SCABEE Analysis of Sustainability in Teaching in Partner's Study Programmes

Initial Analysis Research Framework (A2.1)

Aalborg (Denmark), March 2024

Co-funded by the European Union

Project partners

esta school of business & technology Belfort

FHV Vorarlberg University of Applied Sciences

Silesian University of Technology

UCN

Dissemination level

Code	Access granted to	
PU	**Public**	
PP	Restricted to other programme participants (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Legal Disclaimer

The project is co-funded by the European Union. The views and opinions expressed are those of the author(s) and do not necessarily reflect those of the European Union or Agency Erasmus+ France / Education Formation as awarding authority. Neither the European Union nor the awarding authority can be held responsible for them.

About the SCABEE project

Climate Change is one of the most crucial challenges humanities must confront in an urgent manner. Therefore, the SCABEE project aims to strengthen the sustainability skills & critical thinking of engineering and business students. This helps plant sustainability in future engineers' and managers' mindsets on the partner level and beyond.

The project SCABEE introduces sustainability teaching and thinking in business and engineering study degrees as a persistent leitmotif. Students will discover sustainable products and solutions through Sustainability Teaching Case Studies and develop more sustainable behaviour in their personal and future professional lives. They will also transport their knowledge and behaviour to their companies and thereby contribute to the green transition of the European industry and help save our planet for future generations.

SCABEE partners will produce a total of 16 Teaching Case Studies with a focus on sustainability that can be used in higher education institutions as well as vocational education training courses.

Project duration: September 2023 to August 2026.

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List of abbreviations

EPD	Environmental Product Declaration
ESTA	ESTA Belfort, www.esta-groupe.fr/en
EQF	European Qualifications Framework
FHV	Fachhochschule Vorarlberg, Austria, www.fhv.at/en
LCA	Life Cycle Analysis
OEF	Organizational Environmental Footprint
PEF	Product Environmental Footprint
PSS	Product Service Systems
SDG	Sustainability Development Goal, https://sdgs.un.org/fr/goals
SUT	Silesia University of Technology, www.polsl.pl/en/
TCS	Teaching Case Study
UCN	University College Northern Denmark, www.ucn.dk
UN	United Nations

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1 Introduction

This document outlines the research framework for conducting the first 'as-is'-analysis (activity 2.1) in the SCABEE project. The document is intended for both internal and external use as part of the deliverables of the project.

The primary goal of the first 'as-is'-analysis is to investigate how sustainability is presently addressed in the educational programmes among the partners of the project. The analysis will take the perspective of the students a point of departure, focusing on their competencies (including knowledge and skills) to address sustainability. Accordingly, this study adopts the concept of the European Qualifications Framework (EQF) for Lifelong Learning in which the students' learning outcome is described as a combination of knowledge, skills, and competences[1]. Accordingly, the term 'competencies' refers to both the combination of 'knowledge, skills, and competences', and 'competencies' alone. In the following 'competencies' will cover the combination of knowledge, skills, and competences, unless anything else is stated.

With a point of departure, in the above description, the research framework will contain an operationalisation of the term '*sustainability'*, from a 'student/competency perspective', as well as a description of the steps in the analysis. The operationalization of the term *'sustainability'* into students' competencies will be used to map and categorize any relevant learning goals and additional educational activities (e.g., workshops, student projects, company visits, etc.). The results of the analysis will serve as a baseline that can later be used to measure the impact of the project's initiatives. Additionally, the analysis will serve as a tool for identifying specific areas of interest within sustainability, which will be instrumental in shaping the development of the case studies at each institution.

The focus of the analysis will be on educational programmes within the technical and business-oriented field of study (selected by each partner) due to the partners involved in the project.

Figure 1.1 Relationship between the analysis of the educational programmes and the framework of competencies.

In addition to outlining the research framework of the first 'as-is'-analysis, this document also provides a description and definition of the term *'sustainability'*. This is crucial for establishing a shared understanding of the term among all participants in the project. Furthermore, the description and definition of the term will contribute to the development of the research framework.

In summary, this document contains:

- A description and definition of the term '*sustainability'*.
- A framework for conducting the 'as-is'-analysis, including an operationalization of competencies for addressing sustainability from a student perspective.
- An example of an analysis

[1] This framework builds on the European Qualifications Framework for Lifelong Learning where learning outcomes are divided into knowledge, skills, and competences (https://europa.eu/europass/system/files/2020-05/EQF-Archives-EN.pdf).

The expected output of the 'as-is'-analysis is:

- An analysis from each partner that is in accordance with the research framework (conducted by each partner).
- A list of identified areas of interest within sustainability from each partner (conducted by each partner).
- A joint analysis across the analyses provided by each partner (conducted by UCN).

2 Sustainability – A Definition

The term *'sustainability'* is used across various contexts, resulting in a situation where it has different meanings for different groups of people (Bianchi G. , 2020). Accordingly, the term sustainability becomes very ambiguous and complex to define. The Sustainable Development Goals (SDG) proposed by the UN is an example of a broad understanding of sustainability, where social, economic, and environmental sustainability are considered (United Nations, 2023).

In this project, the focus is on environmental sustainability. This does not mean that the economic and social aspects of sustainability are not valued and considered in the project. However, it does mean that the starting point and focus of this project is on environmental sustainability. This follows the purpose of the project (see the Application) and the educational context in which it is conducted: supporting and developing technical and business-oriented educational programmes at institutions within higher education in the EU.

In the following, 'environmental sustainability' and 'sustainability' will be used interchangeably to mean 'environmental sustainability', unless anything else is stated.

To better understand the complexity of the biophysical aspect of 'environmental suitability', we adopt the concept of Planetary Boundaries. Planetary Boundaries is a concept developed by researchers at Stockholm Resilience Centre describing the biophysical system of our environment (Steffen, Richardson, Rockström, & Cornell, 2015). The core of the concept is a description of the Earth system as consisting of nine interrelated sub-system processes. The nine sub-systems are:

- Biosphere integrity
- Land-use change
- Climate change
- Freshwater use
- Ocean acidification
- Biogeochemical flows (nitrogen and phosphorus cycles)
- Atmospheric aerosol pollution
- Stratospheric ozone depletion
- Release of novel chemicals

For each of the sub-systems, a boundary has been identified that should not be crossed. If the boundary is crossed irreversible damage to the overall Earth system may ensue, leading to hampered conditions for life as we know it[2].

Thus, when aiming for environmentally sustainable solutions, e.g., in new products, manufacturing setups, or business models, the goal is to find solutions that allow us to stay within the planetary boundaries of all the sub-systems and the entire Earth system altogether while maintaining or even developing life as we know it. Accordingly, it is important to measure the environmental impact of any goods and services. One common way to do that is to do a Life Cycle Analysis (LCA). Within the EU several specific approaches for conducting LCA's have been developed, such as PEFs, OEFs and EPDs aimed at different contexts. However, LCAs and the concept of planetary boundaries do not provide an answer to how to maintain life as we know it in a sustainable way, in other words, a path forward.

One such approach is suggested by the concept of Circular Economy (CE). CE focuses on maintaining products and materials in use at the highest level and for the longest possible time, through maintenance, reuse, refurbishment, remanufacture, and recycling, to reduce the needed resources (materials and energy) (Ellen MacArthur Foundation, 2023). Narrowing and slowing the use of resources, while designing to avoid waste (closing), allows nature to regenerate and supports the aim of environmentally sustainable solutions that allow us to stay within the planetary boundaries (Ellen MacArthur Foundation, 2023). However, it is equally

[2] For more information on the concept of Planetary Boundaries, please see: https://www.stockholmresilience.org/research/planetary-boundaries.html

important that the circular solutions are supported by feasible business models to have real impact. Such models could, e.g., focus on the recovery of the products and/or materials extending their lifetime, sharing products to reduce the need for additional products and materials, or developing Product Service Systems (PSS).

Hence, environmentally driven solutions should consider both circularity and environmental impact allowing us to stay within the planetary boundaries while supporting feasible business models.

To support this understanding of environmental sustainability, we use the following definition of sustainability in this project. The definition is inspired by the 'The European sustainability competence framework' suggested by GreenComp[3] (Bianchi, Pisiotis, & Cabrera Giraldez, 2022) but it is extended with a reference to circularity (sustainable development):

Sustainability means prioritizing the needs of all life forms and of the planet by ensuring that human activity does not exceed planetary boundaries while striving for sustainable- and circular-based development.

This definition addresses sustainability while taking into consideration the concept of planetary boundaries and a circular-oriented approach. Moreover, it focuses on human activities which resonates very well with the aim and focus of the SCABEE project which addresses the competencies of the students in technical and business-oriented educational programmes.

[3] GreenComp is a reference framework for sustainability competences. It provides a common ground for learners and guidance to educators, providing a consensual definition of what sustainability as a competence entails.

3 Competencies for Sustainability – Five Parameters

Working with sustainability is inherently complex, making it challenging to identify the competencies needed for addressing the field. The complexity arises from various interconnected factors, making it a multifaceted issue. These factors include the tension between long-term and short-term perspectives, the involvement of diverse stakeholders with their unique interests and priorities, the global nature of sustainability challenges, and the intricate aspects of nature, such as climate change, biodiversity loss, and resource depletion (Bianchi, Pisiotis, & Cabrera Giraldez, 2022). Moreover, encouraging behavioural change, navigating evolving policies and regulations, and handling resource scarcity also add to the complexity, and all play a critical role in the complexity and success of addressing sustainability challenges (Bianchi, Pisiotis, & Cabrera Giraldez, 2022).

Hence, being aware and developing the necessary competencies to manage this level of complexity and a broad variety of topics are essential skills for effectively working in the field of sustainability. As an educational institution, it becomes useful to align the identified needed competencies with educational activities, allowing the students to develop the knowledge, skills, and competencies needed to navigate the intricacies of sustainability effectively (Bianchi, Pisiotis, & Cabrera Giraldez, 2022).

Several proposals for competencies addressing sustainability already exist, e.g., (Wiek, Withycombe, & Redman, 2011) and (Brundiers, 2020). Common for most of these proposals is that they suggest general competencies, like critical thinking and system understanding, rather than more specific ones aimed at understanding the biophysical system or solution-oriented knowledge, e.g., aspects of Circular Economy (Straková & Cimermanová, 2018). While critical thinking and the ability to frame a situation or a problem are also relevant when working with sustainability, a broader range of competencies is needed. A broader and more comprehensive proposal is made by GreenComp with *'The European sustainability competence framework*' (Bianchi, Pisiotis, & Cabrera Giraldez, 2022). This framework offers a structured approach to building competencies and covers four areas, 1) Embodying sustainability values, 2) Embracing complexity in sustainability, 3) Envisioning sustainable futures, and 4) Acting for sustainability. However, this proposal is aimed at an understanding of sustainability that includes social and economic aspects, in addition to the environmental aspects. As the focus of this project is on *environmental sustainability,* this aspect should be addressed more directly in the framework.

Environmental sustainability competencies should enable students to assimilate sustainability values and to embrace system complexity in their understanding of the biophysical system. They should also enable students to conceive of sustainable solutions and give them the ability to drive and implement those solutions in practice.

Taking the framework of competencies proposed by GreenComp as our point of departure, albeit with stronger focus on environmental sustainability, we propose a framework consisting of five parameters for measuring and mapping the competencies (skills and knowledge) needed for addressing sustainability:

Parameter	Creating an Understanding	Developing the Fundamentals	Giving Insights	Building Solutions	Driving the Implementation
Description	A positive attitude towards environmental sustainability by fostering overall environmental sustainability awareness, understanding, and acceptance of the environmental challenge.	Addressing the ability to handle complexity.	Insights into the biophysical system of the earth.	Ability to build solutions with a low environmental impact and a high degree of circularity.	Ensure an impact in real life.

Figure 3.1 Overview of the parameters describing the needed competencies.

In the following, each of the five parameters will be described in detail.

3.1 Creating an Understanding – Parameter One

The first category, adopted from the proposal made by GreenComp, focuses on the meta-level aimed at ensuring a positive attitude among the students towards sustainability in general. To contribute to improving environmental conditions, one must recognize the need for addressing sustainability and, hence, have a positive attitude towards environmental sustainability. Emphasis is therefore on learning goals and educational activities fostering overall environmental sustainability awareness, understanding, and acceptance.

As focus is on competencies (skills and knowledge) at meta-level, the educational activities could extend beyond the individual educational programmes, whether at a department or institutional level.

An example of a meta-level event:

Each year the students on the Export and Technology Management Programme visit the municipality's facilities for managing household waste to understand how the waste is separated into different fractions for reuse. This visit aims to make the students understand how much waste people in Denmark produce and the challenges this generates.

3.2 Developing the Fundamentals – Parameter Two

Contributing to solving environmental challenges is a complex task. Hence, competencies are needed to manage complexity and to avoid the complexity of a task being overlooked or even disregarded to make the task manageable. In the framework proposed by GreenComp, the general competencies addressing the ability to manage complexity are 1) system thinking, 2) the ability to frame a problem situation, and 3) critical thinking. This set of competence is in alignment with the work of other scholars, e.g., Wiek, Withycombe, & Redman (Wiek, Withycombe, & Redman, 2011). Therefore, this set of competencies is adapted to the framework of this study.

As our focus is at a more general level of competencies, the educational activities could also extend beyond the individual educational programmes, whether at a department or institutional level. Moreover, the activities could also extend beyond sustainability, as complex problems exist within many areas of work, e.g., digitalization.

An example of an event (also) addressing the above competencies (not specifically related to sustainability):

An annual workshop is held at UCN focusing on innovation in healthcare with students from the faculties of Technology, Business, and Healthcare working in cross-disciplinary groups. This event aims to create a shared culture while enhancing students' competencies in handling complex problems (by improving their ability to apply system thinking, frame a task/situation, and think critically).

3.3 Giving Insights – Parameter Three

To develop solutions that will have a real and positive impact on the environment, one needs to understand what 'environmental sustainability' is. Hence, insight into the biophysical system of the earth is vital. Building on the concept of Planetary Boundaries (Steffen, Richardson, Rockström, & Cornell, 2015) and taking into consideration that this is aimed at technical and business-oriented educational programmes, the main themes are identified to be an understanding of climate, pollution, water management (both ocean and freshwater), the ecosystem (land, air, and water) including biodiversity, and resources (use and scarcity). Moreover, it could also be the overall concept of Planetary Boundaries itself.

An example of an activity addressing the above competencies:

At ESTA all the students are introduced to the Climate Fresk (https://climatefresk.org/) to increase their awareness and understanding of environmental challenges while giving them insights into the climate system. The Climate Fresk is a 'game' focussing on teaching the students the fundamental science behind climate change while empowering them to act.

3.4 Building Solutions – Parameter Four

When building solutions for a sustainable future two focus areas are interesting: 1) environmental impact and 2) the level of circularity (van Loon, Diener, & Harris, 2021).

Normally, environmental impacts are measured using a Life Cycle Analysis (LCA). Several terms are used to describe an LCA analysis, e.g., Life Cycle Assessment and Cradle-to-cradle, just as there are different versions or methods that build on the concept of a LCA, e.g., PEF/OEF and EPD.

At its core the concept of circularity (Circular Economy) consists of three key elements; 1) eliminate waste, 2) circulate products and materials (at their highest value), and 3) allow nature to regenerate (Ellen MacArthur Foundation, 2023). Hence, the main terms in circularity are the R-strategies (e.g., rethink, refuse, reuse, remanufacture, repurpose, recycle, and recover). Related topics are, e.g., Sustainable Business Models or Product Service Systems (PSS) (Yang, Smart, Kumar, Jolly, & Evans, 2018) making any solution feasible in real life.

An example of an activity addressing the above competencies (not specifically related to sustainability):

At ESTA the students participate in different hackathons, where they must find a solution to a problem normally within a limited period, e.g., 1-2 days. The theme for these hackathons/problems is in some cases related to environmental sustainability.

3.5 Driving the Implementation – Parameter Five

The solutions developed need to create an impact in real life to become valuable. Hence, understanding and emphasizing the environmental system and building solutions accordingly is not enough. The solutions must also be implemented in real life to create an impact and make a change towards a more sustainable future. Accordingly, competencies, knowledge and skills are needed to ensure this.

Implementing sustainable solutions and driving the situation can be described as a transition, requiring competencies in change management, cultural understanding, collaboration and management skills. Moreover, insight into the political tendencies and national and international (EU) framework of legislation is needed, e.g., Green Deal (European Commission, 2023a), Eco-design for Sustainable Products Regulation (Commission, 2023b), or A new Circular Economy Action Plan (European Commission, The European Green Deal, 2023a), (European Commission, Ecodesign for Sustainable Products Regulation, 2023b), (European Commission, 2023c).

An example of an activity addressing the above competencies (not specifically related to sustainability):

During their education, UCN students complete a minimum of 20 weeks of internship in a company. Depending on the content of the internship, some of the students work on implementing sustainability solutions in practice.

The five parameters of competencies can visually be presented like this, showing how the five parameters are interrelated:

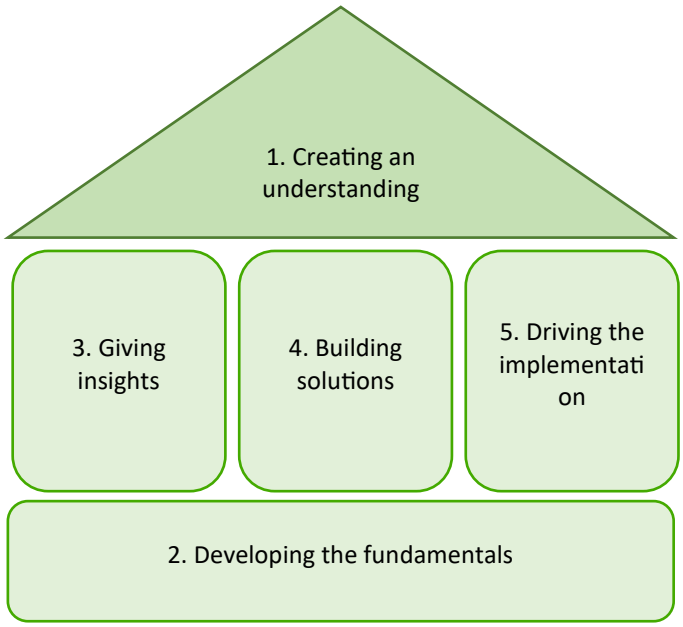

Figure 3.2 A visualisation of the parameters and how they are interrelated.

The first two parameters, 1. Creating an understanding and 2. Developing the fundamentals support the other three main parameters, 3. Giving insights, 4. Building solutions and 5. Driving the implementation.

4 Research Framework

In the following, the research framework of the analysis is described. To further support understanding of the framework, an example of an analysis can be found in Annex A

4.1 Analysis approach

The analysis process hinges on the description and operationalization (indicators) of the five key parameters as described in Chapter 3:

Parameter	Creating an Understanding	Developing the Fundamentals	Giving Insights	Building Solutions	Driving the Implementation
Description	A positive attitude towards environmental sustainability by fostering overall environmental sustainability awareness, understanding, and acceptance of the environmental challenge.	Addressing the ability to handle complexity.	Insights into the biophysical system of the earth.	Ability to build solutions with a low environmental impact and a high degree of circularity.	Ensure an impact in real life.
Learning Goals Educational Activities	**Indicators** • Awareness of the environmental challenge? • Understanding of the environmental challenge? • Acceptance of the environmental challenge?	**Indicators** • System thinking • Ability to frame a problem situation • Critical thinking.	**Indicators** • Climate • Pollution • Water management (both ocean and freshwater) • The ecosystem (land, air, and water) including biodiversity. • Resources (use and scarcity)	**Indicators** • Life Cycle Analysis or Assessment (LCA), PeF/OeF, EPD, or similar. • Develop circular solutions, hence, adopt R-strategies (e.g., rethink, refuse, reuse, remanufacture, repurpose, recycle, and recover) or related topics, e.g., Sustainable Business Models or PSS.	**Indicators** • Change management. • Cultural understanding. • Collaboration and management. • Environmental legislation (e.g., Green Deal, Eco-design for Sustainable Products Regulation or A new circular economy Action Plan).

Figure 4.1 Overview of the parameters describing the needed competencies, including the operationalisation of five key parameters.

The aim of the analysis is to investigate how sustainability is presently addressed in the educational programmes at the partner institutions, taking the perspective of the students as the point of departure and focusing on their competencies (including knowledge and skills) to address sustainability.

Hence, the level of focus should be on the entire educational programme (or similar), rather than just individual courses. The level of documentation should reflect the overall aim of the analysis; to provide an overview, rather than a detailed mapping. Each analysis should be documented using the designated template, see the document: SCABEE - Initial Analysis Research Framework - TEMPLATE.
This template includes specific requests for additional information, extending beyond the reporting of the five parameters, focusing on identifying the educational programme, partner information, and the corresponding year/period.

Bloom's Taxonomy (Vanderbilt University, 2023) is used to indicate the level of learning outcomes for the identified learning goals and educational activities, providing a more nuanced understanding of how sustainability is addressed within the five parameters.

To increase the quality of the analysis, it is mandatory that the results are internally (at each institution) peer-reviewed.

All the individual analyses are afterwards gathered into one main analysis.

5 References

Bianchi, G. (2020). *Sustainability competences, EUR 30555 EN.* Luxembourg, ISBN 978-92-76-28408-6, doi:10.2760/200956, JRC123624: Publications Office of the European Union.

Bianchi, G., Pisiotis, U., & Cabrera Giraldez, M. (2022). *GreenComp The European sustainability competence framework, Punie, Y. and Bacigalupo, M. editor(s), EUR 30955 EN.* Luxembourg, ISBN 978-92-76-53201-9, doi:10.2760/821058, JRC128040: Publications Office of the European Union.

Brundiers, K. B.-R. (2020). Brundiers, K., Barth, M., Cebrián, G., Cohen, M., Diaz, L., Doucette-Remington, S., Dripps, W., Habron, G., Harre, N., JarchoKey competencies in sustainability in higher education - towards an agreed-upon reference framework. *Sustainability Science*, pp. 1-17.

Commission, E. (2023b, December 10). *Ecodesign for Sustainable Products Regulation*. Retrieved from European Commission: https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/sustainable-products/ecodesign-sustainable-products-regulation_en

Ellen MacArthur Foundation. (2023, November 23). *Circular economy introduction*. Retrieved from What is a circular economy: https://www.ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview

European Commission. (2023a, December 10). *The European Green Deal*. Retrieved from European Commission: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

European Commission. (2023b, December 10). *Ecodesign for Sustainable Products Regulation*. Retrieved from European Commission: https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/sustainable-products/ecodesign-sustainable-products-regulation_en

European Commission. (2023c, December 10). *Circular Economy Action Plan*. Retrieved from European Commission: https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en

Steffen, W., Richardson, K., Rockström, J., & Cornell, S. E. (2015, January 13). Planetary Boundaries: Guiding Human Development on a Changing Planet. *Science, Vol 347, Issue 6223*.

Straková, Z., & Cimermanová, I. (2018, September 20). Critical Thinking Development—A Necessary Step in Higher Education Transformation towards Sustainability. *Sustainability in Leadership and Education*.

United Nations. (2023, November 23). *United Nations Sustainable Development*. Retrieved from United Nation: https://www.un.org/sustainabledevelopment/

van Loon, P., Diener, D., & Harris, S. (2021, March 15). Circular products and business models and environmental impact reductions: Current knowledge and knowledge gaps. *Journal of Cleaner Production, Volume 288*.

Vanderbilt University. (2023, November 23). *Bloom's Taxonomy*. Retrieved from Center for Teaching: https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/

Wiek, A., Withycombe, L., & Redman, C. L. (2011, May 11). Key competencies in sustainability: a reference framework for academic program development. *Sustainability Science volume 6*, pp. 203-218.

Yang, M., Smart, P., Kumar, M., Jolly, M., & Evans, S. (2018, May 21). Product-service systems business models for circular supply chains. *Production Planning & control, Vol. 29, no. 6*, pp. 498–508.

Annex A Example

SCABEE reports - Example

Initial Analysis - UCN

Education: Export and Technology Management

Version 1.2

Dissemination level

Code	Access granted to	
PU	**Public**	
PP	Restricted to other programme participants (including the Commission Services)	
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The project SCABEE introduces sustainability teaching and thinking in business and engineering study degrees as a persistent leitmotif. Students will discover sustainable products and solutions through Sustainability Teaching Case Studies and develop a more sustainable behaviour in their personnel and future professional life. They will also transport their knowledge and behaviour to their companies and thereby contribute to the green transition of the European industry and help saving our planet for future generations.

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List of abbreviations

ESTA	ESTA Belfort, www.esta-groupe.fr/en
FHV	Fachhochschule Vorarlberg, Austria, www.fhv.at/en
SDG	Sustainability Development Goal (see sdgs.un.org/fr/goals)
SUT	Silesia University of Technology, www.polsl.pl/en/
TCS	Teaching Case Study
UCN	University College Northern Denmark, www.ucn.dk

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6 'AS-IS' ANALYSIS

6.1 General Information

Institution	UCN
Educational programme or course	Export and Technology Management, 3.5-year bachelor programme (210 ECTS)
Introduction to the educational programme	Export and Technology Management has a 50/50 focus within two focus areas - a business aspect focusing on marketing, micro/macroeconomic, communication, and culture understanding and a technical aspect focusing on product development production, and quality management. Export and Technology Management is a generalist education where students acquire competencies that cut across a company's value chain.
Conducted by	Christina Koch Pedersen
Timeframe	October 2023
Additional info	As this education has implemented a new curriculum in September 2023, the curriculum from February 2023 forms the basis for this analysis. Teachers at the education have been interviewed to find learning activities focusing on environmental sustainability.

6.2 Creating an Understanding – Parameter One

Learning Goals
Are there any learning goals supporting overall environmental sustainability: • *Awareness of the environmental challenge?* • *Understanding of the environmental challenge?* • *Acceptance of the environmental challenge?* *If so, please report the learning goals (translated) and a brief description of the relation to the educational programme (e.g., name of subject/course, number of ECTS, etc.). The description should also include a categorizing according to Bloom's Taxonomy, if not explicitly stated.*

Learning goals	Bloom's Taxonomy level	Name of course/ subject and semester	Number of ECST/ Importance
NA			

Other Educational Activities
Are there any other educational activities on either the level of the educational programme, the department, or the institution supporting an overall: • *Awareness of the environmental challenge?* • *Understanding of the environmental challenge?* • *Acceptance of the environmental challenge?* *If so, please make a brief description of the activity and its relation to the educational programme). The description should also include a categorizing according to Bloom's Taxonomy, if not explicitly stated.*

Educational Activities	Bloom's Taxonomy level	Name of course/ subject and semester	Number of ECST/ Importance
UN SDG has been a part of the exam project. The students should reflect upon the selected SDG in relation to the case company.	Understand	1st + 2nd semester	**Minor** question in the interdisciplinary exam project.

			The project covers 30 ECTS.
Introducing to the history of Design for Sustainability (Ozon layer, Brundtland report, etc.)	Remember and understand	Product development, 4th semester	This activity is a **minor** part of the course Product Development. The course covers 4 ECTS in 4th semester.

6.3 Developing the Fundamentals – Parameter Two

Learning Goals

Are there any learning goals supporting the student's ability to:

- *System thinking?*
- *Frame a problem or situation?*
- *Critical thinking?*

If so, please report the learning goals (translated) and a brief description of the relation to the educational programme (e.g., name of subject/course, number of ECTS, etc.). The description should also include a categorizing according to Bloom's Taxonomy, if not explicitly stated.

Learning goals	Bloom's Taxonomy level	Name of course/ subject and semester	Number of ECST/ Importance
Work with open issues and include relevant topics in analyses and assessments	Analyze	2nd semester	**Key learning goal** for a full semester covering 30 ECTS
Perform problem-orientated work	create	2nd semester	**Key learning goal** for a full semester covering 30 ECTS

Other Educational Activities

Are there any other educational activities on either the level of the educational programme, the department, or the institution supporting the student's ability to:

- *System thinking?*
- *Frame a problem or situation?*

- *Critical thinking?*

If so, please make a brief description of the activity and its relation to the educational programme). The description should also include a categorizing according to Bloom's Taxonomy, if not explicitly stated.

Educational Activities	Bloom's Taxonomy level	Name of course/ subject and semester	Number of ECST/ Importance
A one-day workshop focusing on UN SDG. The students had a case of redesigning a bike for rural areas in Africa.	Create	Interdisciplinary workshop, 2nd semester	Secondary learning activity for a full semester covering 30 ECTS

6.4 Giving Insights – Parameter Three

Learning Goals

Are there any learning goals supporting the student's insight into:

- *Climate?*
- *Pollution?*
- *Water management (both ocean and freshwater)?*
- *The ecosystem (land, air, and water) including biodiversity?*
- *Resources (use and scarcity)?*

If so, please report the learning goals (translated) and a brief description of the relation to the educational programme (e.g., name of subject/course, number of ECTS, etc.). The description should also include a categorizing according to Bloom's Taxonomy, if not explicitly stated.

Learning goals	Bloom's Taxonomy level	Name of course/ subject and semester	Number of ECST/ Importance
NA			

Other Educational Activities

Are there any other educational activities on either the level of the educational programme supporting the student's insight into:

- *Climate?*
- *Pollution?*
- *Water management (both ocean and freshwater)?*
- *The ecosystem (land, air, and water) including biodiversity?*
- *Resources (use and scarcity)?*

If so, please make a brief description of the activity and its relation to the educational programme). The description should also include a categorizing according to Bloom's Taxonomy, if not explicitly stated.

Educational Activities	Bloom's Taxonomy level	Name of course/ subject and semester	Number of ECST/ Importance
Company visits at Aage Vestergård Larsen (producing plastic granulate from recycled plastic)	Understand	Product development, 2nd semester	This activity is a **minor** part of the course. The course covers 4 ECTS in 2nd semester.
Company visits at Recycling station Nordværk in Aalborg (sorting household trash in different plastic and metal fractions).	Understand	Product development, 2nd + 4th semester	This activity is a **minor** part of the course Product Development. The course covers 4 ECTS in 2nd and 4th semester
As part of analyzing a company's micro and macro conditions in a given market, the focus is among other things on CO2 accounting and ESG.	Understand (1st semester) and apply (2nd semester)	Marketing, 1st + 2nd semester	This activity is a **minor** part of the course Marketing. The course cover 4 ECTS on 1st semester and 3 ECTS on 2nd semester
One lesson in the subject *material & process* involves dwelling into the environmental aspects of the use of plastics. The entire lesson centers on the assignment "The Environmental Aspects of Polymer Materials"	Understand	Material & Process, 2nd semester	This activity is a **medium** part of the course Material & Process.

			The course covers 4 ECTS in 2nd semester

6.5 Building Solutions – Parameter Four

Learning Goals			
Are there any learning goals supporting the student's ability: • *To analyze the environmental impact, e.g., conduct a Life Cycle Analysis or Assessment (LCA), PeF/OeF, EPD, or similar?* • *Develop circular solutions, hence, adopt R-strategies (e.g., rethink, refuse, reuse, remanufacture, repurpose, recycle, and recover) or related topics, e.g., Sustainable Business Models or PSS?* *If so, please report the learning goals (translated) and a brief description of the relation to the educational programme (e.g., name of subject/course, number of ECTS, etc.). The description should also include a categorizing according to Bloom's Taxonomy, if not explicitly stated.*			
Learning goals	**Bloom's Taxonomy level**	**Name of course/ subject and semester**	**Number of ECST/ Importance**
Perform product optimization and work on innovative measures	Create	Product development, 4th semester	**Key learning goal** for the course Product Development. The course covers 4 ECTS in 4th semester.
Work on product development from different approaches *(The overall focus in the course product development has been R-strategies. The students had a case to redesign a product focusing either on Design for Disassembly or Design for Material Change, and Guest teacher talking about LCA, what it is, and how to use it.)*	Create	Product development, 4th semester	**Key learning goal** for the course Product Development. The course covers 4 ECTS in 4th semester.

Other Educational Activities
Are there any other educational activities on either the level of the educational programme supporting the student's insight into:

- *To analyze the environmental impact, e.g., conduct a Life Cycle Analysis or Assessment (LCA), PeF/OeF, EPD, or similar?*
- *Develop circular solutions, hence, adopt R-strategies (e.g., rethink, refuse, reuse, remanufacture, repurpose, recycle, and recover) or related topics, e.g., Sustainable Business Models or PSS?*

If so, please make a brief description of the activity and its relation to the educational programme). The description should also include a categorizing according to Bloom's Taxonomy, if not explicitly stated.

Educational Activities	**Bloom's Taxonomy level**	**Name of course/ subject and semester**	**Number of ECST/ Importance**
One lesson in the subject *material & process* touches upon the topic of Energy Content of materials. The topic is related to the economic aspects of the recyclability of metals and also connects with supply chain issues (e.g., pollution).	Understand	Material & Process, 1st semester	This activity is a **minor** part of the course Material & Process. The course covers 5 ECTS in 1st semester
Lean production and the 5S philosophy are part of what underpins an introduction to modern-day manufacturing concepts. Minimizing "*The 7 Wastes*" in the value chain is key to both concepts. (1st semester).	Apply	Material & Process, 1st semester	This activity is a **medium** part of the course Material & Process. The course covers 5 ECTS in 1st semester
Sustainability is used as an example in other learning activities, for example, the subjects Cultural Understanding and Communication	Understand and apply	Culture and Communication, 2nd + 3rd semester	**Minor** part of the course Culture and Communication.
Bachelor students focusing on environmental sustainability in their bachelor project. The focus was e.g., minimizing waste during production, minimizing water consumption, more sustainable material use, and Take-back programs to extract cobber or gold from used products.	Evaluate and create	7th semester	**Larger or minor** parts of the final bachelor project. The bachelor project covers 20 ECTS.

6.6 Driving the Implementation – Parameter Five

Learning Goals			
Are there any learning goals supporting the student's competencies within: • *Change management?* • *Cultural understanding?* • *Collaboration and management?* • *Environmental legislation (e.g., Green Deal, Eco-design for Sustainable Products Regulation, or A new circular economy Action Plan)?* *If so, please report the learning goals (translated) and a brief description of the relation to the educational programme (e.g., name of subject/course, number of ECTS, etc.). The description should also include a categorizing according to Bloom's Taxonomy, if not explicitly stated.*			
Learning goals	**Bloom's Taxonomy level**	**Name of course/ subject and semester**	**Number of ECST/ Importance**
NA			

Other Educational Activities			
Are there any other educational activities on either the level of the educational programme supporting the student's insight into: • *Change management?* • *Cultural understanding?* • *Collaboration and management?* • *Environmental legislation (e.g., Green Deal, Eco-design for Sustainable Products Regulation, or A new circular economy Action Plan)?* *If so, please make a brief description of the activity and its relation to the educational programme). The description should also include a categorizing according to Bloom's Taxonomy, if not explicitly stated.*			
Educational Activities	**Bloom's Taxonomy level**	**Name of course/ subject and semester**	**Number of ECST/ Importance**

In the elective course, Change Management UCN SDG is used as a case in relation to implement and changing behavior in a sustainable direction	Evaluate and create	Change Management, Elective course, 6th semester	This activity is a **medium** part of the course Change Management. The course covers 10 ECTS in the 6th semester.
The students play the board game "Doing Good Business" (developed by UCN). The board game focuses on The Triple Bottom Line and the students work with specific cases	Evaluate	Strategic Management, Elective course, 6th semester	This activity is a **medium** part of the course Strategic Management. The course covers 10 ECTS in the 6th semester.
Bachelor students focusing on environmental sustainability in their bachelor project. The focus was e.g., changing the cultural mindset in a company towards sustainability or how to implement a sustainable business strategy.	Evaluate and create	7th semester	Larger or minor parts of the final bachelor project. The bachelor project covers 20 ECTS.

7 Bloom's Taxonomy

The table below is intended to help clarify where on the scale of Bloom's taxonomy a learning activity is located. An example is given at each step of the scale.

Table 1 - Level of Bloom's Taxonomy with examples

Level of Bloom's Taxonomy		Example
Create	***Produce new or original work***. *Design, assemble, construct, conjecture, develop, formulate author, investigate*	The students should be able to develop a company's product development strategy based on R-strategies
Evaluate	***Justify a stand or decision.*** *Argue, appraise, defend, judge, select, support, value, critique, weigh*	The students should be able to select and argue for the choice of R-strategies for redesigning a product
Analyze	***Draw connections among ideas.*** *Differentiate, organize, relate, compare, contrast, distinguish, examine, experiment, question, test*	The students should be able to compare and organize different R-strategies within product development
Apply	***Use information in new situations.*** *Execute, implement, solve, use, demonstrate, interpret, operate, schedule, sketch*	The students should be able to implement R-strategies during product development to develop more environmentally friendly products
Understand	***Explain ideas or concepts.*** *Classify, describe, discuss, explain, identify, locate, recognize, report, select, translate*	The students should be able to explain the term "fast fashion" and how it is relevant in relation to environmental sustainability
Remember	***Recall facts and basic concepts.*** *Define, duplicate, list, memorize, repeat, state*	The students should be able to reproduce the consequences of the rising CO2 level on the climate