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

Initial Analysis (Activity 2.1)

Aalborg (Denmark), March 2024

Project partners

ésta
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

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.

Document history

Date	Author(s)	Comment
01.18.2024	Esben Skov Laursen and Christina Koch Pedersen	Transfer of document to template
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Content

List of abbreviations

ECTS	European Credit Transfer System
ESTA	ESTA Belfort, www.esta-groupe.fr/en
EQF	European Qualification Framework
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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1   Introduction

This document contains the initial 'as-is' analysis (Activity 2.1) for the SCABEE project. The document is intended for the public and may be shared with stakeholders outside the project.

The primary goal of the first 'as-is' analysis is to investigate how sustainability is currently addressed in the educational programmes at the partner institutions. The analysis takes the perspective of the students as its point of departure, focusing on their competences to address sustainability. The analysis is based on the research framework described in the document 'Initial Analysis Research Framework', hereafter referred to as 'the research framework'.

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 that will be instrumental in shaping the development of the case studies at each institution.

The focus of the analysis is on educational programmes within the technical and business-oriented fields of studies selected by each partner in the SCABEE project.

2   Research framework - summary

The following is a summary of the main aspects of the research framework supporting this analysis. For a more in-depth description of the various aspects, please see the document 'Initial Analysis Research Framework', hereafter referred to as 'the research framework'. The paragraph begins with a description and definition of the broad term 'sustainability' to create a shared understanding that underpins the entire project. This is followed by a description of the research framework as well as the data underlying this analysis.

2.1   Definition of the Term Sustainability

The term 'sustainability' has taken on a very broad meaning, covering social, economic, and environmental aspects. In this project, the focus is on the environmental aspect. 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[1] (Bianchi, Pisiotis, & Cabrera Giraldez, 2022) and extended with a reference to circularity (a 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 a sustainable- and circular based development.*

This definition emphasizes the environmental aspects through the adoption of the concept of planetary boundaries – the biophysical system – and a circular-oriented approach. Moreover, it focuses on human activities, which resonates very well with the aim and focus of the SCABEE project, emphasizing the competences of the students in technical and business-oriented educational programmes with the aim of graduating future sustainability ambassadors, who will actively contribute to the green transition of the European industry.

2.2   Competencies for Sustainability

Working with sustainability is inherently complex, making it a multifaceted issue. Several proposals for competencies that address sustainability have been put forward, e.g., (Wiek, Withycombe, & Redman, 2011) and (Brundiers, 2020). A broader and more covering proposal is made by GreenComp with *'The European sustainability competence framework'* (Bianchi, Pisiotis, & Cabrera Giraldez, 2022). However, this proposal is aimed at an understanding of sustainability that includes social and economic aspects beyond the environmental aspects. Taking a point of departure within the framework of competencies proposed by GreenComp but with a stronger focus on environmental sustainability, we propose a framework consisting of five parameters for measuring and mapping the competencies (knowledge, skills, and attitudes) needed for addressing sustainability:

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[1] 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.

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 2.1 Overview of the parameters describing the needed competencies.

These five parameters constitute the foundation of the research framework on which this analysis is built. Each parameter is reported in the form of a description of the Learning Goals and/or Additional Activities (a qualitative description), the ECTS credits associated with the Learning Goal and/or Additional Activity, and an assessment of the level of learning (according to Bloom's taxonomy). This ensures both a quantitative and qualitative indication of each parameter, providing a more nuanced understanding of how sustainability is addressed. The data is provided by interviewing the lecturers associated with the educational programme and based on the educational curriculum.

For a further description of each of the parameters, please see the research framework.

The following educational programmes have been analysed:

Institution	Educational Programme	Length	Level	ECTS
ESTA	'Ingénieur d'Affaires Industrielles'	7-year	Diploma	300
FHV	Management and Engineering	3-year	BSc	210
SUT	Industrial Automation and Robotics	3.5-year	BSc	210
SUT	Mechanical Engineering	3.5-year	BSc	210
SUT	Production and Management Engineering	3.5-year	BSc	210
UCN	Export and Technology Management	3.5-year	BSc	210
UCN	Innovation and Entrepreneurship	1.5-year	BSc*	90
UCN	Product Development and Integrative Technology	1.5-year	BSc*	90
UCN	Production Technology	2-year	AP**	120

* Top-up programme, building on top of an AP degree to the level of Bachelor (BSc).
** AP (Academy Profession) is a 2-year educational programme at EQF level 5 (BSc is level 6).

Table 2.1 – List of educational programmes included in the analysis.

3   Results

In the following, the results of each analysis are presented. The input data of each of the educational programmes, including a description of the educational programme, can be found in Appendix A.

Below we present the results of each analysis in the form of a diagram. To ease the understanding of the diagrams, a detailed description is given to the first diagram: the analysis of the educational programme at ESTA – Ingénieur d'Affaires Industrielles.

3.1   ESTA: Ingénieur d'Affaires Industrielles
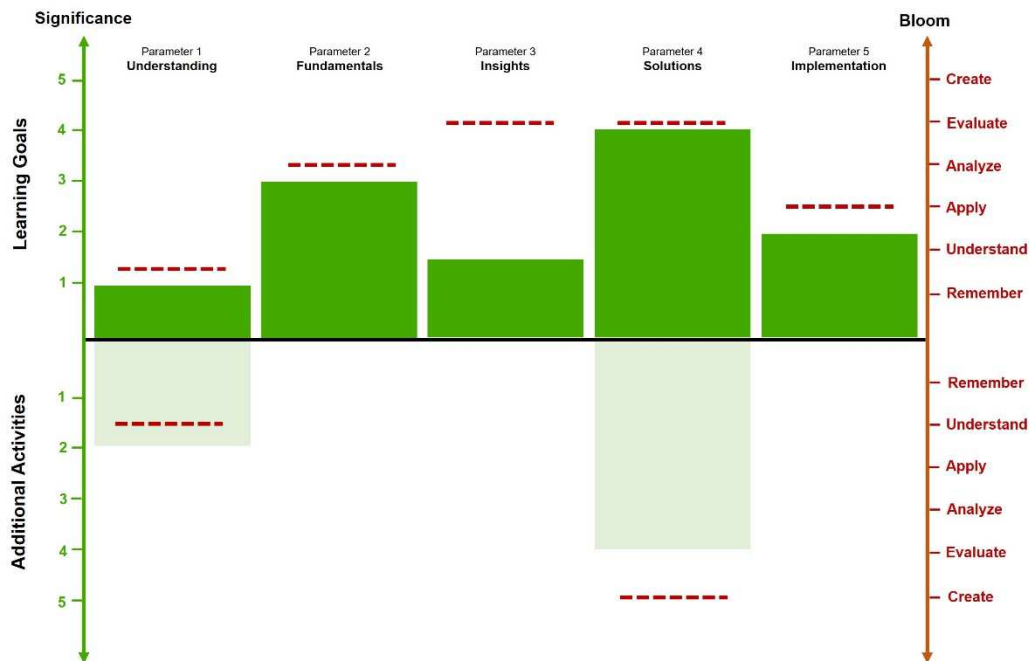
Figure 3.1 ESTA- Ingénieur d'Affaires Industrielles

Following the research framework, the diagram is divided into two main elements, 1) 'Learning Goals', marked with dark green boxes above the x-axis, and 2) 'Additional Activities', marked with light green boxes below the x-axis. The level (significance) within each parameter is marked on a scale 1-5. The level is found by analysing the description of the 'Learning Goals'/'Additional Activities' within each parameter (see Appendix A).

To determine the level of significance, the amount of 'Learning Goals'/'Additional Activities' are considered together with the importance (described as part of the input in the analysis), the amount of ECTS associated with each 'Learning Goals'/'Additional Activities', and the relevance of the content of the 'Learning Goals'/'Additional Activities' in relation to the parameter.

The results of this analysis have afterwards been verified by the project participant of the relevant educational programme/educational institution to further strengthen the quality of the results [2].

Afterwards the level of learning outcome has been evaluated according to the scale of Bloom's Taxonomy. The level is marked with a red dotted line. In case of more than one Learning Goal/Additional Activity (at different levels of learning outcome according to Bloom) within one parameter, a weighted average is found, taking into consideration the aspects described above regarding the level of significance.

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[2] This has not been possible in the case of FHV.

3.2   FHV: Engineering and Management
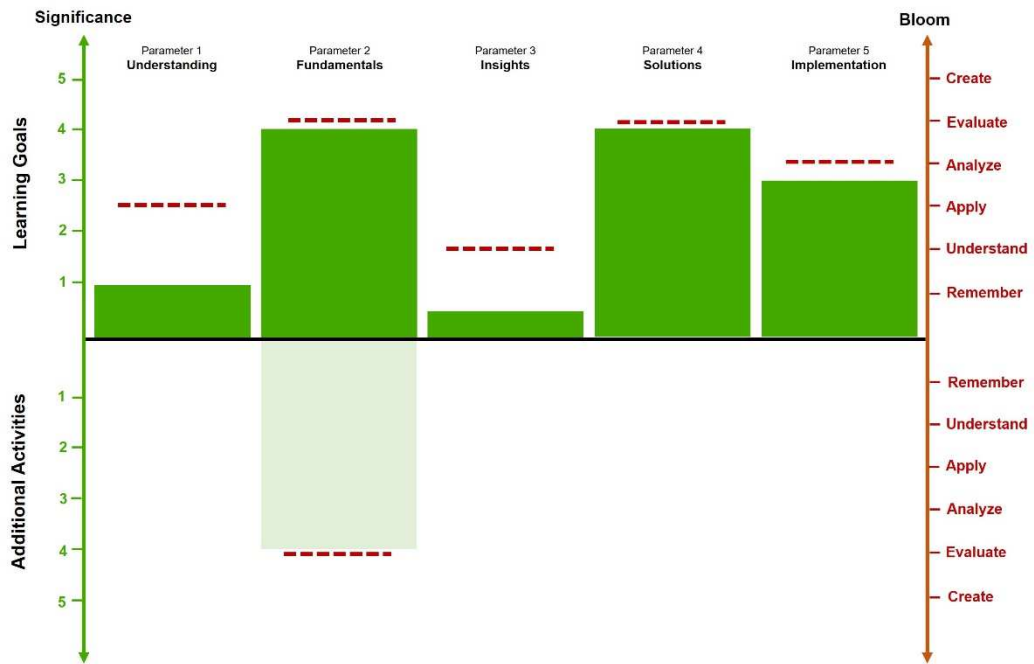
Figure 3.2 Engineering and Management

3.3   SUT: Industrial Automation and Robotics
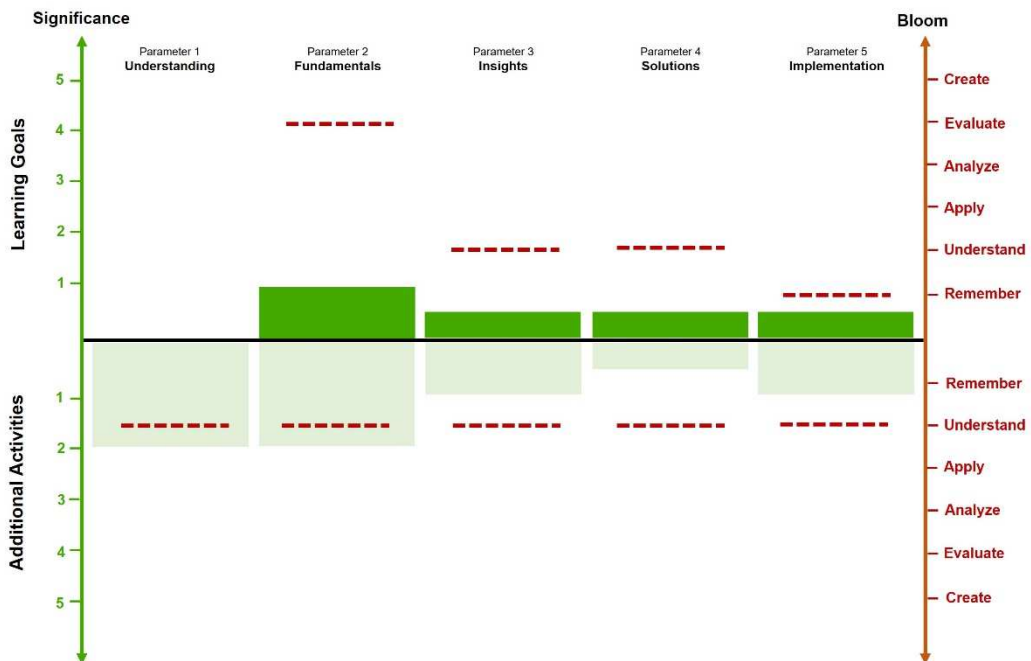
Figure 3.3 Industrial Automation and Robotics

3.4   SUT: Mechanical Engineering
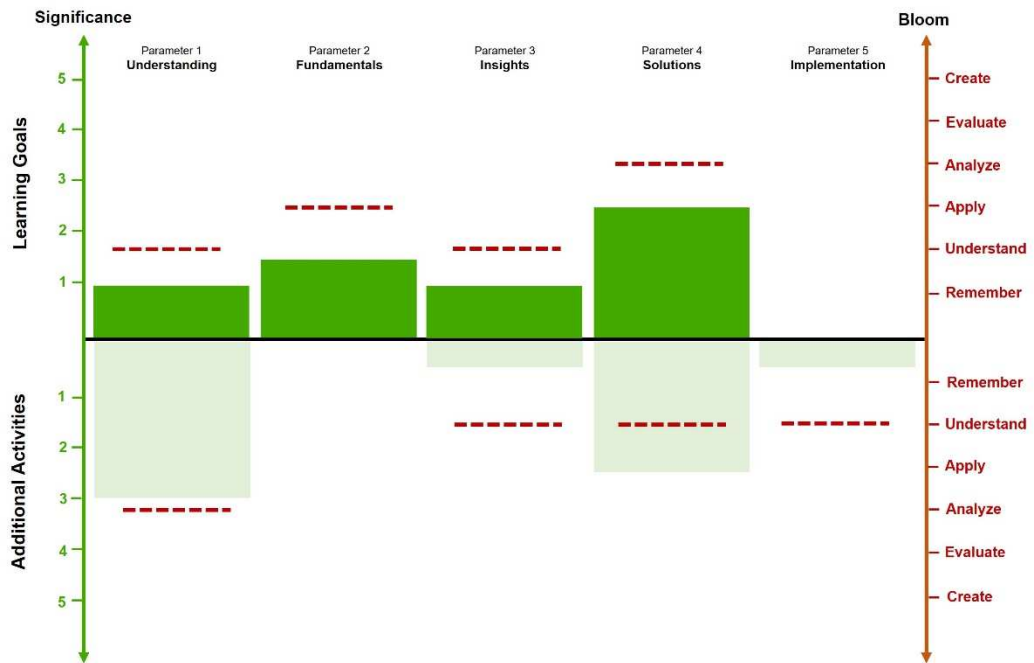
Figure 3.4 Mechanical Engineering

3.5   SUT: Production and Management Engineering
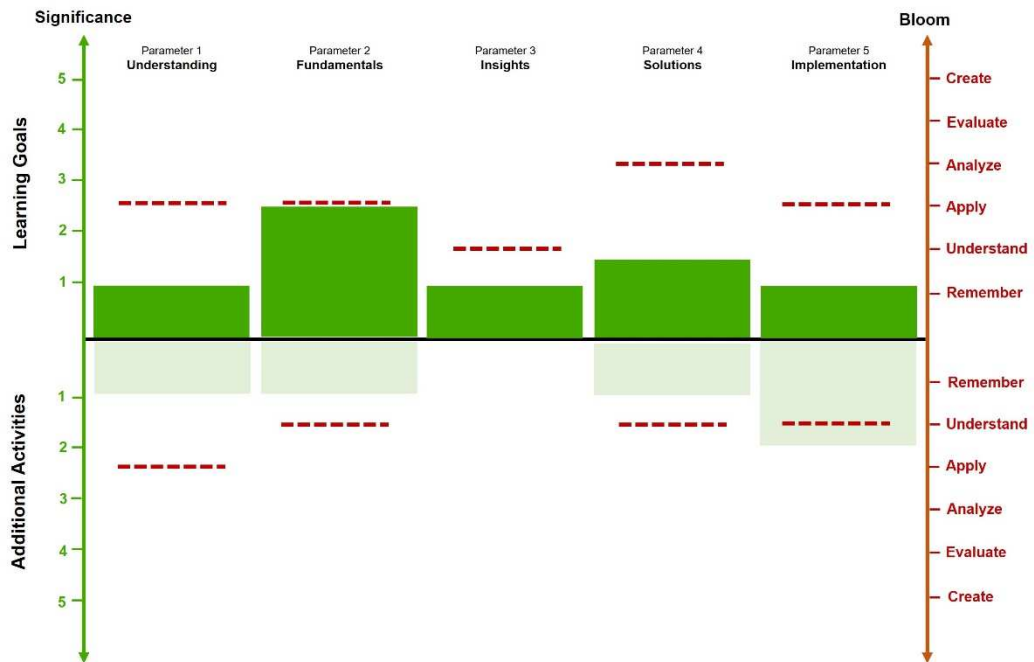
Figure 3.5 Production and Management Engineering

3.6   UCN: Export and Technology Management
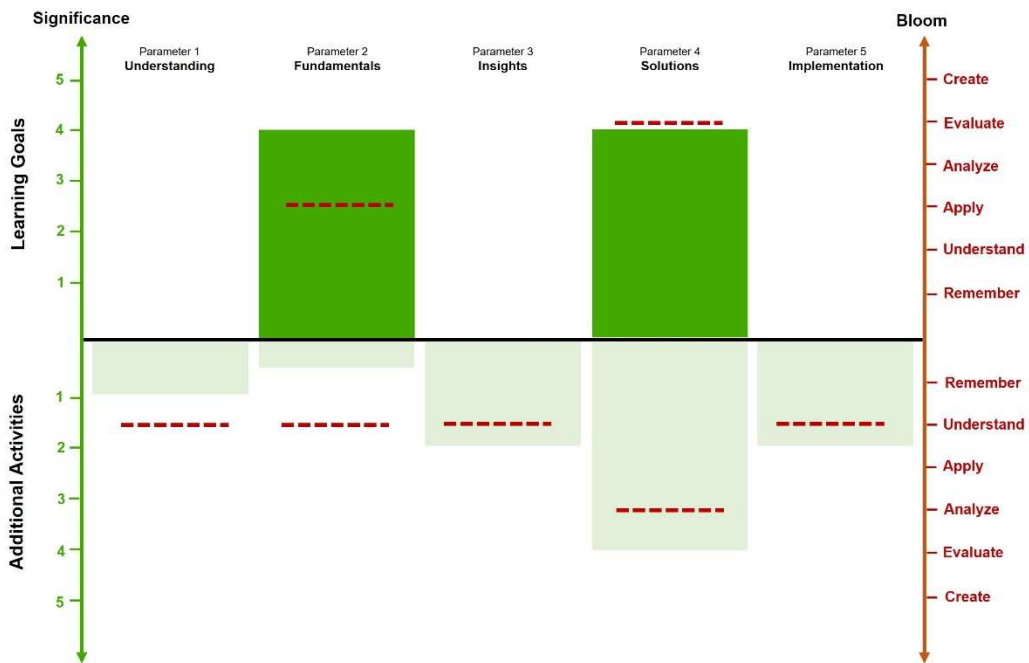
Figure 3.6 Export and Technology Management

3.7   UCN: Innovation & Entrepreneurship
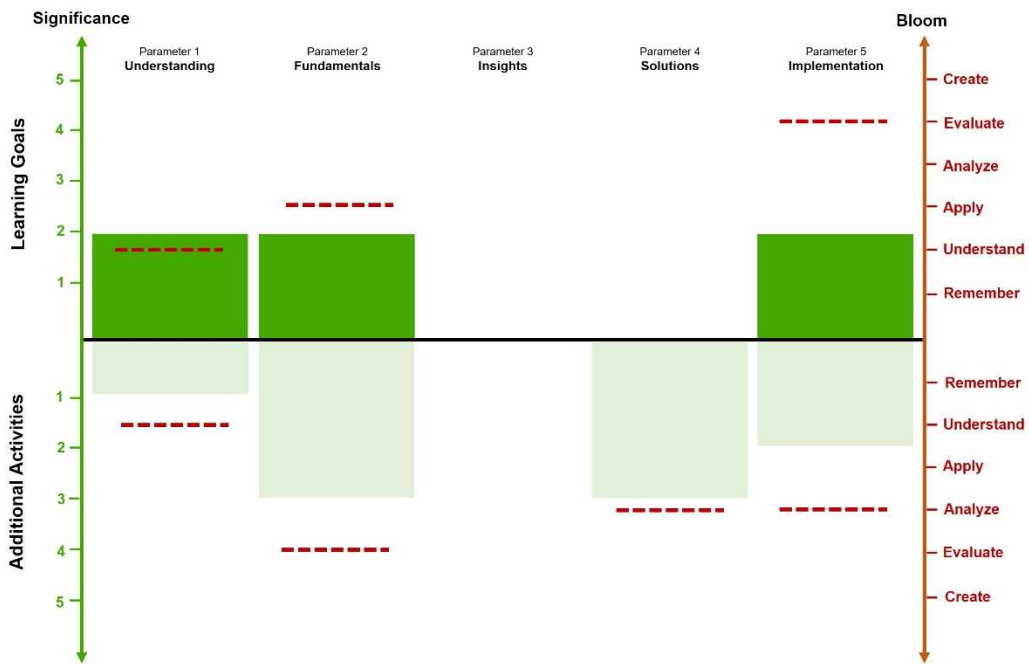
Figure 3.7 Innovation & Entrepreneurship

3.8   UCN: Product Development and Integrative Technology
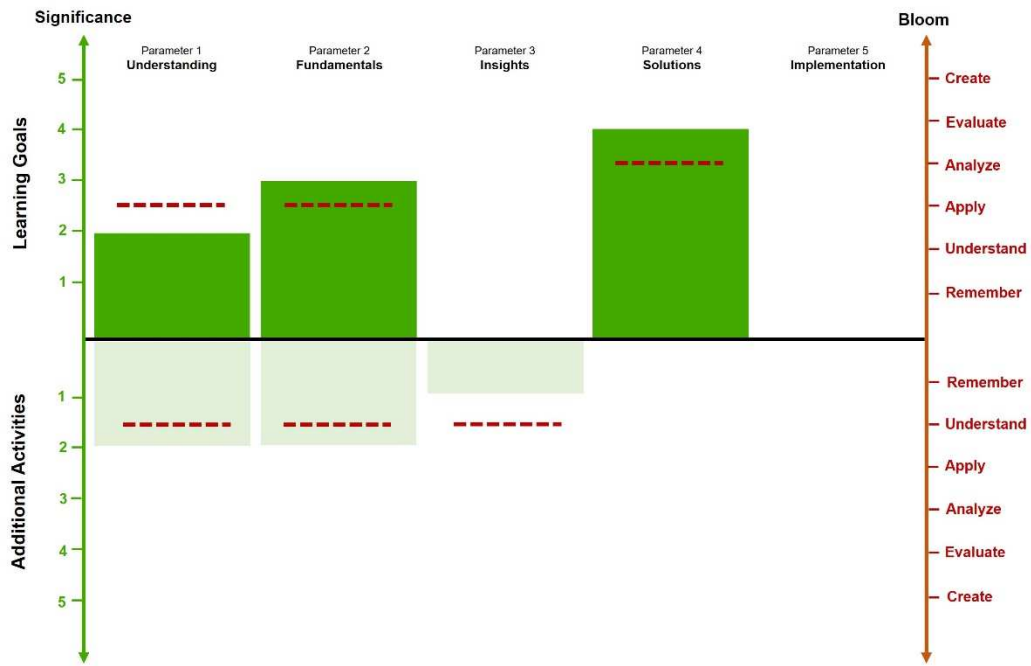
Figure 3.8 Product Development and Integrative Technology

3.9   UCN: Production Technology
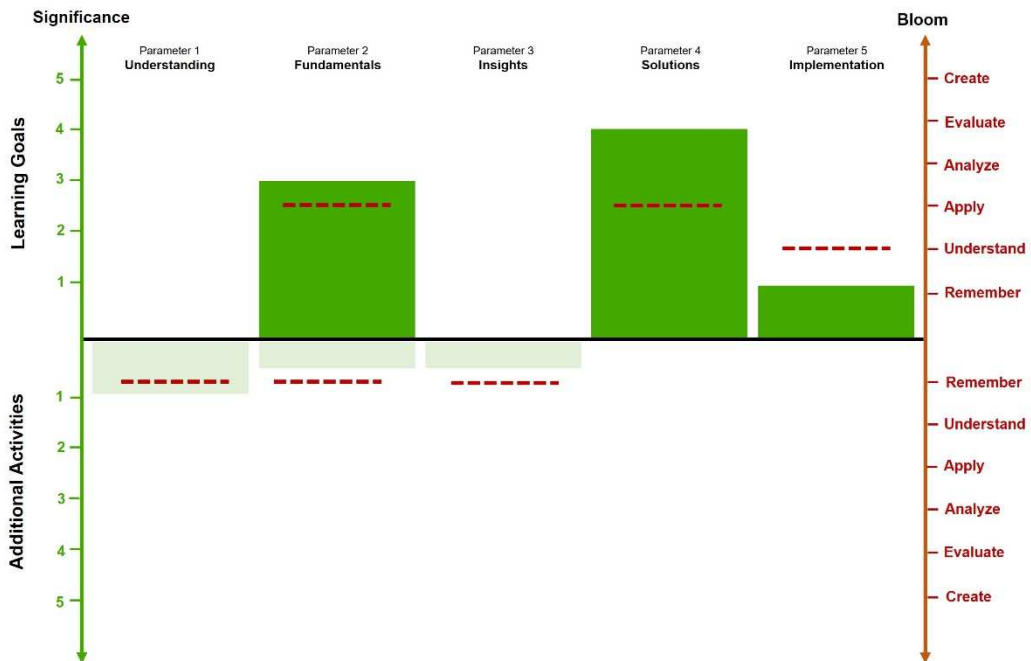
Figure 3.9 Production Technology

4   Analysis

The results of the analysis reveal great variation across the selected educational programmes.

However, to better compare the results across the different educational programmes, an overview has been created, combining the results from the individual analysis into one diagram. Initially, the focus is on the 'Significance' of the 'Learning Goals' and 'Additional Activities'. The thickness of the green lines for each parameter (both for 'Learning Goals' and 'Additional Activities') indicates the number of programmes scoring this level of Significance. Hence, a thick line indicates many, and a thin line indicates fewer. The light green boxes highlight where the main emphasis is within each parameter.
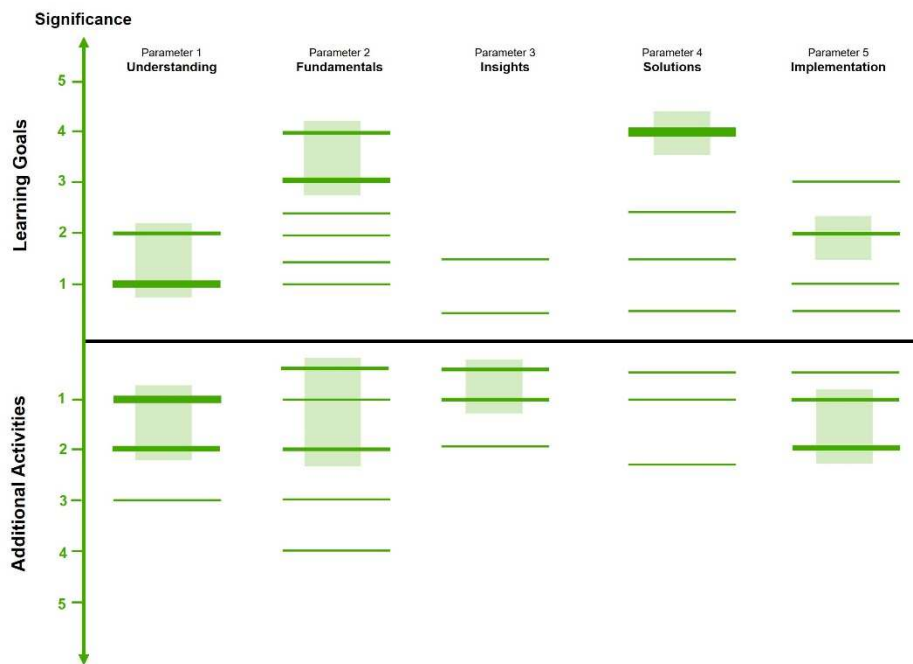
Figure 4.1 A summary of the results ('importance') of the analysis.

Despite the great variety across the educational programmes, some tendencies emerge when combining the results.

The thick green line for parameter 4 (Solutions) at significance level 4 (Learning Goals) indicates that the ability to build and create solutions to support sustainability is already formally emphasized at a high level among most educational programmes. This is not surprising as the analysis focuses on technical and business-oriented programmes aimed at industry, where innovation and the ability to create and develop solutions are traditionally regarded as valuable among companies. Hence, this strong focus on the ability to innovate and create solutions is driven by an underpinning fundamental value embedded in the educational programmes.

Moreover, the diagram shows a rather high level of focus for parameter 2 (Fundamentals) across the various educational programmes with many/thicker lines indicating a higher score (4) on Significance. The 'Fundamentals' are, for example, the ability to frame a problem, critical thinking, or system thinking, making it possible to handle the complexity embedded in sustainability. However, these competencies are not solely useful when working with sustainability, on the contrary, these competencies are useful beyond that. Hence, the focus on this parameter is also fuelled by other core elements of the educational programmes. It indicates that the students already have a strong competency base for handling the complexity embedded in sustainability.

Parameters 1 (Understanding) and 5 (Implementation) have a medium focus (compared to the other three parameters). In both cases, these parameters are most likely not regarded as core competencies of the educational programmes, hence they are not emphasized, either in the curriculum for the educational programmes or the selected additional activities. However, understanding (and valuing) the importance of environmental sustainability and having the competencies to implement solutions in real-life scenarios are essential to create a positive impact in practice. In both cases, the teaching cases developed in SCABEE could be a way to strengthen these competences, as the cases can bring real-life scenarios close to the educational activities.

The parameter 'Insights' covers insights into the bio-physical system of sustainability and is the parameter with the lowest score of importance: a few thin lines with a lower score on Significance. This is not surprising as the selected educational programmes for this analysis are technical and business-oriented and not particularly focused on sustainability. However, insights into the bio-physical system are a foundation for understanding and working with environmental sustainability. It is, for instance, important to understand the concept and complexity of planetary boundaries and how the different bio-systems are connected and affect each other. The last part is of particular importance to understand how to avoid 'burden-shifting' between the different bio-physical systems when developing and creating new solutions. Hence, this could be a potential area of greater focus for the educational programmes.

Finally, it also seems that much of the emphasis on sustainability at the educational programmes is obtained through additional activities, rather than being formally addressed as part of the learning goals. This indicates that lecturers are selecting additional activities like, e.g., company visits, project assignments, and cases/examples, to enhance focus on sustainability.

In the diagram below the Bloom's Taxonomy score has been added to the first overview.
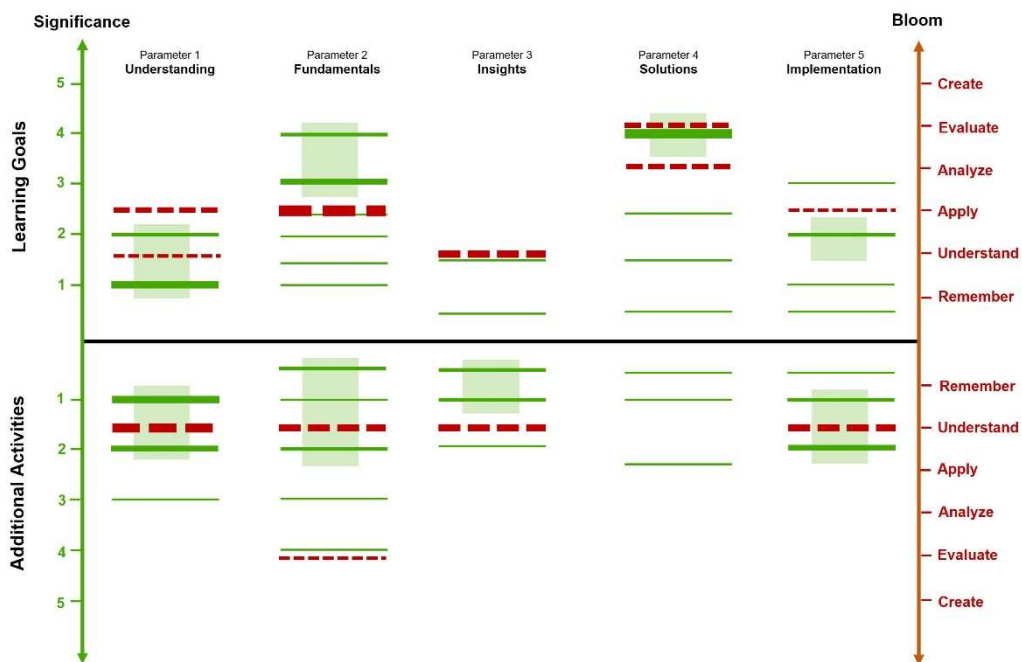
Figure 4.2 A summary of the results of the analysis with both 'Significance' and the level of learning outcome (Bloom's Taxonomy).

Focusing on the learning outcome of the activities, the level on Bloom's taxonomy increases with the level of significance for the different parameters. This is not surprising, because what is emphasized as important is

also given a stronger focus in terms of learning. Moreover, for most of the parameters focusing on 'Learning Goals', the full scale of Bloom's taxonomy is widely covered. Especially at the level of 'understand' and 'apply'. This resonates well with the selected educational programmes, where focus is on innovation and solutions in the context of companies.

It should be noted that given the setup for the analysis, the educational programmes selected for the analysis could be biased in favour of already addressing sustainability, as the programmes are selected by the participants of the SCABEE project. In other words, the results of the analysis could show a greater focus on sustainability among the programmes than would be the case in general.

Furthermore, the analysis only uncovers how sustainability is addressed today; not to what extent it is addressed (e.g., in relation to the entire educational programme). Moreover, the results of the individual analyses results cannot be compared across cases. In other words, a level 4 within parameter 4 in one case is not necessarily comparable to the same value within the same parameter in another case. The values can only be compared within the individual analysis/cases.

4.1   Summary

The analysis has uncovered how environmental sustainability is addressed today across a number of technical and business-oriented educational programmes within higher education across Europe. Despite a great variety across the programmes, the analysis shows a strong emphasis on solution-building skills. Additionally, the analysis shows that the students already possess a solid foundation for handling the complexity inherent in sustainability. Both types of competencies are not surprising, given the selected educational programmes for the analysis.

Moreover, the analysis also revealed a medium focus on Parameter 1 (Understanding) and 5 Parameter (Implementation) compared to the other three parameters, possibly because they are not considered core competences in the educational programmes, and hence, not emphasized in the curriculum or additional activities.

Parameter 3 (Insight) has the lowest score of importance. It covers insights into the bio-physical system of sustainability. While technical and business-oriented programmes may not prioritize this, understanding the bio-physical system is essential for environmental sustainability. Awareness of planetary boundaries and interconnected bio-systems is crucial to avoid burden-shifting when creating new solutions. Hence, this could be a potential area of greater focus for the educational programmes.

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Annex A   Individual analyses

Initial Analysis: ESTA Belfort
Ingénierie d'Affaires Industrielles

Version 1.1

Belfort (France), December 2023

6 'AS-IS' ANALYSIS : Ingénieur d'Affaires Industrielles

6.1 General Information

Institution	Ecole Supérieure des Technologies et des Affaires Belfort – ESTA Belfort
Educational programme or course	Diploma "Ingénieur d'Affaires Industrielles"
Introduction to the educational programme	The study programme "Ingénieur d'Affaires Industrielles" was initiated in 1986 by Belfort (France) industrialists to train sales engineers able to sell technical products and services on global markets. The study programme combines technical teaching with marketing and management. The academic programme is topped with 5 different placements as well a strong international component (language skills, international placement, intercultural education). After two years, students chose one of three technical specialisations: Industry 4.0, Digital Transformation, or Chemistry/BioTech. Starting in September 2024, a fourth specialisation focusing on Clean Energy will be also offered. Students enter directly after their A-level exams for five years, or after two years technical studies in another institution. Both groups are mixed for some semesters (S3-S5 and S8-S10), thus the latter study a reduced programme compared to the five years students. The present analysis covers the five-years study programme. Graduates thus have profound academic knowledge and skills as well as a broad professional experience and are highly searched on the labour market.
Conducted by	Thomas Röhr
Timeframe	December 2023
Additional info	All teachers of the 5-years degree programme have been asked to contribute information regarding their lectures. ESTA aims at raising awareness of students on environmental and sustainability issues and initiates students as integrated part of traditional lectures as well as through dedicated lectures and activities (see lists below).

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 program (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**
Introduction to economic knowledge including raising awareness on sustainable development and resource consumption	Understand	Economy S1	1 ECTS
Sensitising students on the environmental impact of technology: Process control and product design already integrate reflections about best materials, recyclability, and energy costs for production and processing as fundamentals for future works.	Understand	Process control Product design S1	3 ECTS 6 ECTS
Understand the legal and regulatory environment and major contemporary issues through different categories of law	Understand	Legal fundamentals S1	1 ECTS
As part of the Experimental Marketing lecture, students work on a given situation/product/service. In 2023, students worked on a project about poverty (SDG #01)	Apply	Part of Marketing-Sales S4	1 ECTS
The students should be able to understand the environment of a company to formalize a marketing plan (including sustainability in the analysis of the environment, customer's needs, and doing a sustainable commercial response…)	Understand, Evaluate	Industrial Marketing S4	1 ECTS
Understand the concept of CSR and companies' contributions to sustainable development	Understand	Corporate Sustainable Responsibility S6	2 ECTS

Other Educational Activities			
Are there any other educational activities on either the level of the educational program, 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 program). 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**
All freshmen participate in a half-day climate fresk session to understand the links between man-made impacts on ecology and climate change.	Understand	Climate fresk S1	0 ECTS

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 program (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**
Consider the market's needs when designing a new product and know and master the tools of semi-structured interviews: The students should be able to detect customer "latent needs" in order to design a differentiated sustainable product with a competitive advantage. The students should be able to select and argue for the choice of functional items to design a sustainable new concept/product.	Apply Evaluate	Concept Engineering Method S6 (S10 from 2024)	1 ECTS

Students must create an IoT demonstrator answering to an identified need, including the "Thing" side and the server side. This implies framing a problem as well as system thinking capacities. This lecture is only for students in the Digital Transformation specialization.	Create	Internet of things S6 (Digital)	2 ECTS
Enable students to handle and analyse huge amounts of data, including strategies for energy-saving algorithms. All students do the Data-Mining lecture, whereas only students from the Digital Transformation specialisation also have the Big Data lecture, which goes into much more detail.	Apply	Data Mining S6

Big data S6 (Digital) | 2 ECTS

2 ECTS |
| Practical case evoking companies and the law (S6 and S8) – Possibility of colouring sustainability with the reform of company law (company with a mission, reason for being) – PACTE Law 2019 – Opening with the future PACTE law?
(Note: PACTE: Action plan for business growth and transformation (PACTE), law aiming at removing obstacles to business growth at all stages of their development) | Understand | Company law S6

Social law S8 | 1 ECTS

1 ECTS |
| Students identify a problem within their organization (placement, apprenticeship) and suggest a solution based on scientific insights (literature review). The final thesis work allows students to get familiar with creating new solutions based on the evaluation of a given situation, using all knowledge and critical thinking acquired during their studies. | Create | Final thesis S10 | 20 ECTS |

Other Educational Activities

Are there any other educational activities on either the level of the educational program, 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 program). 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
The CrunchTime is an event organised by the Technical University Belfort-Montbéliard over one week in which all ESTA students participate. The aim is to develop a solution to a given problem from companies. CrunchTime is a great opportunity to train students in complex problem-solving under time pressure,	Create	CrunchTime S8	1 ECTS

including teamwork, the definition of a problem, critical thinking, and the development of a solution (including a prototype where applicable).			
The CXI Challenge (Customer Experience Marketing Challenge) is a two-day Hackathon on customer-oriented services in cooperation with companies. Organised by ESTA, this hackathon allows students to deepen their skills to find new and innovative solutions for a given problem.	Create	CXI Challenge S9	1 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 program (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
During the presentation of Customer (Relation) Management Systems, emailing campaigns, and social networks, students discover the impact of digital tools on the environment and the concept of responsible computer sciences.	understand	Tools 2.0 S3	1 ECTS
Understand the relation between energy (production, distribution, consumption) and its impact on global climate. The lecture includes a session on the OGRE atelier. OGRE means scale, students try to solve the energy problems in the future by increasing energy production (different options available: nuclear, renewables, water…) and at the same time reducing energy consumption with a limited budget.	evaluate	Climate Change S8	2 ECTS

Other Educational Activities			
Are there any other educational activities on either the level of the educational program 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 program). 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**

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 program (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**

After getting taught the necessary knowledge about different kinds of sustainable business models, students must develop one for a given product.	Apply	Innovation Management Systems S9	3 ECTS
Conduct a complete technological project, starting with user needs/problem identification, specification, and design until prototyping, considering materials, energy consumption and recyclability. Students very often suggest sustainable materials (reusable, recyclable...). The project is part of the ESTA Business Challenge (EBC), see below.	Analyse, Create	Technological project S9	6 ECTS
International business law: practical case, drafting of clauses and contracts	Understand / Create	International Business Law S9	1 ECTS
Participation in a complex negotiation game in the context of increasing renewable energies: wind power with the TCS StaWind / PowerBest company	Create, Evaluate, Analyze, Apply, Understand, Remember	Complexe negotiation S8	1 ECTS
Students should be able to do a benchmarking analysis in order to integrate best sustainable practices into the realization of their commercial and technical offer	Analyse	Competitive intelligence S9	ECTS

Other Educational Activities			
Are there any other educational activities on either the level of the educational program 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 program). 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**
Students suggest projects that will serve as a red file for many lectures and exercises such as, e.g., marketing, technological project, sales, law, regulations, project management…. The EBC covers the last two study years (4th and 5th year). Projects must offer a sustainable product/answer/solution to companies or customers; they are validated by a committee from ESTA staff.		ESTA Business Challenge (EBC) 4th & 5th year	N/A

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 program (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**

Students know the main tools that allow them to plan and control a project. Project management is applied to the ESTA Business Challenge (see 1.5) project.	apply	Project Management BS8	2 ECTS
Students learn about different cultures with a focus on business aspects. Insights cover ethical values, behaviours, rules, and regulations in different countries to better adapt to those target markets.	Understand, evaluate	Cross-cultural management BS9	4 ECTS
The students can make a marketing and financial plan for the development of a new product line based on circular economy (TCS named Hop Crispy Crackers)	Remember (marketing and financial tools) Understand circular economy bases	Management Accounting S8	2 ECTS
Supply chain serious game including CRS criteria to evaluate suppliers, analyse a company's situation, apply a supply chain strategy	Evaluate, Analyse, Understand, Apply	Serious game S8	1 ECTS

Other Educational Activities

Are there any other educational activities on either the level of the educational program 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 program). 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
N/A			

Initial Analysis: FH Vorarlberg
Engineering and Management

Version 1.1

Dornbirn (Austria), November 2023

7 'AS-IS'-ANALYSIS: Management and Engineering

7.1 General Information

Institution	Vorarlberg University of Applied Sciences
Educational programme or course	Management and Engineering, 3-year programme
Introduction to the educational programme	The six-semester degree in Engineering and Management (WING) offers integrative and interdisciplinary courses with technical economic and personality-building content. The modules, some of which run across more than one semester, and a constant switch between technical and economic content stimulates your "lateral thinking" as an intermediary between the worlds. The core areas • **Engineering** (engineering, natural sciences, mathematics, IT), • **Management** (economic, legal, and social sciences) and • **Social capacity** (methods and social skills, languages) are emphasised to different extents in different phases of the degree programme.
Conducted by	FHV
Timeframe	December 2023
Additional info	Engineering and Management part-time studies, Bachelor (fhv.at)

7.2   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 program (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 ECTS/ Importance (1 = high / 5 = low)
As a precondition and side aspect for the holistic topic for operational energy supply	Evaluate, apply, understand	Energy technology, 2nd semester	2 ECTS / 4

Other Educational Activities
Are there any other educational activities on either the level of the educational program, 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 program). 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 ECTS/ Importance (1 = high / 5 = low)

7.3 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 program (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 ECTS/ Importance (1 = high / 5 = low)
The students can name and differentiate between the various phases of the systems engineering (SE) life cycle model.	Remember, understand	Systems Engineering 1, 2nd semester	2 ECTS / 1
The students are proficient in the target search and solution search of the SE problem-solving cycle and are able to demonstrate this using a case study.	Understand, evaluate	Systems Engineering 1, 2nd semester	2 ECTS / 1
The students know the methods of solution selection and are able to carry them out using examples	Understand, apply	Systems Engineering 1, 2nd semester	2 ECTS / 1
The students are able to demonstrate the interplay between the problem-solving cycle and the life-phase model.	Analyze	Systems Engineering 1, 2nd semester	2 ECTS / 1
The students know how to search for and select methods for specific problem-solving and are able to reproduce this using examples	Evaluate	Systems Engineering 1, 2nd semester	2 ECTS / 1
On the basis of systems thinking, students can reproduce a problem-solving cycle	Create	Systems Engineering 2, 3rd semester	2 ECTS / 1

On the basis of systems thinking, students can name the influencing factors on the process level of problem-solving	Remember	Systems Engineering 2, 3rd semester	2 ECTS / 1
On the basis of systems thinking, students can state typical rules of (multi-personal) problem solving	Remember, understand	Systems Engineering 2, 3rd semester	2 ECTS / 1
On the basis of systems thinking, students can discuss aspects of the content level of problem-solving processes	Evaluate	Systems Engineering 2, 3rd semester	2 ECTS / 1
On the basis of systems thinking, students can discuss the influence of trilemma and rationality on problem-solving	Evaluate	Systems Engineering 2, 3rd semester	2 ECTS / 1
On the basis of systems thinking, students can assess the opportunities and risks of individual phases of the problem-solving cycle.	Analyze	Systems Engineering 2, 3rd semester	2 ECTS / 1
Students can name aspects of thinking in systems	Remember	Systems Engineering 3, 4th semester	2 ECTS / 1
Students can discuss the Viable System Model as a reference model for organisational structures	Evaluate	Systems Engineering 3, 4th semester	2 ECTS / 1
Students can: create and discuss a basic impact structure	Create	Systems Engineering 3, 4th semester	2 ECTS / 1
Students can incorporate SE into their own professional practice	Create	Systems Engineering 3, 4th semester	2 ECTS / 1
Finally, SE 1-3 will be updated in the new WING7.0 Curricula. On the whole, it will be reduced by 2 ECTS and the lectures will be held in semesters 2 and 3 (without the problem-based-learning content).			

Other Educational Activities

Are there any other educational activities on either the level of the educational program, 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 program). 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 ECTS / Importance (1 = high / 5 = low)
Some lectures on the elective subject of interdisciplinary integration have these learning goals as mentioned in the above questions. Here are some examples: • Introduction to ergonomics	Fully in use	Interdisciplinary Integration, 5th and 6th semester; at end of study programme	< 1 ECTS --> between 8 and 16 lecture units / 2

7.4   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 program (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 ECTS / Importance (1 = high / 5 = low)
As a precondition and side aspect for the holistic topic of operational energy supply	Evaluate, apply, understand	Energy Technology, 2nd semester	2 ECTS / 4

Other Educational Activities

Are there any other educational activities on either the level of the educational program 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 program). 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 ECTS / Importance (1 = high / 5 = low)

7.5   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 program (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 (1 = high / 5 = low)
Course topics and Activities over the two semesters include: (additional activities) • general insight into sustainability, circular economy, circular design, resource-based management • difference between PLC, cradle-to-grave (C2G) and cradle-to-cradle (C2C) and how they deal with recycling, upcycling and reuse; integrated with the Research Centre Business Informatics and its focus on C2C, C2G, upcycling and accompanying data modelling. • systemic thinking • Porter's Diamond model and sustainability-related trends • segmentation, differentiation and positioning in a sustainability context • real transactional cost analysis and implications for circular design and pricing • triple top line and triple bottom line • creating a SWOT analysis to understand implications and impact of decision-making • applying risk and scenario analysis to sustainable product development • creating specifications for more sustainable products • determining pricing based on real transactional costs, • determining appropriate distribution and channel from a cradle-to-cradle perspective	Analyse, Evaluate, Create	Responsible Product Management 1, 5th semester / Responsible Product Management 2, 6th semester	9 ECTS / 9 ECTS 5

• creating an appropriate basic sales folder emphasizing sustainability • determining sustainability-oriented key metrics and creating a dashboard			
The new curricula WING7.0 will offer some new aspects for life-cycle-costing (starting in winter term 24/25)		Life-cycle-costing	3 ECTS

Other Educational Activities
Are there any other educational activities on either the level of the educational program 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 program). 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

7.6   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 program (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 (1 = high / 5 = low)
Some lectures on the elective subject of interdisciplinary integration have these learning goals as mentioned in the above questions. Here are some examples: • GRID (business game) • Change Management (business game) • Event project management (excursion) • Entrepreneurship (business game) • Social Systems Engineering - Leadership • Introduction to ergonomics	Fully in use	Interdisciplinary integration, 5th and 6th semester; at the end of the study programme	< 1 ECTS --> between 8 and 16 lecture units / 2

Other Educational Activities
Are there any other educational activities on either the level of the educational program 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)?*

Educational Activities	Bloom's Taxonomy level	Name of course/ subject and semester	Number of ECST/ Importance
If so, please make a brief description of the activity and its relation to the educational program). The description should also include a categorizing according to Bloom's Taxonomy, if not explicitly stated.			

Initial Analysis: Silesia University of Technology

Industrial automation and robotics

Version 1.1

November 2023

8 'AS-IS' ANALYSIS: Industrial automation and robotics

8.1 General Information

Institution	SUT
Educational programme or course	Industrial automation and robotics - 3.5-year Bachelor (BSc) level programme (210 ECTS)
Introduction to the educational programme	Students of the Industrial Automation and Robotics program possess skills in the analysis, design, and construction of automation systems and control systems, as well as programming industrial and service robotics systems. They are prepared to tackle complex, interdisciplinary problems within the field of automation and robotics in industry. They can develop their own simple programming applications for logic controllers, computer networks, and industrial networks, as well as design automation systems and control systems.
Conducted by	Agnieszka Sękala, Wojciech Sitek, Damian Krenczyk
Timeframe	November/December 2023
Additional info	In the academic year 2023/2024, a new teaching program was implemented.

Teacher surveys were conducted to find educational activities that focused on environmental sustainability. |

8.2   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 program (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 program, 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 program). 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
Recycling of metallic and alloy batch materials; Harmfulness of chemical components in molding and core sands as well as metallurgical dust. Optimization of energy consumption. Environmental protection systems.	Understand, Remember	Foundry, 3rd semester	This activity is a **medium** part of the course. The course covers 2 ECTS

Optimal utilization of CRM (Critical Raw Materials) for reducing vehicle weight and, consequently, fuel consumption.	Understand, Evaluate	Foundry in the Automotive Industry, 4th semester (Elective course)	This activity is a **minor** part of the course. The course covers 2 ECTS
Issues of designing energy-efficient trajectories for robots. Proper selection and application of motion instructions with a focus on minimizing energy consumption, considering the phase in the TCP (Tool Center Point) motion of an industrial robot manipulator.	Understand, Remember	Planning actions and collision-free trajectories of robots, 6th semester (Elective course)	This activity is a **minor** part of the course. The course covers 5 ECTS
Integration of sustainable practices in the areas of production management and the environment.	Understand, Remember, Analyze	Production Management, 4th semester (Elective course)	This activity is a **minor** part of the course. The course covers 2 ECTS
Information about energy-efficient buildings, the role of flat, cylindrical, spherical partitions, and the construction of thermal screens.	Understand, Remember	Modelling the technological environment of manipulative and mobile robots - heat flow., 5th semester (Elective course)	This activity is a **medium** part of the course. The course covers 6 ECTS

8.3   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 program (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
Ability to assess the suitability of basic methods and tools for solving simple engineering tasks typical of automation and robotics, and to select and use appropriate methods and tools.	Understand, Analyze, Evaluate	Automatic control and measurement and control systems in manufacturing, 6th semester	This activity is a **medium** part of the course. The course covers 3 ECTS

Other Educational Activities

Are there any other educational activities on either the level of the educational program, 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 program). 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
Issues of systems thinking lay at the foundation of real-time systems.	Understand	Real-time Systems, 7th semester (Elective course)	This activity is a **medium** part of the course. The course covers 7 ECTS
Problem-solving in subgroups, evaluation of results from the perspective of their correctness.	Understand, Remember	Modelling the technological environment of manipulative and mobile	This activity is a **medium** part of the course. The course covers 6 ECTS

		robots - heat flow., 5th semester (Elective course)	
Discussion during the student conference "Computer Methods." We suggest that students familiarize themselves with literature that discusses the above-mentioned issues.	Understand, Remember	Modelling the technological environment of manipulative and mobile robots - heat flow., 5th semester (elective course)	This activity is a **medium** part of the course. The course covers 6 ECTS

8.4   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 program (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
Designing a product with consideration for the potential reusability of its non-consumable elements or the recovery of materials from which it is made.	Understand, Remember	Engineering materials and the principles of their selection, 3rd semester	This activity is a **medium** part of the course. The course covers 2 ECTS

Other Educational Activities

Are there any other educational activities on either the level of the educational program 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 program). 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
Energy efficiency - efficient programming can contribute to optimizing the energy consumption of robots. Optimal paths, effective motion planning, and intelligent task management can minimize energy consumption.	Apply, Analyze, Understand	Planning actions and collision-free trajectories of robots, 6th semester (Elective course)	This activity is a **minor** part of the course. The course covers 5 ECTS

8.5 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 program (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
Integration of the product life cycle with Life Cycle Assessment (LCA).	Understand	Production Management, 4th semester (elective course)	This activity is a **minor** part of the course. The course covers 2 ECTS

Other Educational Activities
Are there any other educational activities on either the level of the educational program 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 program). 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
Increasing the recycling of foundry materials: moulding sand, circulating scrap, and other materials to produce high-quality castings for the automotive industry.	Understand, Remember	Foundry in the Automotive Industry, 4th semester (elective course)	This activity is a **minor** part of the course. The course covers 2 ECTS

8.6   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 program (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
Corporate social responsibility. Team management, social communication.	Understand, Remember	Production Management, 4th semester (elective course)	This activity is a **minor** part of the course. The course covers 2 ECTS

Other Educational Activities

Are there any other educational activities on either the level of the educational program 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 program). 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	Understand	Apply to the entire education	This is a **minor** activity in the course not linked to any particular ECTS or course.

sca

As part of the course, there is mention of issues related to regulations concerning environmental protection.	Understand, Remember	Modelling the technological environment of manipulative and mobile robots - heat flow., 5th semester (elective course)	This activity is a **minor** part of the course. The course covers 6 ECTS

Initial Analysis: Silesia University of Technology

Mechanical Engineering

Version 1.1

November 2023

9   'AS-IS' ANALYSIS: Mechanical Engineering

9.1   General Information

Institution	SUT
Educational programme or course	Mechanical Engineering - 3.5-year Bachelor (BSc) level programme (210 ECTS)
Introduction to the educational programme	Students of Mechanical Engineering has knowledge from areas of design methods, engineering computations, materials processing technologies, investigations methods and IT techniques assisting design, manufacturing and maintenance of machines. Graduates can use knowledge from the area of mechanics, strength of materials and materials selection using the contemporary computational tools, and management of the design process. They also have fundamental knowledge from areas of the pro-ecological technologies and integrated environment systems.
Conducted by	Damian Krenczyk, Agnieszka Sękala, Wojciech Sitek
Timeframe	November/December 2023
Additional info	In the academic year 2023/2024, a new teaching program was implemented. Teacher surveys were conducted to find educational activities that focused on environmental sustainability.

9.2   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 program (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
The process of recycling and reusing.	Understand, Remember, Analyze	Materials science/ 3rd semester	This activity is a **minor** part of the course. The course covers 5 ECTS
Environmental protection, recycling, and the reuse of worn-out structures and products.	Understand, Remember	Metal materials with elements of heat treatment and surface processing/ 3rd semester	This activity is a **minor** part of the course. The course covers 5 ECTS

Other Educational Activities
Are there any other educational activities on either the level of the educational program, 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 program). 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
Issues related to designing and selecting materials in accordance with the Life Cycle Cost (LCC) methodology. The impact of materials on the environment - CO2 emissions during the production and life cycle of materials/products. Modern low-emission technologies, sustainable technologies.	Understand, Remember,	Advanced Engineering Materials and Technologies/5th semester (Elective course)	This activity is a **minor** part of the course. The course covers 2 ECTS
As part of the course, issues related to replacing environmentally burdensome technologies with eco-friendly alternatives or technologies that mitigate their negative impact on the environment are analyzed. Due to topics covered in the EU Framework Programs, matters related to the "Green Deal" and the "Greening of Enterprises" in the context of manufacturing technologies are discussed. In the case of material research, a crucial aspect addressed in education is the use of research methods to monitor the environmental impact of a given technology, the means of verifying this impact, and quantitative assessment. During research, there is also an influence on reducing the negative impact on the environment by applying methods and materials that mitigate adverse effects.	Understand, Remember, Analyze	Manufacturing and research technologies for structural and special materials/ 4th semester (Elective course)	This activity is a **minor** part of the course. The course covers 4 ECTS
Environmental Management Systems (EMS).	Understand, Remember	Quality Management Systems/ 4th semester (Elective course)	This activity is a **medium** part of the course. The course covers 2 ECTS
These issues are addressed during visits to industrial plants, where students can practically familiarize themselves with specific technologies and methods of environmental impact mitigation employed by various companies. Students participate in meetings with industry representatives, including individuals responsible for monitoring environmental impact within their respective companies.	Understand, Remember	Manufacturing and research technologies for structural and special materials/ 4th semester (Elective course)	This activity is a minor part of the course. The course covers 4 ECTS

9.3 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 program (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
Issues of systemic thinking and critical thinking. Techniques supporting conceptual thinking and evaluation of design solutions.	Understand, Apply	Fundamentals of Machine Design/ 4th and 5th semester	This activity is a **medium** part of the course. The course covers 5 ECTS
Systemic and process-oriented approach in a manufacturing enterprise.	Understand, Remember	Quality Management Systems/ 4th semester (Elective course)	This activity is a **medium** part of the course. The course covers 2 ECTS

Other Educational Activities

Are there any other educational activities on either the level of the educational program, 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 program). 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

sca

NA			

9.4 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 program (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
Environmentally friendly materials. Alternatively, technologies for their disposal that do not cause environmental pollution.	Understand, Remember	Materials science/ 3rd semester	This activity is a **minor** part of the course. The course covers 5 ECTS

Other Educational Activities
Are there any other educational activities on either the level of the educational program 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 program). 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
As part of the course, issues related to the replacement of technologies, where resource depletion occurs, with next-generation technologies that have limited effects on biophysical systems, are analyzed. Due to topics covered in the EU Framework Programs, matters related to the "Green Deal" and the "Greening of Enterprises" are discussed in the context of manufacturing technologies and their impact on climate, pollution, water management, and available raw material resources.	Understand, Remember	Manufacturing and research technologies for structural and special materials/ 4th semester (elective course)	This activity is a **minor** part of the course. The course covers 4 ECTS

9.5   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 program (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
Analysis of Life Cycle Cost (LCC) / Life Cycle Assessment (LCA) in the context of material selection	Analyze	Advanced Engineering Materials and Technologies/5th semester (Elective course)	This activity is a **minor** part of the course. The course covers 2 ECTS

Processing and creating new alloys based on old or worn-out materials (reuse, remanufacture, recycle, and recover).	Understand	Metal materials with elements of heat treatment and surface processing/ 3rd semester	This activity is a **medium** part of the course. The course covers 5 ECTS
Life Cycle Assessment (LCA) analysis based on qualitative and environmental criteria.	Analyze	Quality Management Systems/ 4th semester (Elective course)	This activity is a **medium** part of the course. The course covers 2 ECTS

Other Educational Activities
Are there any other educational activities on either the level of the educational program 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 program). 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
Reducing Emissions by Minimizing the Weight of Automotive and Aircraft Components. Implementing Technologies to Mitigate Harmful Emissions. Reducing Carbon Footprint.	Understand	Advanced Materials and Technologies in Automotive and Aviation/ 6th semester (Elective course)	This activity is a **medium** part of the course. The course covers 6 ECTS
In the case of manufacturing technologies, educational content always includes the possibility of utilizing resources within a closed-loop system	Understand	Advanced Engineering Materials and	This activity is a **minor** part of the course. The course covers 2 ECTS

		Technologies/5th semester (Elective course)	
Participation in workshops in these fields and thematic meetings at conferences for students.	Understand	Advanced Engineering Materials and Technologies/5th semester (Elective course)	This activity is a **minor** part of the course. The course covers 2 ECTS

9.6 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 program (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 program 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 program). 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
Debate of European Green Deal Initiative Issues.	Understand	Advanced Materials and Technologies in Automotive and Aviation/ 6th semester (Elective course)	This activity is a **medium** part of the course. The course covers 6 ECTS
Study Visit to an Industrial Facility	Understand	Advanced Materials and Technologies in Automotive and Aviation/ 6th semester (Elective course)	This activity is a **medium** part of the course. The course covers 6 ECTS

Initial Analysis: Silesia University of Technology

Production and Management Engineering

Version 1.1

November 2023

10 'AS-IS' ANALYSIS: Production and Management Engineering

10.1 General Information

Institution	SUT
Educational programme or course	Production and Management Engineering - 3.5-year Bachelor (BSc) level programme (210 ECTS)
Introduction to the educational programme	Production and Management Engineering is a technical, interdisciplinary course of study that fits into the concept of Industry 4.0, assigned to the discipline of Mechanical Engineering. It comprehensively prepares graduates to solve complex engineering tasks in the design, organisation and control of production processes in various industries. The curriculum content is complemented by issues in management engineering.
Conducted by	Damian Krenczyk, Agnieszka Sękala, Wojciech Sitek
Timeframe	November/December 2023
Additional info	In the academic year 2023/2024, a new teaching program was implemented. Teacher surveys were conducted to find educational activities that focused on environmental sustainability.

10.2   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 program (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
Awareness and understanding of environmental challenges in the aspect of renewable energy sources.	Understand, Remember	Materials and technologies for renewable energy PBL, 6th semester (elective| the form of course: Project Base Learning (PBL))	This activity is a **major** part of the course. The course covers 5 ECTS
Environmental aspects of eco-design. Assessment of the material/process from the point of view of its environmental impact. Making improvements to eliminate negative impacts on the environment, including facilitating recycling.	Understand, Analyze, Apply	Eco-design of materials and processes, 4th semester (elective| the form of course: PBL)	This activity is a **major** part of the course. The course covers 4 ECTS

Other Educational Activities
Are there any other educational activities on either the level of the educational program, 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 program). 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
Analysis of resources necessary for planning and implementing the project, taking into account aspects related to environmental protection, selection of energy sources, and recycling.	Apply, Understand	Project management, 5th semester (elective course)	This activity is a **minor** part of the course. The course covers 2 ECTS

10.3 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 program (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
Determination of risks and their mutual impact on possible complications in project implementation. A critical approach to time progression planning in a work breakdown structure.	Understand, Apply	Project management, 5th semester (elective course)	This activity is a **medium** part of the course. The course covers 2 ECTS

Identification of environmental issues related to product/process design. Taking into account the demands of sustainable development. Prevention of negative environmental impacts throughout the life cycle (existence) of the product/process.	Analyze, Apply	Eco-design of materials and processes, 4th semester (elective| the form of course: PBL)	This activity is a **medium** part of the course. The course covers 4 ECTS
Formulating a production model with disruptions and building predictive schedules. Critical thinking for selecting a method of schedule building.	Analyze, Apply	Management of manufacturing processes, 6th and 7th semester	This activity is a medium part of the course. The course covers 2 ECTS

Other Educational Activities

Are there any other educational activities on either the level of the educational program, 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 program). 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
Considering the project as an interconnectedness of stages, tasks and subtasks. Identifying mutually conflicting stakeholder goals. Determination of risks and their mutual impact on possible complications in project implementation. A critical approach to time progression planning in a work breakdown structure.	Understand	Project management, 5th semester (elective course)	This activity is a **medium** part of the course. The course covers 2 ECTS

10.4   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 program (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
Concept and description of the physical/chemical laws and rules of operation of the solution, geographical and environmental considerations, analysis in terms of global occurrence of resources, availability and constraints, and ecological aspects.	Understand	Materials and technologies for renewable energy PBL, 6th semester (elective| the form of course: Project Base Learning)	This activity is a **major** part of the course. The course covers 5 ECTS
The environmental impact of the product/process (emissions to air, water, soil; impact on climate change; consumption of natural resources, etc.) throughout its life cycle.	Understand	Eco-design of materials and processes, 4th semester (elective| the form of course: PBL)	This activity is a **major** part of the course. The course covers 4 ECTS

Other Educational Activities

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

- *Climate?*

- *Pollution?*

Educational Activities			

*   *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 program). 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
NA			

10.5   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 program (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
Use of resources in accordance with the 7R principles	Apply	Project management, 5th semester (elective course)	This activity is a **minor** part of the course. The course covers 2 ECTS

Selection of materials and/or appropriate components for the selected renewable energy installation with environmental and ecological aspects. Life cycle assessment, closed-loop or recycled solutions.	Analyze	Materials and technologies for renewable energy PBL, 6th semester (elective| the form of course: Project Base Learning)	This activity is a **medium** part of the course. The course covers 5 ECTS
The workshop explores the issues of Life Cycle Assessment (LCA) and its principles in eco-design. Product/process improvements take into account the principles of the Closed-Loop Economy.	Understand, Analyze	Eco-design of materials and processes, 4th semester (elective| the form of course: PBL)	This activity is a **major** part of the course. The course covers 4 ECTS

Other Educational Activities

Are there any other educational activities on either the level of the educational program 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 program). 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
Balancing disassembly lines and building predictive task balances according to forecasts of products for reuse, processing (reuse), and recovery.	Understand	Management of manufacturing processes, 6th and 7th semester	This activity is a **medium** part of the course. The course covers 7 ECTS

10.6   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 program (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
Environmental legislation (e.g., Eco-design for Sustainable Product).	Understand, Remember	Eco-design of materials and processes, 4th semester (elective| the form of course: PBL)	This activity is a **minor** part of the course. The course covers 4 ECTS
The fundamentals of management and management engineering.	Understand, Remember	Fundamentals of Management and Management Engineering, 1st semester	This activity is a **minor** part of the course. The course covers 4 ECTS

Other Educational Activities

Are there any other educational activities on either the level of the educational program 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 program). 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	Understand	Apply to the entire education	This is a **minor** activity in the course not linked to any particular ECTS or course.

Initial Analysis: UCN Aalborg

Export and Technology Management

Version 1.1

Aalborg, December 2023

11 'AS-IS' ANALYSIS: Export and Technology Management

11.1 General Information

Institution	UCN
Educational programme or course	Export and Technology Management, 3.5-year bachelor programme
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.

11.2 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 program (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 program, 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 program). 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, Bundtland 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.

11.3   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 program (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 program, 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 program). 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

11.4 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 program (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 program 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 program). 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
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.

11.5   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 program (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	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 program 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 program). 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
Guest teacher talking about LCA, what it is, and how to use it.	Understand	Product development, 4th semester	This activity is a **minor** part of the course Product Development. The course covers 4 ECTS in 4th semester
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.	Apply	Product development, 4th semester	This activity is a **large** part of the course Product Development. The course covers 4 ECTS in 4th semester
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
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.
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.

11.6   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 program (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 program 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 program). 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 implementing 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.

Initial Analysis: UCN Aalborg
Innovation & Entrepreneurship
Version 1.1

Aalborg, December 2023

12 'AS-IS' ANALYSIS: Innovation and Entrepreneurship

12.1 General Information

Institution	UCN
Educational programme or course	Innovation and Entrepreneurship, 1.5-year top-up programme (90 ECTS)
Introduction to the educational programme	Innovation and Entrepreneurship is a top-up of a 2-year academy programme. The focus of the programme is to equip the students to help companies develop business ideas or start their businesses. The Innovation and Entrepreneurship programme combines creative competencies with market understanding and insight into innovation, management, and business development.
Conducted by	Christina Koch Pedersen
Timeframe	November 2023
Additional info	This is a 1.5-year top-up programme; hence the students already have a 2-year AP degree. The students have various educational backgrounds e.g., 1) Marketing Management, 2) Service, Hospitality and Tourism Management or 3) Products and production. Hence, cross-disciplinary collaboration is required.

12.2   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 program (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
Knowledge and understanding of the practice and applied theory and methods for the development of **sustainable** business models, designs, products/concepts, or processes, from problem identification to idea generation, for validation and implementation	Understand	The National subject elements Innovation	The element covers 10 ECTS. Only one of 9 Key Learning goals for the subject element.

Other Educational Activities
Are there any other educational activities on either the level of the educational program, 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 program). 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

Introduction to what ESG (Environment, Social and Governance) is, the ESG Compass and how to work with ESG. First half of a 6-week project.	Understand	2nd semester	6-week course in 2nd semester. The semester covers 30 ECTS
3 to 4 company visits to or presentations from relevant companies that work with environmental sustainability or ESG	Understand	2nd semester	Covering 1-2 days in the 2nd semester. The semester covers 30 ECTS

12.3   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 program (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
Apply intrapreneurial and entrepreneurial methods and tools and be able to reflect on their relevance and applicability to the development, establishment, and operation of sustainable concepts	Apply	The National subject element: Entrepreneurship	The element covers 10 ECTS. Only one of 8 Key Learning goals for the subject element.

Other Educational Activities
Are there any other educational activities on either the level of the educational program, 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 program). 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
Project where the students are to develop "*something that makes an impact to someone*". The focus is on working with Design Thinking concerning framing a problem and thinking critically.	Evaluate and create	1st semester	1-month project in 1st semester. The semester covers 30 ECTS
Exam project where some students work with sustainable ideas and concept development. The exam project is related to a company that the students have worked with during the semester.	Evaluate and create	2nd semester	The exam project covers 12-15 pages and an oral exam. The exam covers 30 ECTS

12.4   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 program (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 program 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 program). 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**
NA			

12.5   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 program (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 program 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 program). 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 project where the students are to develop "*something that makes an impact to someone*" based in the UN SDG,	Evaluate and create	1st semester	1-month project in 1st semester. The semester covers 30 ECTS
The students are working with different companies to find a sustainable "problem" and help the companies develop solutions. Second half of a 6-week project	Evaluate and create	2nd semester	6-week project in 2nd semester. The semester covers 30 ECTS
Some bachelor students are focusing on environmental sustainability in their bachelor project. The focus was e.g., calculating the company´s CO2 emission	Create	3rd semester	The bachelor project covers 15 ECTS

12.6   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 program (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
A basic understanding of business economics to ensure sustainable business models.	Understand	National subject elements Business Development	The element covers 10 ECTS. Only one of 9 Key Learning goals for the subject element.

Other Educational Activities
Are there any other educational activities on either the level of the educational program 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)?*

Educational Activities	Bloom's Taxonomy level	Name of course/ subject and semester	Number of ECST/ Importance
If so, please make a brief description of the activity and its relation to the educational program). The description should also include a categorizing according to Bloom's Taxonomy, if not explicitly stated.			
Some bachelor students are focusing on environmental sustainability in their bachelor project. The focus was e.g., implementing a sustainable business strategy or working with sustainable management	Create	3rd semester	The bachelor project covers 15 ECTS

Initial Analysis: UCN Aalborg

Product Development and Integrative Technology

Version 1.1

Aalborg, December 2023

13 'AS-IS' ANALYSIS: Product Development and Integrative Technology

13.1 General Information

Institution	UCN
Educational programme or course	Product Development and Integrative Technology, 1.5-year top-up programme (90 ECTS)
Introduction to the educational programme	This education provides students with knowledge about product development and technical integration, within IT and electronics, Installation and automation or Products and production. The students learn to assess and solve issues within their field, and master methods for developing products and technical solutions. They will also develop the ability to work independently and in interdisciplinary collaboration and identify their own learning needs.
Conducted by	Esben Skov Laursen
Timeframe	December 2023
Additional info	This is a 1.5-year top-up programme; hence the students already have a 2-year AP-degree. The students have various educational background within three main areas: 1) IT and electronics, 2) Installation and automation or 3) Products and production. Hence, cross-disciplinary collaboration is required.

13.2 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 program (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
Able to reflect on the profession's practice and application of theory and method, based on their own qualifying expertise, with a particular focus on **environment**, safety, and **sustainability**.	Understand	Apply to the entire education	Covering the entire educational program of 90 ECTS but is only one of 19 Key Learning goals for the educational program.
Handle complex product development, construction, and technical design, incorporating knowledge about the development of the product or service, its manufacture, use, and **disposal** or termination.	Create	Apply to the entire education	Covering the entire educational program of 90 ECTS but is only one of 19 Key Learning goals for the educational program.
Assess practical and theoretical issues, justify and choose relevant solution models to ensure **sustainability** in the choice of technology and materials	Evaluate	Apply to the entire education	Covering the entire educational program of 90 ECTS but is only one of 19 Key Learning goals for the educational program.

Other Educational Activities

Are there any other educational activities on either the level of the educational program, 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 program). 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
Sustainability is integrated as a topic in the product development course	Apply	Product Development I	This activity is a **medium** part of the course Product Development I. The course covers 5 ECTS in 1st semester

13.3   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 program (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
Master methods for developing products and **complex technical solutions** within their own profession	Apply	Apply to the entire education	Covering the entire educational program of 90 ECTS but is only one of 19

		Key Learning goals for the educational program.

Other Educational Activities

Are there any other educational activities on either the level of the educational program, 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 program). 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
The semester projects are chosen to support the student's ability to handle system and critical thinking, as well as the ability to frame a problem or situation.	Apply	Semester projects, 1st, and 2nd semester.	Large parts of the semester projects, covering 10 or 20 ECTS, depending on the semester.

13.4   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 program (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 program 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 program). 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
There are no specific learning goals addressing the students understanding of the bio-physical aspects. However, this is very superficial touch upon in 'Construction and sustainability', as part of the lecturing.	Understand	Construction and sustainability, 1. Semester.	This is a **minor** activity in the course. The course is 5 ECTS.

13.5   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 program (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
Development-based knowledge about practice and applied theory and methods within **environmental management**, **environmental management systems**, and **sustainability philosophies**.	Understand	Construction and sustainability, 1. Semester.	This is a **major** activity in the course. The course is 5 ECTS.
Understanding of practice, applied theory and method for construction and product development within the field of study, and can reflect on how the **environmental and sustainability perspective plays into a company's business.**	Understand	Construction and sustainability, 1. Semester.	This is a **major** activity in the course. The course is 5 ECTS.
Identify their own learning needs and develop their own knowledge, skills, and competencies in relation to construction and **sustainability** within the field of study.	Analyze	Construction and sustainability, 1. Semester.	This is a **minor** activity in the course. The course is 5 ECTS.

Other Educational Activities
Are there any other educational activities on either the level of the educational program 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 program). 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
NA			

13.6 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 program (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 program 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 program). The description should also include a categorizing according to Bloom's Taxonomy, if not explicitly stated.

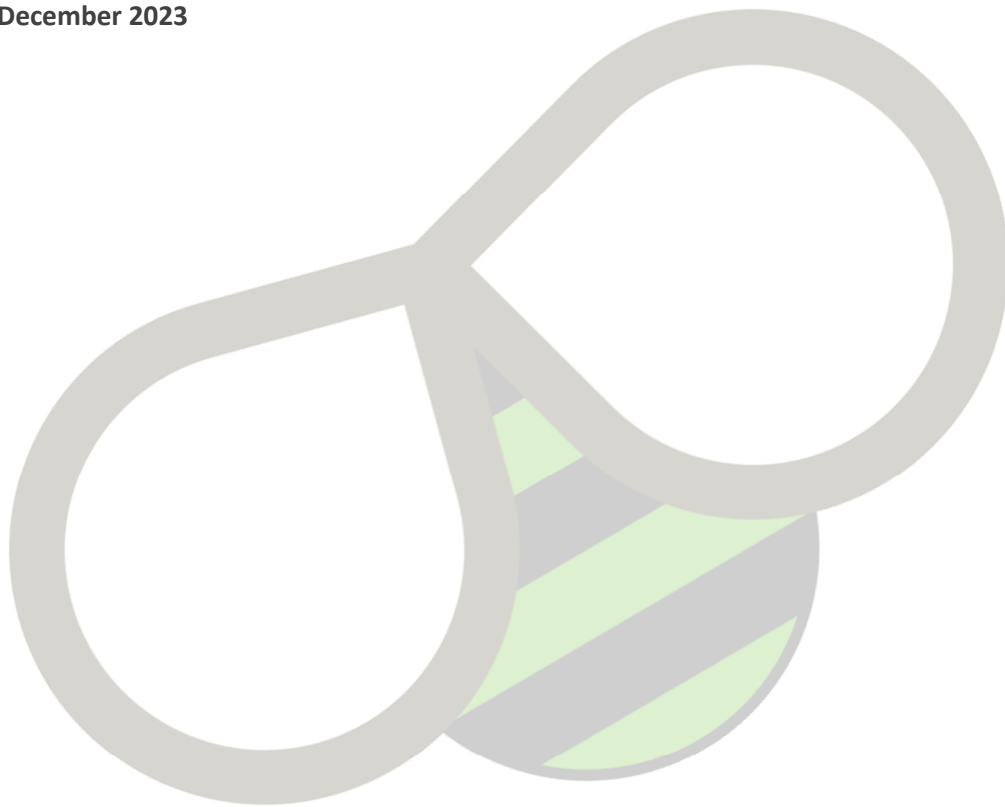| Educational Activities	Bloom's Taxonomy level	Name of course/ subject and semester	Number of ECST/ Importance
NA			

Initial Analysis: UCN Aalborg
Production Technology
Version 1.1

Aalborg, December 2023

14 'AS-IS' ANALYSIS: Production Technology

14.1 General Information

Institution	UCN
Educational programme or course	Production Technology, 2-year academy programme (AP)
Introduction to the educational programme	Production technologists handle technical calculations, documentation, quality, and management tasks in production firms. They understand the entire process behind a product, from idea to production. This includes idea development, construction, production optimization, quality assurance, and customer/supplier interaction.
Conducted by	Esben Skov Laursen
Timeframe	December 2023
Additional info	This is a 2-year AP-degree programme. The students can choose between two main specializations, 1) manufacturing or 2) construction. However, in this analysis, the programme will be treated as one.

14.2   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 program (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 program, 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 program). 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	Understand	Apply to the entire education	This is a **minor** activity in the course not linked to any particular ECTS or course.

14.3   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 program (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
System thinking: Handle situations of a development-oriented nature within production, product development, and technical sales and purchasing.	Apply	Apply to the entire education	Covering the entire educational program of 120 ECTS but is only one of 11 Key Learning goals for the educational program.

Other Educational Activities
Are there any other educational activities on either the level of the educational program, 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 program). 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
Study projects, e.g., focused on product development or manufacturing management	Remenber	Apply to the entire education	This is a **minor** activity in the course not linked to any particular ECTS or course.

14.4 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 program (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 program 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 program). 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
The students are given insights into, e.g., the climate during various lectures	Remember	Apply to various courses	This is a **minor** activity in the course not linked to any particular ECTS or course.

14.5   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 program (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

The applied technical, organizational, economic, quality, and **environmental theories and methods** of companies within production, product development, and technical sales and purchasing.	Understand	Apply to the entire education	Covering the entire educational program of 120 ECTS but is only one of 11 Key Learning goals for the educational program.
Technical, organizational, economic, quality, and **environmental concepts and methods**, and understanding of companies' application of these concepts and methods within production, product development, and technical sales and purchasing.	Understand	Apply to the entire education	Covering the entire educational program of 120 ECTS but is only one of 11 Key Learning goals for the educational program.
Apply the central methods and tools of the subject area and be able to apply the skills including: • the technical, organizational, economic, quality, and **environmental areas**. • use technical documentation and calculation to communicate the technical, organizational, economic, quality, and **environmental issues and proposed solutions**.	Apply	Apply to the entire education	Covering the entire educational program of 120 ECTS but is only one of 11 Key Learning goals for the educational program.
The student can apply the central methods and tools of the subject area, as well as apply the skills related to employment within the profession, including: • environment/sustainability. The student should be able to assess practical issues and set up and choose solution options, including: • assess both material and manufacturing process from environmental considerations.	Apply	Materials and manufacturing processes	9 ECTS-point. This is a **medium** activity in the course

Other Educational Activities

Are there any other educational activities on either the level of the educational program 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 program). 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
NA			

14.6   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 program (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
The student has development-based knowledge and should be able to understand the profession's and subject area's practice and central applied theory and method within: environment, working environment, and applicable legislation.	Understand	Company operations	11 ECTS. A **minor/medium** activity at the course.

Other Educational Activities
Are there any other educational activities on either the level of the educational program 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 program). 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
NA			

15   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