneurship have converged within the last few decades and support this research trend by analyzing two important competence frameworks—GreenComp for sustainability and EntreComp for entrepreneurship—that have not been researched in synthesis to date (A4 in Appendix A). After giving an overview of the data (the two competence frameworks), we elaborate the article’s method and research design, which provides a thematic analysis of the two competence frameworks, based on an interpretivist approach.

A third part (Sustainability through Entrepreneurship) synthesizes these theoretical insights and suggests one way of teaching sustainability through entrepreneurship education through a case study. In order to offer educators a way to integrate these results into their curricula without having to compromise either entrepreneurship or sustainability competencies, we suggest three different tools to be used in project- and team-based experiential learning environments.

We end by delineating some limitations of this study, pathways for further research, and implications for theory and practice.

2. Sustainability and Entrepreneurship: Theoretical Context, Literature Review, and Method

2.1. Sustainable Entrepreneurship as a Research Objective

The combination of sustainability and entrepreneurship marks an important theoretical underpinning of our study. While entrepreneurship for some manifests one of the major driving forces of unsustainable behavior in the Anthropocene, research and practice have fundamentally shifted the orientation of entrepreneurship to be aligned with sustainability

within the last few decades [12,13]. Sustainability and entrepreneurship may thus no longer be viewed as two separate spheres of action, but part of the same goal.

The integration of sustainability into entrepreneurship practice can be traced back to the genesis of social and sustainable entrepreneurship. Research on sustainable entrepreneurship increased markedly in the last three decades [14], with a heightened scholarly interest starting in the 2000s (A5 in Appendix A). Sustainable entrepreneurship (SE) can be seen as a development of shortcomings of classical entrepreneurship [15]. Definitions of sustainable entrepreneurship make up a spectrum. Some authors define a company as sustainable if it works within the boundaries of the triple bottom line (ecological, social, economic) [16], while others argue that SE necessitates an integration of sustainability into the operational strategy of an existing organization [17]. Even stricter approaches only see SE at hand when sustainability is part of the core business model of the organization [18], while some even argue that SE is always “challenging the status quo” [19].

For the purpose of this study, we define SE as a process (instead of individuals or organizations) that creates solutions to environmental challenges like climate change, waste, deforestation, pollution etc., while finding a balance between the triple bottom line. This process can be focused on efficiency, by decreasing the negative effects of challenges, or regenerative, by creating social, environmental, and economic value (A6 in Appendix A).

While the last few decades have witnessed the evolution of different “nontraditional” [20] concepts of entrepreneurship, there are also schools of thought that focus on an integrative, holistic, and systemic understanding (A7 in Appendix A). Instead of focusing on a differentiation of taxonomies of entrepreneurship that will only drive a theoretical and practical divide, we see the integration of sustainability into entrepreneurship and entrepreneurship into sustainability as an inevitable necessity in the 21st century. Although there are differences within the methodological and conceptual approaches of these terms, a holistic and systemic approach to entrepreneurship and its education may erase these boundaries.

2.2. Systems Thinking as a Research Philosophy

Besides sustainable entrepreneurship, one essential theoretical angle that provides this study with a lens that accentuates connections and compatibilities in social phenomena is systems thinking. Systems thinking has different theoretical antecedents and related ontological and epistemological assumptions (A6 in Appendix A). A basic understanding of systems thinking is that social phenomena are interrelated and depend upon one another: “Systems thinking has been developed based on the understanding that it is not enough to study only parts and processes in isolation” [21]. The literature on systems thinking has formulated different principles of how linear thinking and systems thinking differ, which Lynch and colleagues summarize according to the following dichotomies: disconnected vs. interconnectedness, linear vs. circular, silos vs. emergence, parts vs. whole, analysis vs. synthesis, and isolation vs. relationships [21]. Whereas sustainability science is more interoperable with systems thinking [22,23], in the sense that sustainability research often looks at ecosystems on a larger-scale view [22,24], entrepreneurship research only recently started to apply systems thinking perspectives to micro-systems such as entrepreneurial actors [25] but also to problems [26] ecosystems, which Lynch et al. describe accordingly: “Entrepreneurship may be understood as a system or network of interconnected actors, intimately related to today’s complex societal challenges like sustainability” [21].

For the purpose of our study, a systems thinking perspective provides us with a lens to delineate the interconnections between entrepreneurial and sustainability competencies. This approach lets us see relationships between apparently separate and even contrasting phenomena. A systems thinking perspective thus necessitates holding two observations at the same time: understanding that entrepreneurship as one part of larger sustainability systems, while at the same time sustainability as part of larger entrepreneurial systems.

2.3. Literature Review of Sustainability and Entrepreneurial Competencies and Research Gap

The research on competencies, both entrepreneurial and sustainable, is vast. For the purpose of this study, we provide an overview of the research that combines entrepreneurial and sustainable competencies. In entrepreneurship education research, numerous authors recognize the significance of learners acquiring competencies in sustainability and entrepreneurship, empowering them to develop impactful ideas that address social, environmental, and economic challenges [27–30]. This development has been propelled by the rise in sustainable and social entrepreneurship education (hereafter, SEE) and social innovation movements [31]. Emphasizing the importance of providing learners with the skills and attitudes to develop business opportunities considering environmental and societal needs, Diepolder et al. (2021) underscore the primary objective of SEE [32].

In this regard, SEE endeavors to nurture these competencies, often conceptualized as “a combination of knowledge, skills, and attitudes” [33]. Weinert argues that competencies are not predetermined solutions, but rather evolve through learners’ active engagement in hands-on experiences and reflective practices [34]. Similarly, Lans et al. regard competencies as empowering individuals to effectively address real-world challenges [29].

One of the foundational competence frameworks for sustainable entrepreneurship can be found in Lans et al. [29]. Based on two focus group discussions on two literature-based lists of competencies for sustainable development and entrepreneurship involving eight educators, they identified the following seven competencies: (1) systems-thinking competence; (2) embracing diversity and interdisciplinarity; (3) foresighted thinking; (4) normative competence; (5) action competence; (6) interpersonal competence; and (7) strategic management [29]. In their research, Lans et al. (2014) laid the foundation for subsequent research in the field [30,32,35–38].

While this shows that the research on sustainability and entrepreneurial competencies is growing, an in-depth analysis of the two European competence frameworks EntreComp and GreenComp in combination is still missing. Thus, the existing research on entrepreneurial and sustainability competence frameworks has not considered GreenComp in comparison with EntreComp. Although there exists more research on EntreComp [39,40], GreenComp has received little attention so far [41]. Moreover, a thorough comparison of both is still missing. Moon and colleagues attempt to compare the two frameworks, but without clear methodology or results [42]. In their article, which develops a self-assessment tool for EntreComp, López-Núñez et al. mention in the conclusion that EntreComp and GreenComp could be combined without further investigating the commonalities [43]. Moon and colleagues promise to interrogate the “real” relationship between EntreComp and GreenComp, but fail to do so in a systematic way.

As can be seen from the overview of the literature, research on sustainability and entrepreneurial competencies is growing, yet a systematic analysis of the European Union’s two competence frameworks remains a research gap. In the following, we introduce the two European frameworks and delineate our methodological approach to analyze both frameworks.

2.4. Data: EntreComp and GreenComp

EntreComp was introduced by the European Commission in 2016 as a comprehensive and common understanding of entrepreneurial competencies [44]. It entails three main competence areas—“into action”, “ideas and opportunities”, and “resources”—that each contain 15 competencies, 15 descriptors, 8 proficiency levels, and 442 learning outcomes. EntreComp focuses on a broad understanding of entrepreneurship that includes the overall creation of cultural, social, and economic value, and in this sense encompasses different types of entrepreneurship (e.g., digital, social, or green entrepreneurship). Accordingly, entrepreneurship is defined as a “transversal competence”, enabling anyone “to transform ideas and opportunities into action by mobilizing resources” [19] (A7 in Appendix A). Figure 1 illustrates EntreComp’s 15 competencies divided into the three categories.

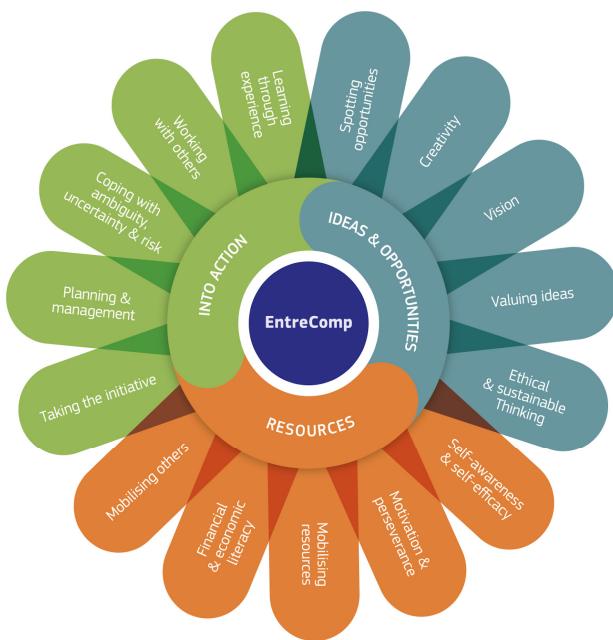


Figure 1. Areas and competencies of the EntreComp competence model [20].

Six years later, GreenComp was introduced in 2022 as a comprehensive and common understanding of sustainability competencies. The framework consists of 12 different competencies organized in four main areas: embodying sustainability values, embracing complexity in sustainability envisioning sustainable futures and acting for sustainability. Under the term “sustainability” the authors of GreenComp specify “prioritising the needs of all life forms and of the planet by ensuring that human activity does not exceed planetary boundaries” [33] (A8 in Appendix A). Based on this, the GreenComp framework defines sustainability as a competence that enables learners “to embody sustainability values, and embrace complex systems, in order to take or request action that restores and maintains ecosystem health and enhances justice, generating visions for sustainable futures” [33]. Figure 2 shows an overview of green competencies corresponding to Figure 1 in the four main areas mentioned above that are represented by four symbols in a metaphorical graphic: bees (acting for sustainability) are carrying pollen (embracing complexity in sustainability) from flowers (envisioning sustainable futures) to their pod (embodying sustainability values), underlining their interdependence.



Figure 2. Visual representation of GreenComp [33].

2.5. Method and Research Design: A Qualitative Thematic Analysis of EntreComp and GreenComp

By looking more closely at the congruence of sustainability and entrepreneurship competencies, we contribute to the research that stresses the compatibility of entrepreneurship and sustainability. Our interest in understanding and delineating the relationships between the two competence frameworks is situated in a social constructivist meta-theoretical framework [45] that interrogates the two frameworks as language and relationships that create and sustain social reality [46], since both frameworks have a fundamental impact on the strategic structuring and design of curricula in Europe.

In this vein, we adopted a qualitative research approach utilizing a social constructionist thematic analysis (TA) according to Braun and Clarke [47,48]. The method serves as an entry point into qualitative research, guiding the systematic process of coding and analyzing qualitative data with the aim of detecting themes and patterns [48]. Accordingly, TA offers a systemic concept for “identifying, organising, and offering insight into patterns of meaning (themes) across a dataset” [47]. These themes capture significant aspects of the data concerning the research question, thereby guiding our analysis within each framework.

TA was deemed suitable for our research question and dataset, focusing on EntreComp and GreenComp publications by the European Union and its Joint Research Center, as it enables the systematic identification and organization of patterns of meaning across the two competence frameworks [48]. Using TA allowed us to explore in detail the differences and similarities between the two frameworks and to gain a deeper understanding of how they integrate entrepreneurship and sustainability. It supported a comprehensive analysis, generated insights, and helped us to interpret our data. By using TA, we were able to effectively facilitate a clear understanding of the congruence between entrepreneurship and sustainability in both frameworks. This method ensured a structured and rigorous comparison, making it well suited to our research question and dataset.

Following the six steps suggested by Braun and Clarke [47,48]—1. familiarizing yourself with the data, 2. generating initial codes, 3. searching for themes, 4. reviewing potential themes, 5. defining and naming themes, and 6. producing the report—we conducted our analysis as indicated in Table 1 below.

Table 1. Thematic analysis methodology: research steps according to Braun and Clarke [47].

Phase	Action
1	Familiarizing yourself with the data To gain a thorough understanding of the content of the EntreComp and GreenComp competence frameworks, we read them three times, focusing on areas, competencies, hints, and descriptors. This first phase helped us familiarize ourselves with the two different competence frameworks.
2	Generating initial codes Subsequently, we conducted another thorough reading of both competence frameworks, guided by theory-driven [47] codes specifically focusing on each point that referenced entrepreneurial or sustainable characteristics within the descriptors of each competence. This approach aimed to deepen our understanding through semantic-level coding.
3	Searching for themes We reviewed the coded data to pinpoint similarities and overlaps among codes, as well as broader topics or issues within which codes were clustered into themes, with a particular emphasis on sustainability and entrepreneurial competencies. Our analysis revealed distinct patterns in the clustering of codes, and we also looked for patterns in the structural design to understand the relationships between the two frameworks and their respective links to sustainability and entrepreneurship competencies.
4	Reviewing potential themes We assessed the coherence of our themes by comparing them to the compiled data extracts and evaluated how well each theme aligned with the data. We discussed the identified themes with our co-authors to discern patterns and review them in light of the entire dataset through a final comprehensive rereading.
5	Defining and naming themes We defined each theme taking into account the overlaps, components, and combination of GreenCom and EntreComp competencies. We held discussions to highlight the distinctiveness and specificity of each theme, with the aim of capturing its essence. We worked with the co-authors to refine and finalize the definitions of the three themes identified by the analysis (see Section 3.1).
6	Producing the report As part of the final stage, we completed the analysis by writing up the findings.

3. Sustainability and Entrepreneurship: A Foundation to Holistically Integrate Sustainability and Entrepreneurial Competencies

3.1. Results and Analysis

Based on our thematic analysis, we derived three results (themes): (1) there exists an overlap between the two competence frameworks, (2) GreenComp can be seen as part of EntreComp rather than the other way around, and (3) the combination of the two provides a comprehensive framework that enables students to translate sustainable thinking into action to achieve applied sustainability competencies. Figure 3 summarizes the outcomes of our thematic analysis, which will be further elaborated in the following section.

		Related competencies of		
		EntreComp		GreenComp
Competence areas	EntreComp	Ideas and Opportunities		Valuing sustainability, Supporting fairness, Promoting nature, Systems thinking, Critical thinking, Problem framing, Futures literacy
		Ressources		Adaptability, Exploratory thinking, Individual initiative
		Into Action		Political agency, Collective action
	GreenComp	Embodying sustainability values	Ethical and sustainable thinking	
		Embracing complexity in sustainability	Ethical and sustainable thinking	
		Envisioning sustainable futures	Spotting opportunities, Creativity, Vision, Valuing ideas, Ethical and sustainable thinking, Motivation and perseverance, Planning and management, Coping with uncertainty, Ambiguity and risk	
		Acting for sustainability	Ethical and sustainable thinking, Self-awareness and self-efficacy, Mobilizing resources, Mobilizing others, Taking the initiative, Working with others, Learning through experience	

Figure 3. Mapping of competencies according to competence areas of EntreComp and GreenComp (created by the authors).

- (1) There exists an overlap between the two competence frameworks.

As shown in Figure 3, the first EntreComp competence area, ideas and opportunities, including the competencies spotting opportunities, creativity, vision, valuing ideas, and ethical and sustainable thinking, almost all align with the GreenComp competence area of envisioning sustainable futures. With regard to the corresponding EntreComp competencies (self-awareness and self-efficacy, motivation and perseverance, financial and economic literacy, and mobilizing resources) in its second competence area, a clear overlap with the GreenComp competence area of acting for sustainability and the associated competencies can be identified. In the last of the three EntreComp competence areas, taking action, all the related competencies (taking the initiative, planning and management, coping with uncertainty, ambiguity and risk, working with others, and learning through experience)

match the two GreenComp competence areas of envisioning sustainable futures and acting for sustainability.

In a second step, we semantically analyzed the twelve different GreenComp competencies (divided into four different competence areas) in terms of their integration into the EntreComp competence framework. The analysis makes clear that the three competencies (valuing sustainability, supporting fairness, promoting nature) of the first competence area cannot be assigned to the entire EntreComp competence area of ideas and opportunities, but only to the specific competence of ethical and sustainable thinking.

The same applies for the competencies (systems thinking, critical thinking, and problem framing) of the second competence area of GreenComp. As for the third GreenComp competence area, envisioning sustainable futures, most of the related competencies (futures literacy, adaptability, and exploratory thinking) fit into the EntreComp competence area of resources. The final area is acting for sustainability, which includes the competencies political agency, collective action and individual initiative that are semantically related to the EntreComp competence area into action, although they focus more on political action.

- (2) GreenComp can be seen as part of EntreComp, while EntreComp is excluded from GreenComp.

One can discern the separation between entrepreneurship and sustainability already in the structural design of the competence frameworks. Moberg et al. [19] argue that this is intentional and that the differences between EntreComp and GreenComp mainly “provide a language and terminology that differs from the profit- and growth-oriented world of business”. Yet, on a closer examination, and as other authors have observed, “there are clear overlaps between the two” competence frameworks “including ethics and sustainability as a core competence for all entrepreneurs” [42]. Our analysis provides a more nuanced understanding of the relationship between the two frameworks. Figure 3 shows that all GreenComp competencies can be related to the EntreComp competencies. Significantly, almost all GreenComp competencies could be related to one single competence of EntreComp—“ethical and sustainable thinking”. This competence alone seems to subsume all four competence areas of GreenComp. It certainly is arguable that this competence touches upon almost all GreenComp competencies in terms of their semantic nature. In comparison, EntreComp competencies mainly cover two out of four GreenComp competence areas, namely, envisioning sustainable futures and acting for sustainability. The competence of financial and economic literacy cannot be clearly integrated into the GreenComp framework. Furthermore, GreenComp does not mention the word “entrepreneurship” once, while EntreComp mentions the word “sustainability”.

- (3) The two frameworks together holistically combine cognitive and action-oriented competencies needed for sustainability driven entrepreneurship.

Combining both frameworks leads to a holistic set of cognitive and applied competencies for creating meaningful change. GreenComp heavily focuses on thinking and enabling learners in the sense of creating a strong mindset for sustainability competencies. In contrast, EntreComp has a clear focus on competencies related to a strong toolset for entrepreneurship, while the intellectual and cognitive aspects of reflection only appear in the competencies of ethical and sustainable thinking and self-awareness. Therefore, in order to understand how sustainability competencies play a role in and can be combined with entrepreneurship competencies, we distinguish between a mindset and “do-set” for entrepreneurship. Whereas the mindset for entrepreneurship includes a lot of competencies concerning “why” to engage in entrepreneurial activities (i.e., embodying sustainability values, envisioning sustainable futures) the skill set includes the “how” to engage in entrepreneurial activities and “what” is needed to succeed. However, whereas the analytical comparison of the competence frameworks above shows links and interdependencies, they are not yet presented as a holistic set of competencies for future-ready citizens. We argue sustainability competencies should support problem-solving skills for actual challenges [49] and are therefore inherently linked to entrepreneurship competencies such as financial

and economic literacy. Based on our analysis, these frameworks are still regarding some elements of these competencies as mutually exclusive and thereby limiting the potential of education towards an integrated understanding of actively shaping the world in a sustainable direction through entrepreneurial activities.

With the upcoming case study, we introduce our way of bridging these frameworks through methodologies that equip students with both EntreComp and GreenComp skills simultaneously. Thereby, it is our goal to educate active citizens with a holistic understanding of their potential to shape the future.

3.2. Combining Entrepreneurial and Sustainable Competencies in Entrepreneurship Education: A Case Study

In the following section, we offer some suggestions for educators on how to integrate entrepreneurship tools that foster both sustainability and entrepreneurship competencies, based on the analysis above. We explore three tools (*ikigai*, team canvas, and systems mapping) that can help to develop both sustainability and entrepreneurship competencies. These tools are used in an interdisciplinary curricular format, "Real Projects" (RPs), which is being taught at HM Munich University of Applied Sciences and its Strascheg Center for Entrepreneurship. The RPs were introduced more than 10 years ago. With more than 18,000 students and 14 faculties, this technically oriented university is one of the largest in Germany. Its entrepreneurship center was founded in 2002 and offers formats from inspiration and education to startup creation. Since 2011, more than 5000 students have been taught in this format, with more than 50 professors involved. The format has been taught in all of the universities' 14 faculties. While different faculties integrate the format in different ways (mandatory, elective) and with varying ECTS credits, each semester, around 400 students go through this format. During an RP, the students follow an action-based learning journey of five phases from reflecting on their own values and motivations through forming a team and starting to understand a problem to developing a prototype solution, with a final pitch presentation. During this journey, they are made aware of the following five categories that play an important role at every step of the innovation process: the entrepreneur, team and collaboration, customers, stakeholders and ecosystem, the best solution, and responsibility and sustainability. With the help of different tools, methods, and reflection, the student teams are supported by coaches that guide them through the process. The three methods in the following have been selected for this paper since they have been integrated into the entrepreneurship curriculum to foster systems thinking and other sustainability competencies in students.

While these three methods serve as best-practice examples of our theoretical discussion in this paper, we do not presume their universal applicability. Rather, we see them as one potential way of using entrepreneurial methods for establishing a sustainable mindset and toolset in students and vice versa. Table 2 gives an overview of the three methods and the competencies that they can support the development of. To facilitate easy understanding, these competencies have been differentiated in GreenComp and EntreComp according to the elaborated frameworks above. As these methods are part of the entrepreneurial learning experience that we created in order to bridge the gap between sustainability and entrepreneurship, we elaborate on our logic behind choosing them with regard to their potential in competence development. However, it is beyond the scope of this paper to determine whether these exact competencies are an outcome of applying these methods. For quality assurance and future development, we use an evaluation framework that continues to show that overall competence development, especially with regard to EntreComp, is positive for students that undertake an RP. Further research could include an exact determination of the competence development of each method.

Table 2. Overview of methods in relation to competencies (created by the authors).

Methods	<i>Ikigai</i>	Team Canvas	Systems Mapping
Competencies developed			
GreenComp	Valuing sustainability, explorative thinking, individual initiative	Valuing sustainability, collective action, individual initiative, critical thinking	Adaptability, explorative thinking, systems thinking, problem framing, critical thinking, political agency
EntreComp	Spotting opportunities, vision, self-awareness, self-efficacy, financial and economic literacy	Planning and management, working with others, mobilizing others, self-awareness, self-efficacy	Spotting opportunities, ethical and sustainable thinking, financial and economic literacy, coping with uncertainty, ambiguity and risk

- *Ikigai*

As the discourse on sustainability progresses, there is an increasing emphasis on investigating the role of individual circumstances in effecting change. In line with this, programs and initiatives like the Inner Development Goals (IDGs) argue that sustainable development first of all requires personal development, and the *ikigai* tool addresses some of these questions (A11 in Appendix A). *Ikigai* is a Japanese term that can be translated as “a sense of life worth living” and is therefore suitable as a starting point on an innovation journey. It has been chosen as a starting point for the course to enhance a systemic approach to personal development and the entrepreneurial self as an important part of the innovation process. Studies have shown that *ikigai* can serve as a meaningful tool to increase both academic performance and health and well-being [50,51]. Another important aspect to support the use of *ikigai* as a starting point for this entrepreneurial class is its potential to define personal goals antecedently to any innovative activities. While such self-endorsed goals are directly linked to personal well-being [51], our students also develop a sense of purpose and motivation by being able to build their entrepreneurial project and teamwork on their holistic self-image. This is in line with what Hall et al. [52] found in a study of web-based future skills training based on *ikigai* that was successful in helping students discover personal strengths and core values and ultimately increasing self-leadership and self-awareness.

The tool consists of four main themes: what you love, what you are good at, what you can be paid for, and what the world needs. At the intersection of these lies the personal *ikigai*. Filling out the canvas may lead students to reflect on their values and thereby start to value sustainability, especially through asking themselves what it is the world needs and putting this “in relation to sustainability concerns” [19]. The educator may also intervene and mention the global challenges ahead to make the connection to sustainability during the usage of the *ikigai* canvas.

While some students tend to feel overwhelmed by the questions raised in the tool, many approach it with curiosity and end up being surprised by the results. Thinking about personal answers to such a broad life concept inevitably asks for explorative thinking into often unknown territory. This has the potential to ultimately help them to tap into future visions for their own role within economic and societal development and to use their intuition and creativity to this end. This turns into a much deeper understanding of the individual initiative they could take on to turn their values into meaningful actions by identifying their “own potential to sustainability and to actively improving prospects for the community and the planet” [19]. But it is not only these sustainability competencies the tool addresses. Becoming aware of their own purpose and potential for contribution to a more sustainable world increases students’ self-efficacy and room for personal growth. This comes with a much broader sense of self-awareness and self-efficacy as part of EntreComp. By understanding that “what you can be paid for” is also an important aspect of students’ individual purpose, *ikigai* addresses financial and economic literacy on a personal level

that makes sure individual actions need to be economically sustainable and backed by financial know-how as well. Through this process, the students become better at spotting opportunities, as the tool is integrated into the teaching process as a starting point for entrepreneurial activities. It may serve as an overview of the opportunities for reaching their purpose while simultaneously contributing to the world in an innovative and valuable way. Finally, with this purpose-based approach, the RP encourages individuals to start their project with a clear vision that serves as a compass for their actions, both as an individual and within a team, with a common vision of the future.

As this elaboration has shown, ikigai may be used to develop students' understanding that personal goals need to be aligned with economic, social and ecological sustainability to create a long-lasting sense of a life worth living.

- Team Canvas

While one narrative of sustainable development has recently focused on the responsibility of the individual to create a sustainable future, impactful progress will not succeed without collaboration and collective action. There is a large body of research on team collaboration in general [53], as well as explicitly on entrepreneurial teams and educational contexts [54]. With regard to this, the need for team alignment, a shared vision, and creating a common understanding is stated in different sources [55,56]. However, the "team canvas" has not yet been discussed as a potential tool to support these needs. As we acknowledge the necessity to communicate and align well before collaborating on a project for turning beliefs and vision into action, we use the team canvas as a method to start the teamwork and for realignment throughout the course if necessary to secure common understanding. Working with this tool both helps to ease teamwork and develops several entrepreneurship and sustainability competencies. The team canvas was developed by Alex Ivanov and Mitya Voloshchuk in 2015 for agile project teams [57]. With nine building blocks, the canvas is a dynamic tool that supports learners in reflecting, discussing, communicating, and normalizing their team interactions. The nine categories are: people and roles, common goals, values, rules and activities, personal goals, needs and expectations, strengths and assets, weaknesses and risks, and purpose.

The team canvas invites students to follow up on their individual reflections on values and responsibilities in a world of radical climate change and social challenges, and brings this together on a team level, thereby addressing the topic of "valuing sustainability" in the project work. In particular, the canvas categories of personal goals, values, common goals, and purpose may very well be connected to sustainability questions and competencies within a group or team, as they "make learners realise that values are constructs and people can choose which values to prioritise in their lives" [33]. At the same time, the competence of critical thinking is needed, as the tool contains an important second step of reflection that connects the personal to other perspectives and values and requires discussion and synthesis. It also helps in understanding how "personal, social and cultural backgrounds influence thinking and conclusions" [33]. By reflecting and identifying these aspects together, both individual initiative as well as collective action are at the center of using this tool, as it ultimately aims at a common agreement and a clear definition of a role for everyone [33]. Although these sustainability competencies play an important role in the process, the tool equally addresses entrepreneurial competencies that are necessary for bringing a common project to reality. For filling out the categories of rules and activities, people and roles, needs and expectations, and strengths and weaknesses, a discussion about successful ways for planning and management as a team, identifying tasks and defining priorities and action plans, setting long-, medium-, and short-term goals for their project [44], and setting the framework for working with others in a way that uses the potential of all team members effectively, but also helps to "solve conflicts [...] when necessary" [44] is encouraged. Furthermore, each student's self-awareness and self-efficacy is addressed and needed for this process, as only through this will the team ultimately be able to achieve a greater common goal through being aware of individual and group strengths and weaknesses [44]. Proceeding from this individual awareness, it is also crucial

that everyone takes a role in mobilizing others for this common mission and helps them to better understand their unique potential, which will leverage everyone's skills and promote effective teamwork and resource management for a common purpose [44].

Ultimately, the team canvas may support both mindset development based on sustainability values and competencies, and entrepreneurial competencies, especially in addressing operative and coordinative aspects of the process. With the goal of creating active contributors to a better world, navigating successful teamwork can be seen as the foundation for a larger process for change, as it may help to develop many important competencies that form a baseline for this change to happen.

- Systems Mapping

In light of pressing problems like climate change and challenges that call for more complex solutions, one key competence that links entrepreneurship and sustainability is systems thinking [26]. One way of developing competence in systems thinking is through the method of systems mapping. Systems mapping is used in systems innovation approaches to better understand the context of the challenge that is being addressed in a more holistic and comprehensive manner. As suggested by Wilkerson and Trellevik [58], we introduce systems mapping as a method to improve problem understanding [21,58]. We follow their proposal to embed the method into a design thinking-based course framework, as this allows for the goal of including aspects of sustainability in entrepreneurial endeavors in a holistic way [21,58]. Systems thinking can be viewed as one of the key ways to link the two competence frameworks EntreComp and GreenComp to enable students to both work on their sustainability (cognitive) skills and understand ways in which active interference at the right leverage points within a system can actually achieve results for changing the world for the better from the very baseline of its underlying dynamics. Thereby systems thinking, understood in GreenComp as "to approach a sustainability problem from all sides [...] in order to understand how elements interact within and between systems" [33], is the first of many competencies developed through systems mapping. The RPs encourage students to approach the complexity of problems with an elaborate systems map that integrates important stakeholders, stocks, and feedback loops. In order to make students tackle root causes and not mere symptoms of complex problems, this method is very useful for activating students' awareness of their interventions within these systems.

Besides systems thinking, systems mapping also addresses the GreenComp competence of explorative thinking, as learners are supported to understand problems as more than linear cause-and-effect relationships and simultaneously are challenged to engage with both creativity and curiosity fully with a problem and its embeddedness in systems [33]. By analyzing relationships, components, and especially dynamics at play within a system, the students' critical thinking can also be engaged, as it requires them to "assess information and arguments [and] identify assumptions" [33], which forms another important base for the generation of suitable ideas. Furthermore, a systems map improves problem framing, as it asks students to frame current or potential challenges in a way that includes "people involved [and] time and geographical scope" [33]. Since systems thinking and systems maps are fundamentally simply visualizations of complexity that are necessarily incomplete, learners are exposed to the need for adaptability, as they learn to integrate various perspectives and dynamic changes into their strategy of systems interaction and "make decisions related to the future in the face of uncertainty, ambiguity and risk" [33]. Finally, by identifying political, social, and economic factors, especially underlying power dynamics, policies, and regulations contributing to the system, their political agency may be developed, as well as their ability to navigate the system and drive outcomes through entrepreneurship. Whereas the sustainability competencies developed through systems mapping mainly address thinking about sustainability among students, the method also encourages the translation of this understanding into action. This is represented in the entrepreneurial competence of spotting opportunities, as it will lead to a better picture of how to interact with stakeholders, dynamics, and institutions within the system that is underlying a problem as an opportunity for entrepreneurship and for creating "value by

exploring the social, cultural and economic landscape” [17]. Along the way, students tend to develop a more profound ethical and sustainable thinking, as they will need to account for the social, environmental, and economic outcomes of their actions as they interact with a system and reflect on “how sustainable long-term social, cultural and economic goals are” [44]. Finally, students usually engage their competence to cope with uncertainty, ambiguity, and risk by learning that complexity and constant change is inherent in every system. It is their job as an entrepreneur to learn to navigate and react as they embrace uncertainty, deal with changing circumstances, and learn to make decisions in the face of risk and ambiguity with sometimes partial or ambiguous information at hand.

4. Implications, Limitations, Further Research, and Conclusions

This conceptual article explored the question of how sustainability and entrepreneurial competencies can be integrated. An analysis of EntreComp and GreenComp revealed that both competence frameworks can be combined, which paves the way for an alignment of the two concepts. We argued for a synthesis of sustainability and entrepreneurship competencies and showed how sustainability competencies may be developed through entrepreneurial tools and methods. Combining sustainability with entrepreneurial competencies is inevitable if we want to create responsible and entrepreneurially thinking and acting citizens. For HEI managers, educators and learners, our research provides guideposts if they are looking for ways of how to transform their HEI into a sustainable-entrepreneurial institution, if only by starting in their curricula. For policymakers, our analysis might provide a foundation for a critical reflection on whether the separation of entrepreneurial and sustainable competencies is in line with approaches to design pathways that enable a sustainable future. Besides the structural similarities between entrepreneurship and sustainability that can serve as strategic foundations for institutional and curricular transdisciplinary development, we showed how three tools that are used in educational settings combine both competence frameworks. These tools are easy to implement in experiential, team, and project-based settings and should provide educators with a low-threshold way of introducing them. Nevertheless, we want to stress that effective education relies heavily on educators that bring complementary expertise to the table and develop a systemic view just as they are teaching their students in order to succeed.

Within the limited scope of this article, we add to the discourse that argues for the synergies of two fields that are arguably miles apart and further the discussion on how to combine them. Nevertheless, our approach includes some limitations. We adopted a qualitative approach to this research topic in order to initiate research on the compatibility of sustainability and entrepreneurship education in further investigations. Considering that other competence frameworks for both sustainability and entrepreneurship might have contributed to a more holistic understanding of competence frameworks overall, we intentionally focused on these two important European competence models, since they have not been researched in depth so far and are important transnational guidelines for European universities and curriculum development. Moreover, we did not aim for a quantitative measurement of how these competencies are developed by educational interventions. While there exists research on how to measure EntreComp [40], there is no research on the measurement of GreenComp to date. From a methodological perspective, TA is prone to subjective biases that we as sustainable entrepreneurship educators bring to the analysis, for instance, only analyzing the commonalities of both frameworks, instead of their frictions. TA is limited in its reproducibility, since it relies on subjective interpretations. Within the scope of this article, we focused only on three tools (ikigai, team canvas and systems map), while there are many being used in theory and practice that also contribute to sustainability and entrepreneurship competencies (STEEP analysis, non-human personas, impact gaps canvas, future wheels, impact value chain, sustainable business model canvas, etc.) Moreover, we do not claim to have investigated a measurement of the effects of the three tools on competence development, which means that we cannot make any statements

on the effectiveness and correlation of these tools in the actual competence development of learners.

Being aware of the limitations of our conceptual article, we invite scholars to further dive into the concept of teaching sustainability through entrepreneurship by looking at different levels of interventions and analyze the effectiveness of the tools presented. A holistic pedagogical agenda for sustainable entrepreneurship needs to look at the systemic level of education in order to foster sustainability competencies in an impactful way. Further research is required to develop a concrete integration of these competencies in the framework of constructive alignment into curricula [59]. Here, attention should be concentrated on the context of the intervention (if entrepreneurial tools should be introduced in sustainability curricula or the other way around). In order to better understand the development of sustainability competencies in the framework of GreenComp, more research has to be executed to develop scales for evaluating GreenComp. By gathering more quantitative and qualitative data from students and educators on the effects of acquiring sustainability competencies through entrepreneurship, it would also be valuable to see possible countereffects between sustainability competencies and entrepreneurship competencies.

If entrepreneurship lives up to its proclamations to change the world for the better, sustainability and entrepreneurship need to grow even more together. In this article, we showed that there are tendencies of both realms (in terms of concepts as well as competencies) that are synergetic and that both can be adapted and brought together in order to create more impactful solutions in education and beyond.

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Appendix A

A1 This is based on Kate Raworth’s *Doughnut Economics* [60].

A2 For just one of a plethora of other approaches, see Halberstadt and colleagues’ recent book *Transforming Entrepreneurship Education* [61].

A3 Block et al. exemplarily argue that “Entrepreneurship students not starting a business after completing their education is also a good outcome of entrepreneurship education” [62].

A4 While there exists research on the EntreComp framework, for instance, Rațiu et al. [39] or Joensuu-Salo et al. [40], to date, no research has rigorously investigated EntreComp in conjunction with GreenComp. In their paper “EntreComp and GreenComp for Entrepreneurship. What is the ‘Real’ Relationship?” [42], Moon et al. only scratch the surface of a thorough analysis of both frameworks. López-Núñez et al. [43] mention GreenComp in their article, but focus more on EntreComp.

A5 Rosário et al. [63] offer a literature review of the concept and find 329 scholarly articles published on SE until 2022, with an increase in publications starting in 2000. Amatucci, Pizarro and Friedlander observe in 2013 [64] that the concept is still “relatively new”.

A6 Some authors differentiate the terms social entrepreneurship (focus on social and economic value), environmental entrepreneurship or eco-entrepreneurship (environmental and economic value) and sustainable entrepreneurship (environmental, social and economic value) [14,16].

A7 One could thus argue that “classical” models of entrepreneurship and startups already have sustainability integrated in their core. Eric Ries’s [65] influential *Lean Startup* ends with a chapter titled “Waste Not” and raises the “big question of our time,” which is “not Can it be built but Should it be built?” In a recent article by Kim and Mauborgne [66], they introduce a concept of “nondisruptive creation” (in opposition to the fixation on disruptive innovation) that fosters “economic growth in a way that enables business and society to thrive together”.

A8 Systems thinking is closely related to systems theory, with its different disciplinary derivatives, from Luhmann’s systems theory [67], Geel’s socio-technical systems theory [68] to name but a few theoretical backgrounds. For an overview, see also von Bertalanffy’s seminal *General System Theory* [69] and Donella Meadow’s *Thinking in Systems* [24].

A9 The concept of planetary boundaries (PB), introduced in 2009, aims to define the environmental limits within which humanity can safely operate [70].

A10 The competence areas are numbered for ease of reference. However, this implies neither an order of development nor hierarchy. In the following, all references to the competencies in both frameworks are quoted from the two publications. For readability reasons, we omit the references for each citation.

A11 The inner development goals (IDGs) are a set of transformational skills for sustainable development that are presented in five categories: being, thinking, relating, collaborating, and acting [71].

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