social bugs

Competency Framework for Social Entrepreneurs in the edible insect industry

November 2025

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Partners

Bugging Denmark

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Executive Summary

The Social Bugs Competency Framework & Curricula defines the knowledge, skills, and attitudes needed for social entrepreneurs to launch and scale sustainable ventures in the edible insect market and translates them into a 16-hour Continuous Vocational Education and Training program with micro-credentials. It aligns with EntreComp: The entrepreneurship competence framework and European Qualifications Framework principles, and was developed through regulatory/literature review, case studies, and a participatory expert workshop. The project links the Social and Solidarity Economy with a fast-growing insect protein sector to drive inclusive, local, and environmentally responsible business models.

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Glossary

Term	Definition
Agrifood	The Agrifood sector includes all activities connected to producing and processing food, encompassing farming, livestock, distribution, and consumption. Its goal is to provide food in an economically, socially, and environmentally sustainable manner. Insect farming is a component of this sector and serves as an alternative protein source.
Attitudes	Dispositions or behavioural tendencies that affect how a learner approaches tasks and interacts with others (e.g., responsibility, ethical thinking, empathy).
Categorization of Competencies	The process of assigning each competency unit to one or more categories (technical, managerial, social), based on its core nature and application.
Competency Area	A broad domain or field of knowledge and skills (e.g., Social Business Development, Insect Farming). It groups related units of competency under a common theme.
Competency Unit	A specific set of learning outcomes that define what a learner should know, understand, and be able to do in a particular context. It is the building block of the framework.
CVET (Continuous Vocational Education and Training)	Structured learning designed to improve or refresh professional competencies for adult learners throughout their careers.
EQF (European Qualifications Framework)	A common European reference framework that helps compare qualifications across countries and systems. CVET frameworks often align learning outcomes to EQF levels.
ESCO (European Skills, Competences, Qualifications and Occupations)	An EU initiative that provides a multilingual classification of skills and qualifications linked to occupations. Often used as a reference when defining competencies.
Knowledge	Theoretical and factual understanding required to perform a task (e.g., legal structures of social enterprises, insect biology).

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Learning Outcome	A clear statement of what a learner is expected to achieve as a result of a learning process, typically formulated as: action verb + object + context.
Managerial Competencies	Abilities related to managing people, resources, and operations in a business context, including planning, budgeting, decision-making, and strategic thinking.
Micro-credential	'Micro-credential' means the record of the learning outcomes that a learner has acquired following a small volume of learning. These learning outcomes will have been assessed against transparent and clearly defined criteria. Learning experiences leading to micro-credentials are designed to provide the learner with specific knowledge, skills and competences that respond to societal, personal, cultural or labour market needs. Micro-credentials are owned by the learner, can be shared and are portable. They may be stand-alone or combined into larger credentials. They are underpinned by quality assurance following agreed standards in the relevant sector or area of activity.
Skills	The practical ability to apply knowledge and use methods and tools to complete tasks and solve problems (e.g., manage feeding cycles, create a business plan).
Social Competencies	Transversal or soft skills that relate to human interaction, communication, ethics, and social responsibility. Especially relevant in social entrepreneurship.
Social Economy	The social economy is the part of the economy where organizations prioritize social, environmental, or community objectives over profit. It includes cooperatives, mutual societies, not-for-profit organizations, and social enterprises, which reinvest surpluses to benefit members or society rather than distributing them as dividends.
Technical Competencies	Skills and knowledge that are specific to a field or occupation, such as farming techniques, hygiene protocols, or food processing.

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General Introduction

Scope

This document was developed within the framework of the Social Bugs project (Project No. 2024-1-DK01-KA220-VET-000251164), which aims to create an innovative ecosystem that links the Social and Solidarity Economy (SSE) with the edible insect industry. To this end, the project brought together 5 partners from 4 European Union countries, namely:

- Bugging Denmark, Denmark (Coordinator)
- University of Copenhagen, Denmark
- Aproximar - Cooperativa de Solidariedade Social, Portugal
- InAgro, Belgium
- European Strategies Consulting, Romania

Social Bugs emerges amidst Europe's expanding insect protein market. Numerous startups are now farming insects to sell ingredients for pets, livestock, and human food. It is a young industry offering promising prospects for future job opportunities: the total output volume of edible insects in Europe is estimated to grow by 47% between 2019 and 2026, reaching 235,000 tons/year, making Europe the second largest growth region (Skotnicka et al., 2021), with a market value of US$828.76 million by 2029 (Global Market Insights, 2022). In parallel, in December 2021, the EU adopted a new action plan to enhance social investment and support social economy actors and other actors and social enterprises to start-up, scale-up, innovate and create jobs (European Commission, 2021). SSE entities are increasingly acknowledged for their significant contribution to addressing social and environmental challenges. SSE is changing, and evolving social economy "clusterisation" is an emerging social movement in the EU defined by cross-sectoral cooperation.

Social Bugs partners' motivation is to boost the contribution of SSE to the fair, social, and sustainable transition and growth of this young sector. The project builds on the partners' motivation to conceptualize how to develop innovative, sustainable social business models for the EU edible insect market, creating the necessary tools to operationalize the needed transformation (e.g. training resources and networking activities). Social Bugs expects to contribute to helping the EU movement to boost the potential of social business models to drive the insect market to a more social and local economy.

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Objectives

The **Social Bugs Competency Framework for Social Entrepreneurs and Curricula** (hereafter referred to as the SB Framework and Curricula) brings together two interrelated components: the *Competency Framework* and the *CVET Curricula*, both designed to support the training of social entrepreneurs interested in establishing and managing sustainable businesses in the insect sector. The *Competency Framework* defines the key knowledge, skills and attitudes required, while the *CVET Curricula* translates these competences into a structured training pathway, including objectives, modules, workload, assessment methods, and certification through micro-credentials.

Specific objectives:

- To identify and describe the competencies for social entrepreneurs in the insect market, based on the EntreComp Framework and other relevant documents.
- To design a comprehensive course curriculum made specifically for social business ventures in insect farming, including topics such as sustainable practices, business management, and community engagement.
- To propose a training methodology that is suitable to equip future social entrepreneurs to start a social business in the insect market.

Together, these outputs address the skills gap in this innovative sector and harness the potential of social economy business models to drive an inclusive and local edible insect market.

By clearly aligning competence development with measurable learning outcomes, this framework serves a dual purpose: it supports professionalization through targeted skills acquisition and contributes to wider systemic goals such as social inclusion, ecological transition, and innovation in both the agri-food and social economy sectors.

Methodology for mapping the competences and designing the Curricula

The development of the Framework and Curricula followed a multi-step process:

1. **Literature review of legislation on both SSE and the edible insect market**

Partners outlined a Report on key enablers for cross-sectoral partnerships between the edible insect market and SSE in the EU, providing a roadmap on how the insect food value chain can enable the development of the proximity and social economy. To foster a

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common understanding of the current state of the edible insect industry in Europe and among partner countries, partners started by mapping and summarising relevant EU regulation frameworks and guidelines for edible insect farming and consumption. In parallel, a structured comparative exercise was conducted to capture both the national framework for SSE and the regulatory environment for insects as food and feed. Detailed information on the findings of these two mapping exercises can be found under Work Package 2.

2. In-depth case study analysis

To exemplify cross-sectoral partnerships between the edible insect market and SSE, partners identified case studies on insect farm projects involving business-nonprofit collaboration. These case studies were useful to showcase and support the potential of the edible insect market to contribute to societal goals through different business approaches, with special focus on edible insect farming.

3. Drafting of the first Framework proposal

Based on the findings of the literature review, case studies, and partners' practical experience in these two sectors, the leader of WP3 (Aproximar) drafted a first proposal of the Competency Framework for social entrepreneurs in the insect industry.

4. Expert workshop

During the 2nd Transnational Project Meeting in Portugal, an expert workshop was organised using a participatory approach.

5. Consolidated Framework and Curricula

Figure 1 illustrates the main phases that led to the final version of the Framework and Curricula:

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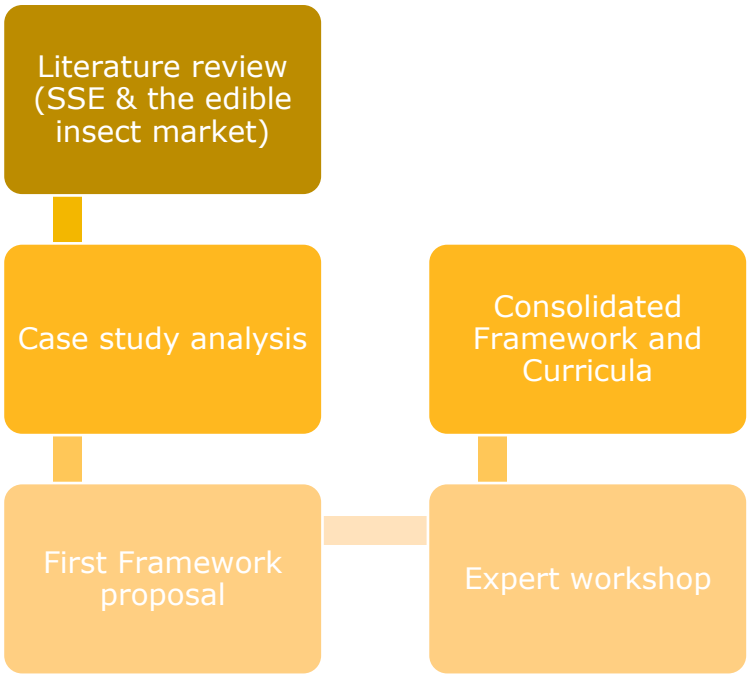

In the specific context of Social Bugs, the Framework guides the design of a tailored CVET curriculum by outlining three key phases:

- Identification and categorisation of competences relevant to social entrepreneurship in the insect-based bioeconomy.
- Translation of these competences into pedagogical objectives and modular learning outcomes.
- Operationalisation through the creation of training methodology adapted to the needs of aspiring or early-stage social entrepreneurs.

The final deliverable is structured into three interrelated Parts:

- Part A – Defining competencies in the ecosystem
- Part B – Social Bugs Competency Framework
- Part C – Social Bugs Course Curricula and Training Methodology – present in another documento.

PART A. Defining competencies in the ecosystem

A.1 What are competencies?

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Competencies can be defined as a combination of knowledge, skills, and attitudes that enable an individual to effectively perform tasks or functions. This definition aligns with the Council Recommendation of 22 May 2018 on key competences for lifelong learning, which states that competencies comprise:

- **Knowledge**: the facts, concepts, ideas, and theories that are already established and support understanding of a given area or subject;
- **Skills**: the ability and capacity to carry out processes and apply existing knowledge to achieve results;
- **Attitudes**: the dispositions and mindsets to act or react to ideas, people, or situations (Council of the European Union, 2018).

This integrated approach emphasises that competencies are not just about acquiring technical knowledge, but also about the ability to apply knowledge effectively in practice, and the attitudes that influence how individuals approach challenges, make decisions, and interact with others.

Within the field of social entrepreneurship and sustainable innovation, competencies are particularly oriented towards addressing societal and environmental needs. They involve the capacity to embed ethical and sustainable considerations into business decisions, to collaborate effectively with a range of stakeholders, and to adapt to new challenges and opportunities that arise in complex systems (Ploum et al., 2018).

A.2 What is a competency framework?

A competency framework is a structured model that organises and connects competencies with specific roles, functions, or organisational goals. Unlike a competency catalogue, which often serves merely as an inventory or reference list, a framework provides the architecture that shows how competencies are grouped, related to one another, and applied in practice (see CIPD, 2024; Corbett, 2023; UN Women, 2023).

Competency frameworks typically cluster competencies into domains (e.g., technical, behavioural, or leadership) and assign proficiency levels (novice, developing, expert) to facilitate developmental progression and measurable learning outcomes (Alonge et al., 2019; AIHR, 2024). By linking competencies directly to roles and responsibilities, frameworks enable organizations and educators to align recruitment, training, and performance management with strategic objectives (Mulder, 2014).

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The practical value of competency frameworks lies in their integrative function. They provide a roadmap for curriculum design, professional development, and assessment, ensuring consistency and comparability across contexts. For social entrepreneurs in emerging markets, such as the edible insect sector, this means that entrepreneurial, ethical, and sustainability-oriented competencies can be structured into actionable domains, embedded in training programmes, and benchmarked across different levels of expertise (Ploum et al., 2018; Council of the European Union, 2018).

A.3 Relevant reference frameworks

The development of the SB Framework and Curricula builds on a set of existing European and international references. Among them, two frameworks are particularly relevant: EntreComp (Bacigalupo et al., 2016), which provides a general model for entrepreneurial competences, and SEntreComp (Gómez González et al., 2025), an adaptation specifically for social entrepreneurship. These are complemented by additional insights from related initiatives, including the Key Competences for Lifelong Learning (Council of the European Union, 2018), ESCO (European Commission, 2017), and other EU-supported research on vocational excellence and skills ecosystems.

A.3.1) The European Entrepreneurship Competency Framework (EntreComp)

Published by the European Commission in 2016, EntreComp has been widely used as a reference model to describe and assess the necessary competences for performing entrepreneurial activities (Bacigalupo et al., 2016). It is structured around three interrelated competence areas:

- Ideas and opportunities (e.g., creativity, vision, opportunity recognition, ethical and sustainable thinking).
- Resources (e.g., financial literacy, self-efficacy, motivation).
- Into Action (e.g., planning and management, risk management, resilience).

Together, these areas cover 15 key competences. A distinctive feature of EntreComp is its eight proficiency levels, which make it adaptable to different learning contexts, from early education to professional development. It also aligns with the European Qualifications Framework (EQF), making it a valuable reference for curriculum design, skills recognition, and lifelong learning strategies.

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A.3.2) The Social Entrepreneurship Competence Framework (SEntreComp)

While EntreComp provides a solid baseline, it has been criticised for underplaying the social dimension of entrepreneurship (Gómez González et al., 2025). To address this gap, the *Open Business for Community Development (OBCD)* project, funded under Erasmus+ Alliances for Innovation, developed an adapted framework for social entrepreneurship – SEntreComp.

Drawing on empirical research across Greece, Finland, Italy, and Spain, OBCD conducted surveys (~122 respondents from social enterprises) and ~60 interviews with social entrepreneurs, educators, and VET/HE stakeholders. Its goal was to identify the distinctive competences required to balance the dual mission of social enterprises: generating both economic and social value.

Key findings include the mapping of 80 competences grouped into ~19 learning outcomes, and the proposal of additional competence threads that are not fully covered by EntreComp. Among these are: Social Literacy; Participatory and Open Governance; Communicating Social Impact; Solidarity; Transparency; Responsibility; Using Open Resources; and Managing the Dual Mission.

Also, OBCD developed two modular curricula aligned with EQF and ESCO: one targeted at administrative professionals (EQF5) and another at managers/developers of social enterprises (EQF6).

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Part B: Competency Framework for Social Entrepreneurs in the Edible Insect Market

The Social Bugs Competency Framework has been specifically adapted to address the demands of the edible insect market, an emerging field at the intersection of sustainable agri-food systems, circular economy, and social economy. Its purpose is to equip current and aspiring social entrepreneurs with the knowledge, skills, and attitudes necessary to design, implement, and scale socially impactful business models in this domain.

Following the selected methodology for competence catalogue creation, the social and sustainable business manager and entrepreneur in the edible insect market profile entails the use and mastery of three main groups of competencies: Entrepreneurship, Social Impact and Business, and Edible Insects Industry (see figure 1).

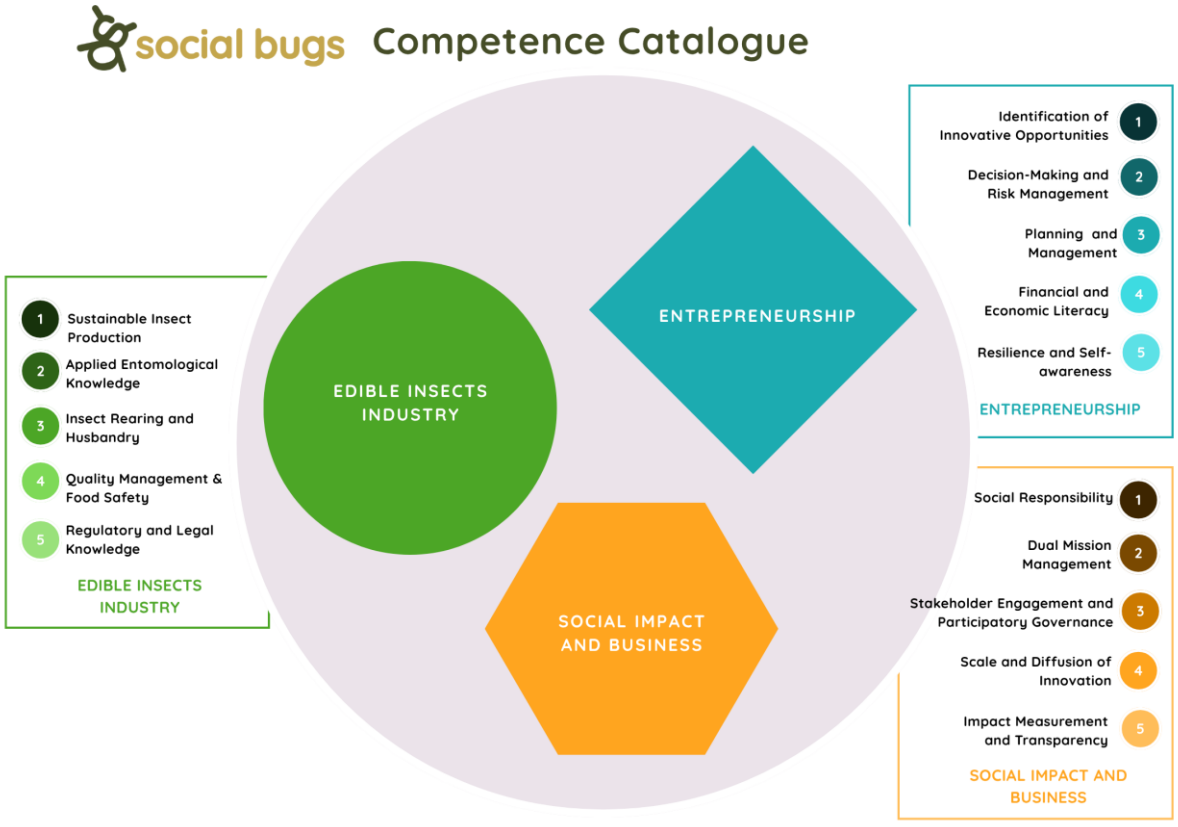

Figure 1. Social Bugs Competence framework and catalogue

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Each of these groups is divided into five key competencies identified through secondary literature research and practical experience, and presented with the definition and division into skills, attitudes, and knowledge.

B.1 Competence groups overview

B.1.1) Entrepreneurship

The Entrepreneurship competence group encompasses the knowledge, skills, and attitudes required to identify opportunities, create value, and launch financially sustainable ventures. It includes classic business skills (i.e., planning, financial literacy, risk management) as well as personal qualities like creativity, initiative, and resilience (Bacigalupo et al., 2016). The European Commission's EntreComp framework (2016) defines 15 entrepreneurial competences across areas of Ideas & Opportunities, Resources, and Into Action, highlighting traits such as spotting opportunities, vision, creativity, taking initiative, and ethical & sustainable thinking (Bacigalupo et al., 2016). These competencies are crucial in any entrepreneurial context and provide a "common language" for education and work in entrepreneurship (Bacigalupo, 2022).

In the context of social and sustainable entrepreneurship, additional emphasis is placed on aligning entrepreneurial action with social innovation and sustainability goals. Researchers have identified that sustainable entrepreneurs must integrate traditional entrepreneurship competencies with sustainability-oriented competencies (Diepolder, Weitzel & Huwer, 2021). For example, Ploum et al. (2018) validated a framework of six key competencies for sustainable entrepreneurship – including strategic action, systems thinking, foresighted thinking, normative (ethical) competence, and interpersonal competence. Similarly, Biberhofer et al. (2019) highlight competencies like systems thinking, anticipatory (foresight), normative (values-driven), strategic management, and collaboration in multi-stakeholder networks as essential for entrepreneurship driven by sustainability (Biberhofer et al., 2019). In essence, a social-sustainable entrepreneur needs the mindset to innovate and take action, and the ethical and systemic understanding to pursue triple-bottom-line outcomes (people, planet, profit).

This is especially relevant for Social Bugs Competence catalogue, given that entrepreneurs in the edible insect sector operate at the frontier of a novel food industry, which demands a strong entrepreneurial competence set. They must be opportunity-oriented innovators — for instance, recognizing the potential of insect protein after landmark studies by the FAO (Huis et al., 2013) highlighted insects' nutritional and environmental benefits (Daub

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& Gerhard, 2022). Founders in this space often exhibit high creativity, vision, and risk tolerance to develop products that challenge culinary norms. For example, the Swiss start-up Essento's founder displayed perseverance, adaptability, and a "nothing-is-impossible" mindset to create an entirely new market for insect-based foods in Europe (Daub & Gerhard, 2022). Such entrepreneurs leverage creativity to develop appealing insect products, spotting opportunities in sustainability challenges (i.e., reducing livestock emissions), and resilience to overcome setbacks like regulatory hurdles or consumer skepticism. Essento's journey required shaping new food regulations and tackling public "yuck" factors (Daub & Gerhard, 2022). Moreover, entrepreneurs in this space often see themselves as change agents, using entrepreneurial action to address societal challenges like food security and environmental sustainability. This aligns with the notion that social entrepreneurs "pursue a dual mission of achieving both social value and financial sustainability" (Stephan & Drencheva, 2017). In sum, strong entrepreneurship competencies enable edible insect innovators to navigate uncertainty, attract resources, and continuously learn and adapt. These are vital for establishing a viable business in this emerging sector. By combining an entrepreneurial mindset with a sustainability mission, they drive the edible insect movement from niche idea to mainstream solution. The entrepreneurship-related competencies included in this competency framework are:

- Identification of Innovative Opportunities
- Decision-Making & Risk Management
- Planning & Management
- Financial and Economic Literacy
- Resilience & Self-Awareness

B.1.2) Social Impact and Business

The Social Impact and Business Competence Group refers to the abilities required to integrate a social mission and measurable impact into a viable business model.

This involves balancing social, environmental, and financial objectives. This is often described as pursuing a "dual mission" of social value creation and financial and economic sustainability (Stephan & Drencheva, 2017). Key competencies in this domain include understanding social needs, designing inclusive business models, impact measurement, ethical leadership, stakeholder engagement, and strategic management. The bottom line - it's about running an enterprise that simultaneously achieves positive societal outcomes and commercial success (Sotiropoulou et al., 2021; Weerawardena et al., 2021). This

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competence group draws on principles of social entrepreneurship and social innovation, requiring entrepreneurs to be adept at social needs analysis, community involvement, and innovative financing (i.e., impact investing, crowdfunding) while maintaining operational sustainability.

One critical competence is social impact assessment and communication is the ability to define metrics for social and environmental outcomes and report them transparently. According to the OECD, systematic social impact measurement helps social enterprises demonstrate their value to funders and stakeholders (Noya, 2015). Linked to this is the competence of transparency and accountability: social entrepreneurs must openly share their enterprise's practices and impacts, which builds trust and credibility (López-Arceiz et al., 2017). For instance, being explicit about profit reinvestment for community benefit, or about the enterprise's environmental footprint, strengthens reputation and customer trust (Gómez González et al., 2025). Day-to-day choices should also reflect ethical and sustainable decision-making—fairness, inclusion, ecological responsibility. The EntreComp framework names ethical and sustainable thinking as a core entrepreneurial competence, asking entrepreneurs to consider the wider consequences of their actions (Bacigalupo et al., 2016). Many social entrepreneurs go further by embedding corporate social responsibility into the core of the model rather than treating it as peripheral (Gómez González et al., 2025). Stakeholder engagement and solidarity matter as well. Here, "solidarity" means cooperation and mutual support across employees, communities, investors, and peer organisations (Bergeron et al., 2015). In practice, that shows up in participatory governance (bringing beneficiaries into decision-making), partnerships with local organisations, and cooperative approaches in place of zero-sum competition. Working this way mobilises resources, fuels innovation, and keeps offerings anchored in real community needs. Overarching all of this is the craft of managing the dual mission. Social enterprises live with a constant tension between social and economic goals and must balance them through adaptive management (Weerawardena et al., 2021). Pricing, growth, and investment choices all carry both a financial and a mission lens; the equilibrium they strike often determines success.

These competences are directly relevant in the edible insect field. The sector tackles social and environmental problems head-on, insect protein can lower land use and greenhouse emissions, and it can improve nutrition and livelihoods (Alhujaili et al., 2023). Many ventures position themselves as impact enterprises, addressing food insecurity, creating alternative incomes for farmers, or upcycling side-streams into insect feed (Halloran et al., 2018). To make that credible, the entrepreneur needs a value proposition that names

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those social and environmental benefits and a revenue model that keeps the work going. Impact measurement then gives weight to the claims. For example, a cricket farming social enterprise might track how many kilograms of food waste are converted to protein or how many malnourished children are reached with its products, and report this to stakeholders and investors. Additionally, edible insect entrepreneurs often must engage in policy and network advocacy, working with governments and networks to shape favorable regulations and public awareness (Daub & Gerhard, 2022). This is part of stakeholder engagement by communicating their social impact and collaborating with NGOs, policymakers, and researchers. They build an ecosystem that supports entomophagy as a socially beneficial innovation. Finally, balancing impact and business is critical; an edible insect venture must remain financially sustainable to continuously deliver social value. Entrepreneurs must make pragmatic decisions, such as product pricing or scaling strategies, that ensure viability without compromising their mission. Those who excel in Social Impact and Business competencies can create hybrid value: insect-based businesses that are profitable enough to grow and simultaneously deliver measurable benefits for society and the environment. This alignment of mission and market is the hallmark of a socially sustainable entrepreneur in the edible insect domain. The social impact and business competencies identified are:

- Social Responsibility
- Dual Mission Management
- Stakeholder Engagement & Participatory Governance
- Scaling and Innovation Diffusion
- Impact Measurement & Transparency

B.1.3) Edible Insects Industry

This competence group covers specialized knowledge and skills related to the edible insect industry, focusing on producing edible insects and marketing insect-based products to consumers. On the production side, it involves understanding insect biology and rearing techniques, feed and breeding management, food safety and quality control, as well as processing methods to turn insects into palatable food products. Entrepreneurs must be knowledgeable about relevant regulations, for example, in the EU, insects are regulated as "Novel Foods" requiring approval and strict hygiene standards (Żuk-Gołaszewska et al., 2022). They need competencies in farm operations on both small and/or large scale, supply chain management, and perhaps engineering aspects of insect breeding systems. On the marketing side, this group entails the ability to develop products that meet

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consumer needs, branding and packaging insect foods appealingly, pricing and distribution strategies, and above all, strategies to overcome consumer skepticism. Marketing competencies here are closely tied to consumer education and communication, given that entomophagy is unfamiliar or culturally sensitive in many markets (see for example, Barbosa et al., 2025). It also encompasses insect commercialization beyond production, for example, transformation into products.

This matters for Social Bugs since edible insects are an innovative protein source with significant sustainability and nutrition advantages. They are rich in protein, healthy fats, vitamins and minerals, making them a highly nutritious food or feed ingredient (Żuk-Gołaszewska et al., 2022). Insect farming has a much lower environmental footprint than traditional livestock, requiring less land, water, and feed, and emitting fewer greenhouse gases (Huis et al., 2013; Alhujaili et al., 2023). Understanding these benefits is a key competence for entrepreneurs as it allows them to position their product in the context of sustainable global food systems. Production competences also include ensuring food safety: entrepreneurs must know how to prevent contaminants, for example, heavy metals or pathogens in insect feed, and comply with food safety regulations. Competence in regulatory awareness and quality assurance is also vital. Successful edible insect businesses often work closely with regulators and researchers to establish rearing standards and get novel products approved. Early pioneers in Europe had to navigate regulatory uncertainty (Daub & Gerhard, 2022).

Even if insects are produced efficiently, consumer acceptance remains a central challenge. Entrepreneurs must therefore be adept at marketing strategies to increase acceptance. The biggest barriers for Western consumers are psychological factors like disgust and food neophobia, as well as concerns about taste and appearance (Barbosa et al., 2025). Key drivers of acceptance are familiarity and exposure, meaning consumers are more willing to try insect-based foods if they are gradually introduced to them in familiar formats and given information about benefits (Alhujaili et al., 2023; Barbosa et al., 2025). In practice, this competence entails product innovation, for instance incorporating insect flour into cookies, protein bars, or pasta where it's less visible, branding and storytelling that highlight sustainability and nutritional benefits, and educational marketing. Entrepreneurs often craft narratives around how insect farming can alleviate environmental issues or how cultures around the world traditionally eat insects, thereby normalizing the idea.

Understanding and selecting target consumers is another aspect; studies can suggest a market segmentation that helps inform the business. For example, young adults and environmentally conscious consumers have been early adopters of insect foods (Hartmann

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& Siegrist, 2017). Thus, a marketing-competent entrepreneur in this sector will segment the market and possibly target these receptive groups with tailored messaging. Possible strategies include offering tasting events, cooking demonstrations, or partnering with restaurants/chefs to improve the food culture around insects. Moreover, communication skills are critical, being able to handle media attention, since edible insects often draw curiosity, utilize social media to showcase recipes, and engage with consumer feedback to refine products.

For a socially sustainable entrepreneur in edible insects, production and marketing competencies are deeply interlinked with their mission. By producing insects effectively, they deliver on environmental and social promises, and by marketing effectively, they ensure consumer buy-in, which in turn grows the social impact – a virtuous loop. The chosen competencies for the edible insect industry are:

- Sustainable Insect Production
- Applied Entomological Knowledge
- Insect Rearing and Husbandry
- Quality Management & Food Safety
- Regulatory & Legal Compliance
- Marketing and Market Development

B.2 Learning outcome format

Each competency unit within the Social Bugs Framework is structured according to the Knowledge–Skills–Attitudes (KSA) model, in alignment with the principles of the European Qualifications Framework (EQF; European Commission, 2008) and the European Credit System for Vocational Education and Training (ECVET; European Commission, 2009). This triadic structure enables clarity, modularity, and transferability across diverse learning settings and qualification systems (European Commission, 2017; Boyatzis, 2008).

- **Knowledge** – conceptual, theoretical, and factual understanding relevant to the edible insect sector and social entrepreneurship (e.g., insect physiology, circular economy models, business registration procedures).
- **Skills** – cognitive and practical abilities required to apply knowledge effectively in real-world contexts (e.g., operating breeding systems, developing financial plans, facilitating community engagement).

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- **Attitudes** – dispositions, values, behaviours, and socio-emotional competences that shape responsible and ethical action (e.g., empathy, collaboration, environmental responsibility, resilience; (European Commission, 2019)).

This outcome-based approach facilitates the development of modular learning pathways and micro-credentials, particularly suited for adult learners engaged in continuing vocational education and training (CVET; European Commission, 2020a). It allows for the recognition of prior learning, flexible upskilling, and progression between formal, non-formal, and informal education settings.

B.3 Competence development across the entrepreneurial lifecycle

Given the importance and relevance of entrepreneurship, Social Bugs competence framework also identifies in each business stage in which competence is better applied and why, providing users with a valuable categorization which they can apply to real-life learning and business practices (Neck et al., 2014; Mair & Martí, 2006).

Ideation Stage

This stage focuses on the emergence of entrepreneurial intent and the capacity to generate socially responsive business ideas. Learners are equipped to identify opportunities, explore the insect farming ecosystem, and formulate purpose-driven initiatives.

- Identification of community needs, socio-environmental challenges, and market gaps
- Mapping of the edible insect value chain and supporting ecosystem
- Application of ideation techniques, design thinking, and social innovation tools
- Feasibility analysis and early-stage concept validation
- Development of entrepreneurial self-awareness, confidence, and motivation

Start-Up Stage

This stage supports the transition from ideas to action, providing competencies for legal establishment, pilot implementation, and early operations. It fosters the creation of socially grounded enterprises with viable production systems and funding mechanisms.

- Design and refinement of value propositions and minimum viable products
- Legal registration and compliance with national and EU-level regulations

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- Exploration of funding mechanisms (grants, impact investors)
- Planning and launch of production infrastructures (e.g., pilot farms, micro-factories)
- Stakeholder identification, engagement, and early-stage communication strategies

Scaling Stage

This stage enables entrepreneurs to consolidate operations and expand their impact through strategic growth, replication, and systems-level change.

- Diversification of products, services, and income streams
- Formation of strategic partnerships, cooperatives, and networks
- Scaling of social and environmental impact through systems thinking
- Development of replication models, franchising, and territorial expansion strategies
- Institutionalization, governance, and long-term sustainability planning

B.4 Proficiency Levels

Each competence within the SB Framework is associated with a proficiency level, indicating the depth of knowledge, skill, and attitude application expected:

- **Intermediate** – Learners can apply competences with guidance, handle standard tasks, and participate in team-based activities.
- **Advanced** – Learners can independently apply competences in complex contexts, lead projects, make informed decisions, and adapt practices to emerging challenges.
- **Expert** – Learners demonstrate mastery, mentor others, drive innovation, and contribute to organizational or sector-level improvements (European Commission, 2008; Mulder, 2014; Boyatzis, 2008).

These levels allow the framework to be modular and adaptable, supporting personalized learning pathways, assessment of progress, and alignment with vocational qualifications, micro-credentials, and real-life entrepreneurial practice.

B.5 Competencies in detail

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ENTREPRENEURSHIP

1 Identification of Innovative Opportunities

Description		Stage Relevance	Proficiency Level	Assessment (examples)
The ability to spot and evaluate unmet needs and emerging trends, particularly in the context of sustainability challenges, by creatively combining resources to generate social, environmental, and economic value. (Bacigalupo et al., 2016; McCallum et al., 2018; Ploum et al., 2018)	**Knowledge** Understanding sustainability trends, market drivers, regulatory shifts, and consumer needs related to innovation. **Skill** Ability to generate, evaluate, and validate opportunities that respond to sustainability and social challenges. **Attitude** Curiosity, openness to change, commitment to sustainable value creation, and resilience in the face of scepticism.	**Ideation (core):** identifying gaps & opportunities **Start-up (supporting):** refining into value propositions	● Identifies and explains drivers of change (e.g., environmental pressures, health concerns, policy incentives) relevant to an emerging sector.	Mapping exercise (PESTLE focused on sustainability); short written reflection on potential opportunities.
			●● Applies structured tools (customer interviews, MVP tests) to validate ideas; prioritises opportunities balancing environmental, social, and economic impact.	Portfolio of opportunity briefs including sustainability criteria.
			●●● Leads sustainability-driven innovation; mentors others in identifying opportunities; models perseverance in building acceptance for disruptive ideas.	Reflective journals on reframing challenges into sustainable opportunities.

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2 Decision-Making and Risk Management

Description		Stage Relevance	Proficiency Level	Assessment (examples)
The ability to make informed and responsible choices under uncertainty, balancing economic viability with social and environmental impact. It involves recognising regulatory, reputational, and ethical risks, and designing mitigation strategies that enable sustainable innovation. (Bacigalupo et al., 2016; Biberhofer et al., 2019; McCallum et al., 2018)	**Knowledge** Understanding decision-making models, sustainability trade-offs, and types of risks (financial, legal, reputational, ecological). **Skill** Ability to analyse options, apply structured tools, and design mitigation plans that balance risk with opportunity. **Attitude** Prudence, accountability, resilience, and willingness to take calculated risks in pursuit of sustainable value creation.	**Start-up (supporting):** making decisions on legal form, funding, pilot launch **Scaling (Core):** evaluating risk in partnerships, replication, growth	● Identifies common risks in emerging industries; explains how social/environmental trade-offs affect decision-making.	Case-study analysis; creation of risk register including sustainability dimensions.
			●● Uses decision matrices or scenario planning integrating sustainability criteria; develops mitigation plans for regulatory, market, and reputational risks.	Simulation exercises; portfolios including risk assessment tables and mitigation strategies.
			●●● Leads teams in making responsible decisions under uncertainty; embraces accountability; demonstrates resilience in adverse outcomes.	360° feedback from team and stakeholders; reflective journals on sustainability trade-offs in past decisions.

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3 Planning and Management

Description		Stage Relevance	Proficiency Level	Assessment (examples)
The ability to design and implement structured action plans that align entrepreneurial activities with long-term sustainability goals. It includes coordinating resources, setting milestones, and adapting plans in response to changing ecological, social, and regulatory environments. (Bacigalupo et al., 2016; McCallum et al., 2018; Ploum et al., 2018)	**Knowledge** Understanding project planning, time/resource allocation, and sustainability management tools (e.g., impact indicators, SDG alignment). **Skill** Ability to create action plans, allocate resources, monitor progress, and adapt strategies with sustainability embedded. **Attitude** Discipline, adaptability, and long-term responsibility for sustainability outcomes.	 **Start-up (supporting):** launch and operational setup  **Scaling (core):** strategic growth, long-term management	● Explains components of a sustainable project plan; describes how to integrate social and environmental indicators alongside economic ones.	Written project plan including impact KPIs; creation of sustainability-balanced scorecard.
			● Develops and manages detailed plans with milestones, budgets, and sustainability indicators; adjusts strategies based on feedback and monitoring.	Portfolio of plans and monitoring reports including triple-bottom-line metrics.
			● Leads complex initiatives, motivates teams to deliver impact-oriented results, and ensures alignment with sustainability goals.	360° feedback; reflective journals on adjustments to plans under social/environmental pressures.

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4 Financial and Economic Literacy

Description		Stage Relevance	Proficiency Level	Assessment (examples)
The ability to understand and apply financial and economic principles to ensure the viability, transparency, and sustainability of social enterprises. It involves budgeting, forecasting, interpreting financial information, and making informed spending and investment decisions that align with social, environmental, and economic goals. (Bacigalupo et al., 2016; Culebro-Martínez et al., 2024; Mohsen & Zivari, 2023; Noya, 2015)	**Knowledge** Understanding financial and economic fundamentals (income, cost, profit, cash flow, assets, liabilities), budgeting, and forecasting; recognising economic and policy factors influencing agri-based social enterprises, and financing sources. **Skill** Ability to prepare and manage budgets, analyse financial data, forecast revenues and costs, interpret reports, and make responsible spending and investment decisions. **Attitude** Transparency, accountability, precision, and ethical conduct in financial management.	**Ideation (supporting):** understanding basic financial viability to design realistic and sustainable business ideas **Start-up (core):** applying financial planning, budgeting, and cost management for operational stability **Scaling (core):** using advanced financial strategies for growth, investment, and long-term sustainability	● ○ ○ Understands key financial terms, prepares simple budgets, and interprets financial data.	Budget and financial case exercises (e.g., edible insect start-up); quizzes on budgeting and forecasting concepts.
			○ ● ○ Conducts cost–benefit analyses, links financial and social performance, and manages financial risks.	Case studies analysing sustainability-oriented financial decisions; preparation of a financial plan linking costs to impact goals.
			● ● ● Develops strategic financial models integrating impact metrics, leads sustainable finance planning, and mentors others.	Real or simulated financial reporting; 360° peer assessment of transparency and decision-making in financial scenarios.

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5 Resilience and Self-awareness

Description		Stage Relevance	Proficiency Level	Assessment (examples)
The ability to understand one's emotions, motivations, and limitations and to use this awareness to sustain perseverance, adaptability, and purpose when facing challenges. (Bacigalupo et al., 2016; Daub & Gerhard, 2022; Fletcher & Sarkar, 2013; Korber & McNaughton, 2018)	**Knowledge** Understanding concepts of emotional intelligence, stress and coping mechanisms, and self-regulation; Recognising the psychological and social dimensions of resilience in mission-driven entrepreneurship. **Skill** Ability to reflect on personal performance, manage emotions constructively, recover from setbacks, and adjust strategies in uncertain contexts. **Attitude** Openness to feedback, commitment to continuous personal growth, empathy, and maintaining optimism and persistence in challenging conditions.	**Ideation (supporting):** building self-confidence and tolerance for uncertainty **Start-up (core):** sustaining motivation and adaptive responses under pressure **Scaling (supporting):** modelling resilience to lead teams and manage complex growth challenges	● Identifies personal strengths, limitations, and stress triggers; applies reflection and simple coping mechanisms in response to challenges.	Reflective journals and peer-feedback sessions on emotional regulation and teamwork; resilience-building workshops (e.g., responding to consumer rejection scenarios).
			●● Demonstrates adaptive problem-solving and sustained motivation under pressure; reframes failures as opportunities for learning; maintains balance between mission and personal well-being.	Case-based assessment analysing how entrepreneurs manage setbacks (e.g., regulatory delays, investor rejection); simulation of crisis response and adaptive planning.
			●●● Models resilience and self-awareness as a leader; mentors others in stress management and reflective practice; sustains optimism and ethical clarity during long-term uncertainty or scaling phases. Incorporates team members' self-care into company ethos.	360° leadership review; portfolio of reflective narratives showing mentoring practices and self-awareness in decision-making during scaling or social impact transitions.

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SOCIAL IMPACT AND BUSINESS

1 Social Responsibility

Description		Stage Relevance	Proficiency Level	Assessment (examples)
The ability to act ethically and accountably, considering the social, environmental, and economic consequences of entrepreneurial decisions. Social responsibility means integrating fairness, ecological stewardship, and inclusion into everyday business practices, going beyond compliance to proactively contribute to community well-being and planetary sustainability. (Bacigalupo et al., 2016; Noya, 2015; Stephan & Drencheva, 2017)	**Knowledge** Understanding ethical frameworks, sustainability principles (SDGs, circular economy), human rights, and ecological responsibility in business. **Skill** Ability to apply responsible practices in sourcing, production, employment, and community engagement, ensuring operations contribute positively to society and the environment. **Attitude** Commitment to fairness, inclusion, solidarity, ecological stewardship, and long-term accountability.	**Ideation (supporting):** framing ideas with ethical & ecological awareness **Start-up (core):** embedding responsible practices in sourcing, hiring, and community engagement **Scaling (core):** institutionalising responsibility in governance, long-term sustainability strategies, and solidarity networks	● Identifies core ethical and ecological principles; describes how entrepreneurial decisions affect communities and the environment	Written case study analysis; quizzes on SDGs and sustainability standards.
			●● Designs and implements operational practices aligned with ethical and ecological standards (e.g., fair sourcing, low-carbon logistics, safe working conditions).	Portfolio of practices (supplier codes of conduct, employee well-being policies, environmental impact plans); simulation of ethical dilemma scenarios.
			●●● Models integrity; actively promotes social and ecological justice; champions solidarity-based approaches (e.g., partnerships with farmers, fair pricing models).	360° stakeholder feedback; reflective journals documenting responsible choices in trade-offs (profit vs sustainability).

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2 Dual Mission Management

Description		Stage Relevance	Proficiency Level	Assessment (examples)
The ability to simultaneously pursue social and environmental objectives alongside financial sustainability. It involves balancing a "dual mission" of value creation for society and economic viability, making strategic choices that align the enterprise's social purpose with operational and market realities. (Bacigalupo et al., 2016; Stephan & Drencheva, 2017; Weerawardena et al., 2021)	**Knowledge** Understanding the principles of social entrepreneurship, dual mission strategy, impact-oriented business models, and trade-offs between social/environmental and financial goals. **Skill** Ability to operationalise dual mission strategies: integrate social/environmental objectives into pricing, investment, growth, and operational decisions. **Attitude** Commitment to maintaining integrity, fairness, and sustainability across both missions; resilience in reconciling conflicting priorities.	**Ideation (supporting):** understanding the dual mission concept, identifying potential tensions in early ideas	● Explains the concept of dual mission, recognises common tensions (e.g., pricing vs. accessibility, growth vs. social impact), and describes approaches to balancing them.	Written case analysis of social enterprises; quizzes on dual mission frameworks.
		Start-up (core): integrating dual mission into business models, pricing, and operations	●● Develops plans that balance financial sustainability with measurable social/environmental impact; monitors KPIs for both dimensions; adapts strategy when conflicts arise.	Portfolio including dual mission business plans; simulation exercises.
		Scaling (core): managing trade-offs transparently, institutionalising KPIs for both impact and financial performance	●●● Leads teams to uphold dual mission principles; Demonstrates long-term ability to make ethically and financially responsible decisions; communicates trade-offs transparently to stakeholders.	360° stakeholder feedback; reflective journals documenting resolution of mission conflicts

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3 Stakeholder Engagement and Participatory Governance

Description		Stage Relevance	Proficiency Level	Assessment (examples)
The ability to identify, communicate with, and actively involve stakeholders in decision-making processes. This includes fostering collaboration, building trust, and ensuring that beneficiaries, communities, partners, and investors have a voice in shaping business strategies and social impact initiatives. (Bacigalupo et al., 2016; Stephan & Drencheva, 2017)	**Knowledge** Understanding stakeholder mapping, participatory governance principles, collaboration frameworks, and communication strategies. **Skill** Ability to engage stakeholders effectively, facilitate participatory processes, co-create solutions, and integrate feedback into decision-making. **Attitude** Commitment to transparency, inclusivity, collaboration, and respect for stakeholder perspectives.	**Ideation (supporting):** stakeholder mapping, anticipating potential collaborations **Start-up (core):** engaging stakeholders in co-design of business models and pilot projects **Scaling (core):** establishing participatory governance structures, institutionalising feedback mechanisms	● Identifies key stakeholders, understands their interests and influence, and describes participatory methods.	Stakeholder mapping exercise; quiz on participatory governance principles.
			●● Conducts stakeholder workshops; develops engagement plans; integrates feedback into business model or project design; manages conflicts and negotiations.	Portfolio including engagement plans, workshop reports, meeting notes with stakeholder feedback; simulation exercises of participatory decision-making.
			●●● Champions participatory governance: ensures marginalized voices are heard; builds trust and long-term collaboration; leads ethically in multi-stakeholder contexts.	360° feedback from stakeholders; reflective journals on engagement outcomes.

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4 Scale and Diffusion of Innovation

Description		Stage Relevance	Proficiency Level	Assessment (examples)
The ability to expand the reach and adoption of innovations, practices, or social solutions while maintaining their effectiveness and core mission. This involves understanding mechanisms of innovation diffusion, designing scalable models, leveraging networks, and adapting strategies to diverse contexts and stakeholders. (Bufalia et al., 2023; Lam et al., 2020; Rogers, 2003; Scheuerle & Schmitz, 2016)	**Knowledge** Understanding theories of innovation diffusion, scaling strategies (scaling up, scaling out, replication, adaptation), systemic and contextual factors affecting adoption, and methods for maintaining mission fidelity during growth. **Skill** Ability to design, implement, and manage scaling strategies that expand the reach of innovations; monitor adoption and impact; adapt to local contexts; build partnerships and networks for diffusion; integrate feedback loops. **Attitude** Commitment to responsible growth, resilience in overcoming scaling challenges, and ethical decision-making to preserve mission and stakeholder trust.	**Ideation (supporting):** identifying potential pathways and barriers for innovation adoption **Start-up (core):** designing pilot strategies for wider adoption and partnerships **Scaling (core):** leading systematic scaling processes, monitoring diffusion outcomes, adapting innovations responsibly	● Explains diffusion processes, recognizes scaling barriers, and identifies strategies for adaptation and replication. ●● Designs and implements scaling strategies, monitors adoption and impact, manages partnerships for diffusion. ●●● Leads organization-wide or multi-stakeholder scaling initiatives; ensures mission fidelity and quality; communicates scaling strategy transparently to stakeholders.	Written case studies; quizzes on diffusion and scaling frameworks. Portfolio of scaling plans; pilot implementation reports; network engagement documentation. 360° stakeholder feedback; reflective journals on scaling challenges and solutions; longitudinal impact evaluation reports.

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5 Impact Measurement and Transparency

Description		Stage Relevance	Proficiency Level	Assessment (examples)
The ability to define, monitor, and communicate social, environmental, and economic outcomes of an enterprise or project in a transparent and systematic way. This involves selecting appropriate indicators, applying measurement methodologies, reporting results to stakeholders, and ensuring accountability. (Alhujaili et al., 2023; Gómez González et al., 2025; López-Arceiz et al., 2017; Noya, 2015)	**Knowledge** Understanding principles and frameworks of social and environmental impact assessment, KPIs, reporting standards (e.g., GRI), and transparency mechanisms. **Skill** Ability to design and implement measurement systems, collect and analyze data, interpret results, and communicate them effectively to diverse stakeholders. **Attitude** Commitment to accountability, ethical reporting, and continuous improvement; willingness to openly share successes and challenges.	**Ideation (supporting):** identifying relevant social, environmental, and economic outcomes for early projects **Start-up (core):** designing impact measurement processes and reporting frameworks; collecting baseline data **Scaling (core):** institutionalizing impact measurement systems; publishing transparent reports; integrating results into strategic decision-making	● Identifies relevant indicators, understands basic measurement methods, and explains the importance of transparent reporting. ●● Designs and implements measurement systems, analyzes results, produces reports for stakeholders, and uses insights to inform decision-making. ●●● Leads organizational or multi-stakeholder impact assessment initiatives, ensures high transparency and accountability, interprets complex data to guide strategic decisions, and communicates findings effectively to diverse audiences.	Quizzes on KPIs and reporting standards; written analysis of impact measurement in case studies. Portfolio including impact measurement frameworks; stakeholder reporting templates; case studies demonstrating data-informed adjustments. 360° stakeholder feedback; comprehensive impact reports; reflective journals documenting lessons learned and improvements made.

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EDIBLE INSECTS PRODUCTION AND MARKETING

1 Sustainable Insect Production

Description	Stage Relevance	Proficiency Level	Assessment (examples)
The ability to design, implement, and manage insect farming systems that minimise environmental impact while ensuring efficiency, animal welfare, and scalability. This competence includes resource-efficient feed use, circular economy approaches (e.g., upcycling organic side-streams), low energy and water input, and integration with sustainable agri-food systems. (Huis et al., 2013; Smetana et al., 2023; van Huis & Oonincx, 2017) **Knowledge** Understanding principles of sustainable food production, circular economy in insect farming, environmental impact metrics (GHG emissions, land/water use), and sustainability standards. **Skill** Ability to apply sustainable practices in feed selection, waste management, water/energy optimisation, and closed-loop farming models; monitoring sustainability KPIs. **Attitude** Commitment to ecological stewardship, long-term sustainability, and ethical farming; advocates for sustainable insect production standards within the sector.	**Ideation (supporting):** understanding sustainability challenges and the potential of insects as a low-impact protein source **Start-up (core):** designing pilot farms with sustainable feed inputs and efficient resource use **Scaling (core):** integrating sustainability certifications, monitoring life-cycle impact, and optimising large-scale production for minimal footprint	● Understands basic principles of sustainable insect production, environmental impacts, and resource-efficient practices; able to apply simple sustainability measures in farm operations.	Written test on sustainable farming principles; case study analysis of insect farm life-cycle assessments.
		●● Independently applies sustainability principles to optimise production processes; monitors KPIs and adapts practices for efficiency, environmental footprint, and animal welfare.	Farm simulation exercises; portfolio of farm management plans including feed cycles, waste reduction strategies, and energy balance models.
		●●● Leads strategic decisions on large-scale sustainable insect production; develops innovative solutions; mentors others and advocates for sector-wide sustainability standards.	Reflective journal on sustainability-driven decisions; 360° feedback from stakeholders (farmers, regulators, community) on ecological responsibility

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2 Applied Entomological Knowledge

Description		Stage Relevance	Proficiency Level	Assessment (examples)
The ability to understand insect biology, physiology, life cycles, and behaviour, and to apply this knowledge in practical insect farming systems. This includes knowledge of species-specific rearing requirements, reproductive strategies, environmental preferences, nutrition, and pest/disease management. (van Huis & Oonincx, 2017; Żuk-Gołaszewska et al., 2022)	**Knowledge** Understanding insect anatomy, physiology, taxonomy, life cycles, nutrition, and ecological interactions. **Skill** Applying entomological knowledge to optimize rearing conditions, improve productivity, and prevent disease. **Attitude** Demonstrating curiosity, attention to detail, and respect for insect welfare in farming practices.	**Ideation (supporting):** identifying species suitability and understanding ecological needs **Start-up (core):** applying species-specific rearing practices and troubleshooting farm operations **Scaling (core):** optimising production systems for multiple species at commercial scale while maintaining productivity and welfare	● Understands basic biology and life cycle of target species; can follow standard rearing protocols under supervision.	Written quizzes on insect biology; practical exercises following standard rearing protocols; observation of routine husbandry tasks.
			●● Independently applies entomological knowledge to optimize growth, reproduction, and survival; identifies and addresses health or environmental issues.	Reports on growth and survival data; troubleshooting farm issues; designing interventions for optimized rearing.
			●●● Leads research-based improvements; develops innovative breeding strategies; advises others and sets best practices in insect husbandry.	Developing new breeding strategies; mentoring farm staff; designing experimental trials; publications or technical reports on best practices.

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3 Insect Rearing and Husbandry

Description		Stage Relevance	Proficiency Level	Assessment (examples)
The ability to manage the day-to-day rearing of edible insects, ensuring optimal growth, survival, reproduction, and welfare. This includes monitoring environmental conditions (temperature, humidity, light), feeding regimes, breeding cycles, hygiene, and health management to maintain consistent and efficient production. (van Huis & Oonincx, 2017; Żuk-Gołaszewska et al., 2022)	**Knowledge** Understanding insect husbandry principles, life cycles, environmental needs, feeding regimes, and health management. **Skill** Ability to implement daily rearing practices, monitor growth and survival, adjust environmental and feeding parameters, and maintain colony health. **Attitude** Commitment to insect welfare, attention to detail, responsibility, and proactive problem-solving in husbandry practices.	**Ideation (supporting):** identifying species suitability and understanding ecological needs **Start-up (core):** applying species-specific rearing practices and troubleshooting farm operations **Scaling (core):** optimising production systems for multiple species at commercial scale while maintaining productivity and welfare	● Understands basic husbandry requirements and standard operating procedures; can perform routine rearing tasks under supervision.	Observation and completion of routine husbandry tasks; practical quizzes on feeding and environmental requirements; recording mortality and growth data.
			●● Independently manages insect colonies, adjusts environmental and feeding parameters for improved productivity, identifies and mitigates health or environmental issues.	Analysis of productivity data; troubleshooting rearing problems; designing and implementing minor adjustments in husbandry protocols.
			●●● Designs and implements optimized husbandry systems for large-scale production, develops innovative techniques to enhance productivity and welfare, and trains/mentors others.	Development of large-scale optimized protocols; experimental trials for improved husbandry; mentoring teams; reporting and presenting best practices to stakeholders.

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4 Quality Management & Food Safety

Description		Stage Relevance	Proficiency Level	Assessment (examples)
The ability to ensure that insect production and processed products meet food safety, hygiene, and quality standards. This includes implementing Hazard Analysis and Critical Control Points (HACCP), monitoring microbial contamination, chemical hazards, and allergens, and maintaining compliance with national and EU regulations for novel foods. (Huis et al., 2013; Żuk-Gołaszewska et al., 2022)	**Knowledge** Understanding food safety regulations, hygiene standards, quality assurance principles, contamination risks, and monitoring protocols. **Skill** Ability to implement quality control procedures, monitor safety parameters, detect hazards, and take corrective actions. **Attitude** Commitment to product safety, ethical responsibility, attention to detail, and proactive problem-solving.	**Ideation (supporting):** understanding basic food safety and hygiene requirements relevant to potential insect species. **Start-up (core):** implementing HACCP and quality procedures for pilot production. **Scaling (core):** managing full-scale quality management systems, ensuring regulatory compliance and safe products at commercial scale.	● Understands basic food safety requirements and hygiene practices; can follow standard quality protocols under supervision. ●● Independently monitors production for compliance, identifies and resolves safety issues, implements corrective measures. ●●● Develops and oversees comprehensive quality management systems; advises on regulatory compliance; leads audits and training for staff.	Practical exercises on hygiene and safety protocols; written quizzes on HACCP and EU food regulations; inspection of pilot farm practices. Monitoring microbial and chemical parameters; reports on corrective actions; internal audits of processes. Designing and implementing full quality management systems; leading external audits; creating staff training programs; publishing technical guidelines or reports.

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5 Regulatory and Legal Knowledge

Description		Stage Relevance	Proficiency Level	Assessment (examples)
The ability to understand and comply with national and EU regulations governing insect production and novel foods, including safety, labelling, environmental, and trade requirements. This includes knowledge of approval procedures, reporting obligations, and legal responsibilities. (Daub & Gerhard, 2022; Żuk-Gołaszewska et al., 2022)	**Knowledge** Understanding relevant legislation, regulatory frameworks, approval processes, labeling requirements, and environmental compliance. **Skill** Ability to implement procedures ensuring compliance, prepare documentation, and communicate with regulatory authorities. **Attitude** Commitment to legal and ethical responsibility, attention to detail, and proactive adherence to standards.	**Ideation (supporting):** understanding regulatory implications for potential species and products. **Start-up (core):** ensuring pilot production complies with legal standards. **Scaling (core):** managing compliance for commercial-scale operations, approvals, and cross-border trade.	● Understands basic regulatory requirements; can follow compliance procedures under supervision. ●● Independently manages compliance documentation, interacts with authorities, ensures operations meet legal standards. ●●● Advises on regulatory strategy, monitors legislative changes, implements compliance systems at scale, trains teams, and leads audits.	Quizzes on EU and national regulations; checklist audits of pilot farm compliance; documentation review exercises. Preparing compliance reports; coordinating with regulatory agencies; resolving minor non-compliance issues. Leading regulatory strategy; conducting full compliance audits; creating training programs; preparing submissions for novel food approvals.

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