

Innovative approaches to collaborative green venturing

Olof Hjelm, Madeleine Larsson, Wisdom Kanda, Charlotte Norrman, and Karl Eldebo, Linköping University

Klaus Fichter, Karsten Hurrelmann, Anne Seela, University of Oldenburg

Frans Stel and Rogier De Jong, Vennebroek Academic Services

Cia Lundvall and Simon Boiertz, Almi East Sweden AB.

Erik Olsson, Matilda Skeppsby, Emelie Detert, Tekniska verken AB

Joint final report of WP3 and WP4, April 2022

The information and views set out in this report are those of the authors and do not necessarily reflect the official opinion of the European Union. Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the information contained therein.



IMPRINT

EDITOR

Institution

Environmental Technology and Management
Department of Management and Engineering
Linköping University

Address

Linköping University
S-581 83 Linköping
Sweden

Web

<https://liu.se/en/organisation/liu/iei/miljo>

CONTACT

Name: Olof Hjelm

E-mail: olof.hjelm@liu.se

PROPOSAL FOR CITATION

Hjelm, O., Larsson, M., Kanda, W., Norrman, C., Eldebo, K., Fichter, K., Hurrelmann, K., Seela, A., Stel, F., De Jong, R., Lundvall, C., Boiretz, S., Olsson, E., Skeppsby, M., Detert, E. 2022. S4S Report on innovative approaches to collaborative green venturing (Work Package 3 and 4) Linköping, Oldenburg and Zuidlaren.

This publication was produced as part of the Erasmus+ project:

Scaleup4Sustainability. Project Reference: 601150-EPP-1-2018-1-DE-EPPKA2-KA

This publication is available on the Internet as a pdf file at:

www.scaleup4sustainability.eu

Linköping, Oldenburg, Zuidlaren, 2022



Table of Content

1. INTRODUCTION	1
1.1 Background and objective of the report	1
1.2 Conclusions from the evaluation of previous activities.....	3
1.3 Introduction of the academic partners.....	5
1.3.1 Carl von Ossietzky University of Oldenburg	5
1.3.2 Linköping University	5
1.3.3 Vennebroek Academic Services	5
1.4 Introduction of the business partners.....	6
1.4.1 EWE	6
1.4.2 BÜFA.....	6
1.4.3 CEWE	7
1.4.4 Tekniska verken.....	7
1.4.5 Againity.....	8
1.4.6 Noble Environmental Technologies Europe BV.....	8
1.4.7 Borderstep Institute for Innovation and Sustainability	8
1.5 Methodology: How we developed and evaluated innovative approaches .	9
1.6 Database of tools and approaches for collaborative green venturing	16
2. IMPLEMENTED INNOVATIVE APPROACHES TO COLLABORATIVE GREEN VENTURING	17
2.1 New and revised modules (full term)	17
2.1.1 Module “Eco-Venturing”: Sustainability-oriented ideation and business model development	17
2.1.2 Digitalizing and Upscaling of the module “Fujifilm Future Challenge (FFC)”	26
2.1.3 Revision of the module “Environmentally Driven Business Development”	35
2.1.4 Increased focus on sustainability in the cross-disciplinary module “InGenious”	41
2.1.5 New Module “Digital Transformation: Strategies and Sustainability”	43
2.2 Learning units and extracurricular activities	49
2.2.1 Climate Challenge as part of the Module “Innovation Management”	49
2.2.2 “Green Creativity” with Lego Serious Play	56
2.2.3 European Sustainable Innovation Contest	61
2.2.4 Negotiation Festival	63
2.2.5 Role of Ecosystems at Upscaling Upcycling	69
2.2.6 Idea Jam for a Sustainable Society.....	74
2.3 Company specific activities	77
2.3.1 Green Business Idea Jam: Co-ideation of students and company employees at BÜFA	77
2.3.2 Co-Design Workshop “Circular Challenge” at ECOR/Noble	84
2.3.3 Improving Corporate Venturing Processes at Tekniska verken.....	88
2.3.4 Internationalization Strategies of the Cleantech Company Againity	94



3. DISCUSSION AND CONCLUSIONS	97
3.1 Innovativeness of developed approaches	97
3.1.1 Benefits of new forms of business-student collaborations	97
3.1.2 From case-based to interdisciplinary challenge-based education	98
3.1.3 Towards digitization and digitalization	99
3.2 Scalability and transferability	100
3.3 Teachers' perspectives on green venturing	105
3.4 Challenges for challenge providers	106
3.5 A reflection on assessment and evaluation	107
3.6 Conclusions and future activities	107
3.6.1 Main conclusions	107
3.6.2 Future activities	110
4. REFERENCES	111
5. APPENDICES	115
5.1 Supplementary material to section 1.5.3 "Tool for evaluation of students Sustainable Entrepreneurship Competencies"	115
5.2 Fact sheet and Syllabus of module "Eco-Venturing"	117
5.3 Evaluation revised module Eco-Venturing (UOL)	122
5.4 Fact sheet and playbook of module "Fujifilm Future challenge"	133
5.4.1 Fact sheet for "Fujifilm Future Challenge"	133
5.4.2 Playbook for "Fujifilm Future Challenge"	135
5.5 Fact sheet and playbook of module "Environmentally driven business development"	140
5.5.1 Fact sheet of module "Environmentally driven business development"	140
5.5.2 Playbook of module "Environmentally driven business development"	143
5.6 Evaluation of the revised module environmentally driven business development (liu) – student self-assessments of sustainable entrepreneurship competencies	146
5.7 Fact sheet and playbook of module "InGenious"	157
5.7.1 Fact sheet of module "InGenious"	157
5.7.2 Playbook of module "InGenious - cross-disciplinary project"	159
5.8 Fact sheet and playbook of new module "Digital Transformation: Strategies and sustainability"	166
5.8.1 Fact sheet for Digital Transformation: Strategies and Sustainability	166
5.9 Playbook and Fact Sheet of Climate Challenge as part of the module "Innovation Management"	169
5.9.1 Playbook for Climate Challenge Seminar	169
5.9.2 Fact sheet for Climate Challenge Seminar	172
5.10 Platbook pf Green Business Idea Jam	175



INVENTORY

LIST OF TABLES

Table 1.	Examples of KPIs, which can be used in the evaluation of collaborative green venturing.	10
Table 2.	Evaluations performed at University of Oldenburg.	12
Table 3.	Evaluations performed at Linköping University.	13
Table 4.	Developments of the Fujifilm Future Challenge in the period 2018-2020	27
Table 5a.	Overview of green-venturing modules developed in the project Scaleup4 Sustainability.	102
Table 5b.	Overview of green-venturing learning units and extracurricular activities developed in the project Scaleup4Sustainability.	103
Table 5c.	Overview of company specific green-venturing activities developed in the project Scaleup4Sustainability.	104



LIST OF FIGURES

Figure 1.	Conceptual framework for the evaluation of tested approaches	3
Figure 2.	The Competence Framework for Sustainable Entrepreneurship	11
Figure 3.	Conceptual changes of the module Eco-Venturing	19
Figure 4.	Motivation for participating in module Eco-Venturing (UOL)	21
Figure 5.	Different creativity tools in two creativity phases	29
Figure 6.	Progress monitor of the Fujifilm Future Challenge	30
Figure 7.	Example of an infographic of the Fujifilm Future Challenge	31
Figure 8.	Example of a business challenge to be used by students as inspiration for their own development of a new business idea.	37
Figure 9.	Survey on development of students' sustainable entrepreneurship competencies (skills and attitudes) connected to Strategic Action Competence in 2021	39
Figure 10.	Examples of prototypes developed so far.	45
Figure 11.	Survey on strategic action competence in winter term 2021.	54
Figure 12.	Managers from CEWE assess the ideas and select the most promising ones	58
Figure 13.	Path model of creative team performance	59
Figure 14.	Example of arousal during team creativity exercise	59
Figure 15.	Cross Cultural Competences	63
Figure 16.	Wordcloud of information need	64
Figure 17.	Participant at the Global virtual program	65
Figure 18.	Dual concern during negotiations	66
Figure 19.	Alliance scan to train alliance competences.	67
Figure 20.	The Engagement diagram (Oskamp, 2020).	70
Figure 21.	Discussion during the cross-country comparison of case studies	72
Figure 22.	Structure of the Idea Jam	75
Figure 23.	Presentation of the first results of the Green Business Idea Jam	78
Figure 24.	Mixed teams of corporate staff members and students develop innovative ideas	79
Figure 25.	Customized Miro Template "Climate Potential"	80
Figure 26.	Customized Miro Innovation Radar Template	81
Figure 27.	UNIDO model of circular business used	85
Figure 28.	The roles of a Teamcher	106



1. Introduction

1.1 BACKGROUND AND OBJECTIVE OF THE REPORT

The project “Scaleup4Sustainability” (S4S) was implemented November 2018 to April 2022. It combines two important demands called by European policy. First it addresses green entrepreneurship in higher education to contribute to the modernization of Europe’s higher education systems. Further it aimed to strengthen Europe’s capacity to innovate by introducing new forms of student-business collaboration in developing, implementing and scaling-up eco-innovations and starting new green businesses. We refer to this activity as “Green venturing”. Venturing is an integral element of entrepreneurship and emphasizes the creation of new business within an organization (new products or business units) or outside an organization (spin-offs, start-ups). With “green” we refer to the concept of a Green Economy and the notion of a triple bottom line. Common elements of green venturing include idea generation, business model innovation, and formulation of workplan for market entry and upscaling. The project focused collaboration of student teams and business partners in green venturing. This form of collaborative green venturing is embedded in Bachelor and Master programs of Higher Education Institutions (HEIs) and is organized and coached by professors and teaching staff. Collaborative green venturing constitutes an innovative form of multidisciplinary, real case-based interactive learning and entrepreneurship education. S4S made use of existing initiatives and schemes for collaborative green venturing of involved HEIs from Germany, Sweden and the Netherlands and developed several new approaches. The objectives of the project were:

- To evaluate the outputs and outcomes of collaborative green venturing and to identify key factors that make the flow of sustainable entrepreneurial knowledge and skills more effective,
- to develop new, innovative approaches and tools to teaching and learning sustainable entrepreneurship and collaborative green venturing,
- to stimulate sustainable entrepreneurship and green venturing skills of students, teaching staff as well as company staff,
- to scale up and diffuse innovative approaches in collaborative green venturing at the involved HEIs and regions as well as across Europe,
- to facilitate and boost the transnational exchange of knowledge and experiences with university-business collaboration in green venturing, and,
- to disseminate good practices and knowledge in collaborative green venturing to provide a European added value.

The project was organized in seven work packages (WPs), WP1 Project management; WP2 Evaluating leading approaches and tools in collaborative green venturing; WP3 Developing innovative approaches and tools in collaborative green venturing; WP4 Testing innovative approaches and tools in collaborative green venturing; WP5 Transnational exchange and learning; WP6 Transfer and dissemination and finally; WP7 Quality assurance.



This report describes the combined activities in WP3¹ and WP4², i.e., development, implementation and evaluation of innovative approaches and tools in collaborative green venturing. Each of the three involved academic partners (University of Oldenburg, Linköping University, and the intermediary company Vennebroek Academic Services (VAS) with Fujifilm Future Challenge) developed new program elements and innovative tools jointly with the involved business partners.

The corona pandemic had its outbreak after the first year of the project and lasted for the full remaining project time. Given the nature of the project focusing collaborations between universities and businesses partners as well as international learning and exchange, the pandemic had serious impact on the project implementation. Throughout the report, this is reflected upon when relevant and it can be concluded that the forced digitalization of teaching and collaboration activities had both positive and negative effects on the project implementation.

All together this report describes the development activities and evaluation of four established educational modules³, the creation of one new module, four teaching units and extracurricular activities, and five company specific activities. The target group is teachers, practitioners in business and business development, and others interested in starting new or develop existing activities in green venturing and student-business collaborations. It also aims to work as a report to officers of the Erasmus+ Programme of the European Union.

The remaining part of the report is structured as follows. The rest of chapter 1 presents conclusions from WP2, the academic and business partners and the applied methodology. In chapter 2 the development and implementation of all approaches are described. Chapter 3 discusses learning outcomes and how approaches developed can be scaled and/or transferred to other HEIs etc. It also elaborates on future activities that further could contribute to modernize the European higher education systems making sustainability a natural part of entrepreneurship education.

¹ WP 3 had the following objectives:

- 1) Providing an overview and analysis of existing approaches and tools in collaborative green venturing from full and associated partners.
- 2) Developing innovative approaches and tools for collaborative green venturing adapted to the specific needs of involved target groups (students, teaching staff, business partners).
- 3) Increasing the multidisciplinary design of collaborative green venturing exercises.
- 4) Implementing the new approaches as an integral part of a larger activity portfolio of university-business interaction for sustainable innovation and entrepreneurship.
- 5) Making sure that we generate added value for regional partners (HEIs, business partners) as well as a European added value by taking into account the transferability and scalability of innovative green venturing approaches and tools.

² WP 4 had the following objectives:

- 1) Testing innovative approaches and tools which were developed in WP 3.
- 2) Evaluating the feasibility, user-friendliness and effectiveness of the developed innovative program elements and tools.
- 3) Assessing the scalability and transferability of the tested programs to other HEIs and regions.
- 4) Using learning mobility activities to provide transnational learning and exchange regarding feasibility, user-friendliness, effectiveness, scalability, and transferability of tested programs.
- 5) Providing guidance to implement collaborative green venturing approaches and tools in form of a publication and website.

³ We define a module as a set of independent units of study or training that can be combined in a number of ways to form a course at a college or university. Completion of a module (or part of it) renders the student a specified number of ECTS (European Credit Transfer and Accumulation System) credits. This differentiates a module from extracurricular activities not rendering ECTS credits.



1.2 CONCLUSIONS FROM THE EVALUATION OF PREVIOUS ACTIVITIES

This report on WP 3 and 4 is a combined evaluation report on approaches developed and tested within the S4S project. Based on various theoretical pillars, such as the knowledge spill-over theory of entrepreneurship (Wagner et al., 2019), sustainable entrepreneurial ecosystems (Volkman et al., 2021), and the Theory of Change (Carman, 2010), the previously implemented WP2 (Fichter et al., 2020) provided insights and frameworks that are valuable for this report. The sections below briefly describe these relevant aspects on which we based the evaluation of each approach presented in chapter 2.

One key conclusion from WP2 is that an effective evaluation of collaborative student-business venturing activities requires an appropriate conceptual framework, a clear definition of the unit of analysis, as well as an evidence-based approach based on defined criteria and key performance indicators. Based on the theory of change, an evaluation should investigate the inputs, activities, outputs, outcomes, and impacts of the tested approaches of student-business collaboration in green venturing. In WP2 the following conceptual framework was developed, and the units of analysis were set to the curricular and extracurricular approaches of collaborative green venturing developed, re-designed and tested in the framework of WP 3 and 4 of the S4S project (see Figure 1).

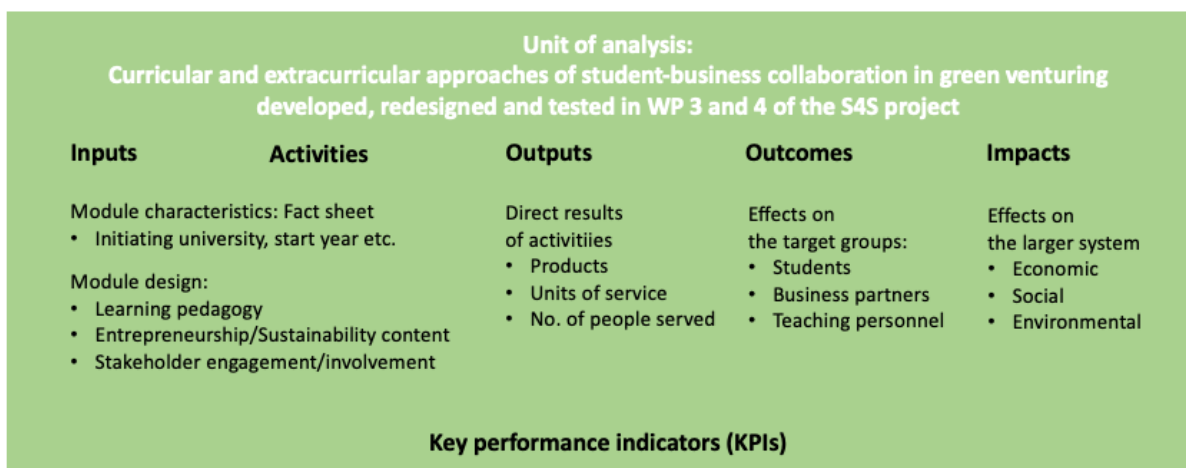


Figure 1. Conceptual framework for the evaluation of tested approaches

For the evaluation process three key stakeholders and targets groups were differentiated:

(1) Students: Does the participation in (collaborative) green venturing influence their entrepreneurial and sustainability-related competencies, their values and worldviews, their entrepreneurial mindsets, and intentions to start a business (in the long run) and their career?

(2) Business partners (venturing teams, start-ups, companies): How do they benefit from collaboration with students (and universities) in joint green venturing exercises? How do the outputs and outcomes of venturing activities influence the economic, environmental, and social performance of business partners and which (intended and unintended) impacts on markets, society and the environment can be observed?

(3) Teaching personnel: How satisfied is the involved teaching personnel with collaborative green venturing exercises and modules? How does it influence their competencies, values, and worldviews? Which impact does the exercise have on education programs and transfer activities of the respective university and on other HEIs? Is the approach scaled up or diffused?



Further, following focal aspects and guiding research questions were formulated for the description of the tested approaches and their evaluation:

Introduction

- What are the key facts about the approach? For this, a fact sheet was developed.
- What are the interests and motivations of participants (teaching personnel, students, business partners) and other stakeholders (e.g., central staff of the university) and which are the development needs?
- Who have been the key persons/promoters in setting up and implementing the module? Who were the involved partners?

Implementation and testing

- How did the process look like, what was the time frame and which steps were taken?
- What? How? When? This includes an overview of teaching materials and implementation tools. Detailed playbook, teaching material etc. can be appended.

Evaluation

- How did it go?
- What are the outputs, outcomes, and impacts of the approaches, how effective are they? Here, evidence-based insights should be provided, including student, teacher, and company perspectives.
- Which sustainable entrepreneurship competences did the students develop? Here, we developed a questionnaire on student development of sustainable entrepreneurship competencies.

Learnings

- What is new and innovative? Are there any unique elements in the design and implementation of the approach? (Innovativeness compared to a) earlier module, b) existing approaches at the respective HEI, c) other existing forms of student-business-collaboration/ other teaching concepts within the field of sustainable entrepreneurship).
- What have been the success factors, drivers, and barriers for the implementation of the approach? What are the general prerequisites for the success of these approaches? What challenges are to be expected?
- What are the strengths and weaknesses of the approach? Is there a need for improving and expanding existing modules or programs?
- Feasibility? Scalability? Transferability? To what extent are the modules scalable and transferable to other HEIs and regions? Future activities?

In section 1.5 we describe more in detail how the learnings from WP2 were used to develop and evaluate the collaborative student-business venturing.



1.3 INTRODUCTION OF THE ACADEMIC PARTNERS

Below follows short presentations of two universities and one consultancy, training and coaching company which have been responsible for the development and practical implementation of teaching activities aimed for students at higher education institutions in Germany, Sweden, the Netherlands, and Belgium.

1.3.1 Carl von Ossietzky University of Oldenburg

The University of Oldenburg (UOL), located in the northwest of Germany, has a long tradition in sustainability related teaching and research. E.g., a three-term non-consecutive master's program in "Renewable Energy" started already in 1987. Among 11 topics sustainability is one of the core areas of the University's Strategic Development Plan. Its research in sustainable development, encompassing several academic disciplines, is especially renowned. UOL has been honoured by the German Federal Ministry of Economics and Energy (BMWi) as one of the best entrepreneurial universities in Germany. The Master's program in "Sustainability Economics and Management" includes the award-winning module "Eco-Venturing" (6 ECTS). Eco-Venturing, which is being offered since 2009, was the first module worldwide with students developing sustainability-orientated business concepts in co-operation with business partners aiming at the promotion of tangible green business start-ups.

1.3.2 Linköping University

Linköping University (LiU) is one of the larger academic institutions in Sweden, Northern Europe. LiU is innovative, highly ranked and known for close collaboration with business and society. In this project staff from the Department of Management and Engineering at the Faculty of Science and Engineering took part. The department offers modules for engineering students and has long experience in innovation and entrepreneurship education including green venturing. The module "Environmentally Driven Business Development" (6 ECTS) is available in the engineering programs Energy, Environment and Management (300 ECTS) and Industrial Economics (300 ECTS) and is being taught since 2013. Similar modules are on offer in more programs but with a slightly different focus (more than 100 students annually).

1.3.3 Vennebroek Academic Services

Vennebroek Academic Services (VAS) is a consultancy, training and coaching company aimed at higher education. VAS integrates forty years of experience in international business and academia. The current research focus is the development of 21st century skills via serious games (e.g., creative problem-solving, negotiation and conflict management, cross-cultural collaboration, and alliances). VAS executes international projects on sustainable entrepreneurship, incubators, and accelerators. VAS has teaching experience at several universities in the Netherlands and abroad concerning strategic management, innovation, and personal development. Examples are the Master track of Science, Business & Policy (University Groningen), Innovation Management (University Twente), personal and team development (Universities of Groningen, Twente, and Tilburg). In addition, VAS has experience in research-based teaching projects regarding sustainability in the Netherlands, Japan, Indonesia, India, Mexico, Finland, and Nepal. For five years, VAS organizes an international business model competition for Fujifilm Europe.



1.4 INTRODUCTION OF THE BUSINESS PARTNERS

Seven business partners were actively involved in the two work packages. This section gives a short presentation of their main activities and earlier experience of student-business collaborations.

1.4.1 EWE

With more than 9,000 employees and sales of 7.6 billion Euro, EWE is one of the largest utility companies in Germany with activities in three key sectors: energy, telecommunications, and information technology. By bringing these three areas together under one roof, EWE is well placed to develop and operate intelligent energy systems. Thanks to its range of innovative products for private and corporate customers, EWE is shaping the energy supply of tomorrow with sustainability, efficiency, and reliability. In the field of sustainability main topics are smart grids, power generation (virtual power plants, fuel cells at home), household (smart storage- and energy management systems) and green mobility.

Previous experiences in student-business collaborations are:

- (1) Involvement of working students (often gained through direct recommendation / personal contacts), e.g., support of the enera⁴ Support Centre by working students (Hotline for FAQs). These students are also used for ad-hoc analyses (market analyses, competitor analyses, business model analyses, etc.)
- (2) Supervision of selected theses (must fit precisely to current relevant topics of EWE, these often arise very short-term); e.g., analysis of acceleration programs in Germany.
- (3) Cooperation of a student consultancy "Active" from Bremen in 2017.
- (4) As part of the degree program "Media Economics and Journalism" (Jade University of Applied Sciences Wilhelmshaven) students participated in a media project.
- (5) Design Thinking workshops with the Entrepreneurship Centre (University of Oldenburg).

1.4.2 BÜFA

The BÜFA Group is an independent, medium-sized family enterprise in the chemical industry (500 employees). For BÜFA, sustainability is closely linked with product innovation. BÜFA offers convincing innovative, resource-conserving products and system solutions and adhere strictly to the principle of sustainability. For sustainable product development the company has a focus on biobased raw materials, responsible use of resources and reduction of risks for the user. For example, BÜFA offers bio-based, environmentally friendly chemicals, develops high-performance cleaning products for industrial and institutional cleaning that are certified with the EU Ecolabel and manufactures products for the use in the renewable energy sector. Close relationships with universities and start-up businesses are part of BÜFA's innovation network. Before Scaleup4Sustainability BÜFA mainly cooperated with universities in the field of bachelor and master theses as well as providing internships.

⁴ Project, that had been funded by the Federal Ministry of Economic Affairs within the program "Smart Energy Showcase - Digital Agenda for the Energy Transition (SINTEG)"



1.4.3 CEWE

CEWE is Europe's leading photographic service and successful provider of commercial online printing. CEWE's success is underpinned by continuous innovation. This enabled CEWE to cope superbly and succeed in the process of transformation from the analogue world to the digital and mobile one. CEWE was distinguished with the 2010 Best Innovator and 2016 Digital Champions Award for the most successful company transformation. The main services of CEWE are photo services (photobooks, calendars, photos etc.), commercial online printing and retail (cameras, lenses and accessories, services and the entire CEWE photofinishing range). With more than 4,000 employees, CEWE successfully bridges mobile trends and the high level of quality and emotionality of printed photo products. Sustainability is implemented as an integral part of their business management strategy in five dimensions: corporate responsibility, economic future proofness, resources conservation and environmental protection, responsibility to employees, and social commitment. CEWE was one of the first SDAX companies to establish a sustainability report, in which it has now documented its activities every year for the past eleven years.

CEWE has already worked with students and the university through various formats: Bachelor Theses, Master Theses, Internships, Cooperation with Modules and lectures, Discussion Fora, Participation at the AI Campus and promotion of an endowed professorship. Experiences had been:

- (1) Student-business collaboration is great: it widens the perspective. With a thesis the company get a more comprehensive elaboration of a certain subject.
- (2) Student-business collaboration is fun: it offers a new and different way of cooperation. Learning from each other and working on projects from such different angles is a great opportunity for students and industry co-workers alike.
- (3) Student-business collaboration means a lot of work: students need attention, a more intensive support and supervision than co-workers.
- (4) Student-business collaborations can sometimes be personally disappointing: especially when the students are very competent, and the company does not have vacancies to offer a job afterwards.

1.4.4 Tekniska verken

Tekniska verken i Linköping AB (publ.) is a municipal owned limited liability company. Tekniska verken is a commercial public utility, and in the subsidiaries', activities continually develop new technologies for social infrastructure, power, water, and heat distribution as well as in the field of energy generation and fuel. The Group's guiding principle over many years is now becoming increasingly tangible – to use available resources in the best possible way and accept responsibility for the consequences. Tekniska verken's vision contributes to building a sustainable society and the work it does covers three dimensions: Social benefit, environmental considerations, and business economics. The company's products and services are based on making use of resources that would otherwise have been lost, often in several stages and always in the most efficient way. The result is one of the world's most resource-efficient energy systems. Tekniska verken has about 260,000 customers, sales 4,867 mil SEK (2016) and 839 employees. Tekniska verken and Linköping university have signed a strategic collaboration agreement and have collaborated much with students over the years. Examples of this is being a guest lecturer and accepting masters' theses students on a regular basis. They also employ a few student collaborators each year to work in different areas of the companies and bridging between education and business experience.



1.4.5 Againity

Againity was founded in 2013 by current Managing Director David Frykerås and Head of R&D Joakim Wren. Since then, the company has grown to 17 employees and developed their core product, ORC systems, from a conceptual design to over 20 full scale operational systems ranging from 50-500 kW electricity output. Againity is currently developing larger ORC systems in the range 500-2,500 kW electricity for use in the industrial waste heat sector and in the energy sector where a tremendous amount of heat is emitted to the atmosphere and water streams. The company has recently added waste management to its portfolio of planned developments to facilitate energy recycling and electricity production from waste incineration. On top of that, they also develop the core component of their system – the patented ORC turbine.

Againity has from the very beginning participated in extensive university collaboration. The forms have varied from study visits to several bachelor and masters' theses as well as project-based modules. Although most work has been related to research and product development, projects have also spanned across industrial engineering, mechanical engineering and environmental and energy systems engineering and management. Almost 40% of Againity's personnel has been recruited during or directly after a university education, as a direct consequence of successful business-university-student collaborations.

1.4.6 Noble Environmental Technologies Europe BV

Noble Environmental Technologies Europe BV is a Dutch business partners of the S4S consortium. Noble uses the trade name ECOR. ECOR stands for: Enabling co-Creation, co-Operation and co-Responsibility. In short, Noble upcycles fiber-based residues from agricultural, industrial, or urban production and consumption cycles and create panels for furniture production, interior design, and displays and booths. The development of the ECOR® Technology started in 2007 by Noble Environmental Technologies in the United States, in collaboration with the United States Department of Agriculture's Forest Products Lab. Since being patented, the subsequent years saw the development and refinement of the technology. The first European ECOR® factory was built in 2014 in Serbia, proving the scalability of the technology. The year 2015 saw the founding of The Netherlands offices, introducing the Circular Economy Effort as the company's leading strategy. In 2018, the ECOR® Research and Development Center opened in The Netherlands. Notably, Noble's R&D created 31 new ECOR® Fibers Alloys solely in the first year. Since 2018, market development in India and Singapore took root. Nowadays, ECOR® has sales and commercialization activities from Mexico to Japan.

ECOR already engaged in short- and longer-term projects with students, Bachelor and Master theses, assignments, events, and guest lectures with a broad range of universities in the Netherlands and abroad.

1.4.7 Borderstep Institute for Innovation and Sustainability

The Borderstep Institute for Innovation and Sustainability is active in the field of applied innovation and entrepreneurship research and committed to the vision of sustainable development. Borderstep is an independent non-profit research institute focused on entrepreneurial solutions for global challenges. Borderstep's research-driven projects focus on eco-innovation, sustainable entrepreneurship, climate change solutions, energy efficiency in buildings and, green IT. Borderstep's primary objective is to achieve measurable, positive social and environmental impacts.



Borderstep's mission is to contribute to a fundamental global transformation toward a green and sustainable economy through excellent inter- and transdisciplinary research. Borderstep focuses on seeking concepts that combine economic success with ecological and social sustainability. For example, Borderstep supports entrepreneurs and support actors to take their responsibility to society more seriously. Borderstep provides innovative services which generate a social and environmental return and employs innovative methods for the support of sustainable innovation and green venturing. Borderstep has a long-standing record on supporting collaborative forms of green venturing, e.g., by providing target-oriented platforms for matching and interaction for co-creation.

1.5 METHODOLOGY: HOW WE DEVELOPED AND EVALUATED INNOVATIVE APPROACHES

This section presents the overall methodology for evaluation and different tools for assessing students' sustainable entrepreneurship competencies (1.5.2) and entrepreneurial and innovative traits of students (1.5.3), respectively.

We based the evaluation of the tested approaches on the conceptual framework, the defined unit of analysis and the guiding questions introduced in section 1.2. In our guidelines for the evaluation of collaborative student-business venturing activities (Fichter et al., 2020, p. 74 ff.), we distinguished three levels and scopes of evaluating approaches of collaborative student-business venturing. For the evaluation of the tested innovative approaches, we applied the following scope:

Focal picture (Lean evaluation): The evaluation is focused on students and selected business partners and is limited to selected Output KPIs and selected Outcomes KPIs. This lean-type evaluation is useful each time the approach is conducted, and it supports continuous improvement.

1.5.1 Key performance indicators and evaluation criteria

Key performance indicators (KPIs) are helpful to assess, measure and manage teaching programs and single approaches in collaborative green venturing. The evaluation performed has included selected KPIs clustered according to the theory of change alongside the effect chains from implementation to impacts on the larger system.

The development of useful KPIs is an iterative process. We started with defining some selected KPIs prior to the first investigation. The first evaluation generated insights on the usefulness of selected KPIs and on the need to use additional KPIs. Table 1 displays examples of KPIs that can be used in the evaluation of collaborative green venturing. As mentioned, we applied a "focal picture"-approach for the evaluation, and we thus focused on selected inputs, activities, outputs, and outcomes KPIs. Given the time frame of the evaluation, we could not consider medium- and long-term impacts.

For the evaluation, we applied the following criteria which are related to the guiding questions presented in section 1.2.



Table 1. Examples of KPIs, which can be used in the evaluation of collaborative green venturing.

Input	Activities	Output (Direct results of activities)	Outcomes (Effects on target groups)	Impact (Effects on the larger system)
<ul style="list-style-type: none"> ▪ Teaching personnel: Total workload for preparing, implementing and follow-up of the module (in hours). ▪ Students: Actual workload/working hours in relation to the credits points of the entire module. ▪ Business partners: Total workload for preparing and implementing the module. 	<ul style="list-style-type: none"> ▪ Total no. of teaching personnel and number of universities/professorships involved. ▪ Total no. of participating students (incl. background and education level). ▪ Total no. of business partners involved (possible characterizations: age, size of companies FTE, sales, branches). ▪ No./ percentage of (sustainable-oriented) methods and tools used for collaborative green venturing. ▪ Number of used (green) tools and methods for green venturing. ▪ Number of direct interactions student-business/ use of collaboration tools. 	<ul style="list-style-type: none"> ▪ Degree of satisfaction of students, business partners, teaching personnel. ▪ Degree of improvement of entrepreneurship / sustainability competencies. ▪ Increase of entrepreneurial spirit by students. ▪ Increase in interest to start a green business (in the long run). ▪ Number of significantly improved green business ideas or elaborated business models. 	<ul style="list-style-type: none"> ▪ President, deans, no. of professors who rate the module as “very important” for the university. ▪ No. of business partners with significantly improved performance (after 1, 2, 3 years). ▪ No. / percentage of venture ideas still pursued or on the market. ▪ No. / percentage of students or business partners who rate the module to be important for their career/ their business. ▪ No. / percentage of students who have an increased level of interest in innovation and/or entrepreneurship and/or sustainability. ▪ No. / percentage of students who work in a green venture / started their own green business. ▪ No. / percentage of students who started their own (green) business. ▪ No. / percentage of teaching personnel who is highly motivated and interested in collaborative green venturing. 	<ul style="list-style-type: none"> ▪ Economic <ul style="list-style-type: none"> ▪ No. of jobs created by business partners 1, 2 or 3 years after the module. ▪ Social. <ul style="list-style-type: none"> ▪ Number of significant contributions to social SDGs. ▪ Number of people served. ▪ Environmental. <ul style="list-style-type: none"> ▪ Reduction in greenhouse gas emissions by sold green products/ services. ▪ Number of significant contributions to environmental SDGs.



1.5.2 Tool for evaluation of students Sustainable Entrepreneurship Competencies

The “Degree of improvement of entrepreneurship/sustainability competencies” is one of the suggested KPIs that could be used for the evaluation of collaborative green venturing formats (Table 1). Although there is no general definition of this term, many scholars describe it as the ability of “successful task performance and problem solving with respect to real-world problems, challenges, and/or opportunities (Barth et al., 2007; Dale & Newman, 2005; Ploum et al., 2018). Successful task performance in this context needs knowledge (e.g. about sustainability in general, global challenges for a sustainable development, idea generation, business modelling), skills (selection and application of appropriate methods and tools) and norms and attitudes (e.g. inter- and transgenerational justice).

Biberhofer et al. (2019) point out that, in addition to the usual entrepreneurial competencies, sustainability-oriented entrepreneurs must be able to reflect on their entrepreneurial activities in conjunction with their values and world views and understand the impact of their company on the environment and society (Biberhofer et al., 2019). Wiek et al. (2011) identified five key competencies for sustainability, which were used by Lans et al. (2014) and further elaborated by (Ploum et al. 2018) with regard to sustainable entrepreneurship by evaluating various studies. Ploum et al. (2018) identified six key competencies which are presented in Figure 2.



Figure 2. The Competence Framework for Sustainable Entrepreneurship (Ploum et al., 2018).

Sustainable entrepreneurship (SE) teaching is now required to enable students to develop these competencies by selecting and designing suitable teaching-learning settings (Mindt and Rieckmann, 2017). On the one hand, this raises questions about these suitable settings (which should be answered by Scaleup4Sustainability) and, consequently questions about the possibilities of measuring or evaluating the success/appropriateness and thus the quality of the teaching formats. The Competence Framework for Sustainable Entrepreneurship by Ploum et al. (2018) provides a methodological framework for describing and identifying sustainable entrepreneurship competencies. This conceptual framework has been tested (validity and reliability) by Ploum et al. (2018) on 402 “would-be-entrepreneurs” but to our best knowledge its application in a teaching context at a university has not been tested/published yet.

Based on this framework we developed a questionnaire for students to answer before and after a module. The questionnaire includes questions providing background information (general information, motivation, entrepreneurial experiences, and intentions) and a self-assessment including the six competencies in Figure 2. For each competence a set of performance criterions where to be assessed by the students and ranked from low competence (1) to high competence (10), see Appendix 6.1.1.



During 2019-2022 the evaluation of sustainable entrepreneurship competencies has been performed in modules both at University of Oldenburg (UOL) and at Linköping University (LIU) and the main findings are presented below.

Evaluation of students Sustainable Entrepreneurship Competencies at University of Oldenburg

At UOL the evaluation was used in three different modules (Table 2), first deployment was in winter term 2019. The students were asked to fill in the questionnaire at the beginning of the module and after the final presentations. The online questionnaire was provided via a link, that was posted in the learning management system and given the students in addition per mail. All participants were reminded several times in writing to complete the questionnaire. It was communicated that the survey serves to evaluate the module and is not part of the examination performance.

The survey was fully anonymous. Since it was planned to match the respective before and after questionnaires, the students were asked to create a self-selected password in the survey. The students were asked to write down this password and to enter it again in the second questionnaire. In addition, we offered the students to get an individual report if wanted.

Table 2. Evaluations performed at University of Oldenburg.

Term	Study module	No of participants	Responses at the beginning of the module	Responses at the end of the module	No. of linkable ex-ante and ex-post questionnaires
Winter 2019/2020	Eco-Venturing	12	12	8	5
Summer 2019	Digitalization and Sustainability	35	22	3	1
Winter 2020/2021	Eco-Venturing	17	17	15	10
Winter 2020/2021	Innovation Management	40	34	30	20
Winter 2021/2022	Sustainable Venturing (former Eco-Venturing)	22	22	19	19

Response rate within the first and second application in 2019 was not satisfying (especially at the end of the module). In 2020 we changed the modus and gave students time during the lecture to fill in the questionnaire. By this, we could recognize in real time if the number of answering persons fits to the number of participants in the study module and motivate to respond if some students would not react. Thus, the response rate was almost 100%.

The idea of letting the students choose an individual password was not successful. Only 2/3 of the returns of the second survey could be linked to the first ones. Individual evaluations could not be created. In the next and last iteration 2021/2022 we changed the survey software and included tokens for allocating the ex-ante and ex-post questionnaires with a 100% match.

The overall findings from the evaluations performed at UOL are the following:

- Competence development could be observed in all of the evaluated modules. Mostly, in the area of strategic competences and system thinking competence, only few changes in normative competences and interpersonal competences.
- The data set is (up to know) too limited for statistical evaluation the correlation between competencies development and learning approach.



- Changes in self-assessment cannot be considered in isolation, as students have taken other modules in parallel that also may have contributed to competence development.

Evaluating the survey the evaluator should take in mind, that it is not a tool to measure competencies as basis for examination but a tool to capture students' self-assessments of their competencies at different points of the module. Results therefore are more subjective perceptions than measurable objective developments. Of course, our hypothesis is that if students assess themselves as significantly better a development of their competencies have happened.

More details about the evaluations performed at UOL can be found in section 2.1.1 and Appendix 5.3.

Evaluation of students Sustainable Entrepreneurship Competencies at Linköping University

At LiU the evaluation tool has been used twice within the module Environmentally Driven Business Development and three times within the module InGenious. In all cases the students were asked to fill in the questionnaire at the beginning of the module and after the final presentations in the end of the module. The online questionnaire was provided via a link, that was posted in the learning management system and for the surveys in 2021 the link was also sent out via mail. All participants were reminded to complete the questionnaire. It was communicated that the evaluation was part of a project where we refine and develop teaching methods with the focus on sustainable entrepreneurship and innovation, and that we as a part of this are interested in learning more about students' competencies related to sustainable entrepreneurship. Furthermore, we made clear that the surveys are evaluated anonymously and that the results are not part of the examination of the module. For the evaluations in the autumn of 2021 each student was assigned a survey-ID and asked to use it when responding to the survey, making it possible for us to assign and match surveys before and after the modules. In Table 3 below we present an overview of the evaluations made.

Table 3. Evaluations performed at Linköping University.

Term	Study module	No of participants	Responses at the beginning of the module ¹	Responses at the end of the module ¹	No of linkable ex-ante and ex-post questionnaires
Autumn 2020	InGenious	40	6	0	0
Autumn 2020	Environmentally Driven Business Development	53	38	25	0
Spring 2021	InGenious	14 ²	21 ²	4	0
Autumn 2021	Environmentally Driven Business Development	56	47	26	26
Autumn 2021	InGenious	31	12	6	5

¹Only fully completed responses were included in the evaluation.

²Only 14 students completed the module which is the base for number of participants in the module. 1/3 of the students responding to the survey in the beginning of the module did not finish the module.



During the first year the response rate for InGenious was very low leading to an unworkable evaluation. For the two evaluations in 2021 the response rates were ok in the beginning of the module, but in the end of the module it dropped making it very difficult to evaluate the student's development with this specific tool. The results from the survey before the module can however still be useful as it can give input to the teachers about motivation, experiences and the level of competence starting up the module.

For Environmentally Driven Business Development we have had a high response rate when starting up the module and the students have been given time to fill in the questionnaire during scheduled time. The response rate has dropped in the end of the module, possibly due to that it has been sent out in connection to the final conference where it may be challenging to get the students full attention. The use of survey-IDs was successful as all the complete responses after the module could be coupled to a response in the beginning of the module.

Based on our practical learnings from above we will continue to use the evaluation tool in the modules, however, trying to increase the response rate.

The overall findings from the evaluations performed at LiU are the following:

- For Environmentally Driven Business Development, development of competencies was observed for all the competencies evaluated. Most obvious development were found connected to strategic action competence and system thinking competence. On the opposite side, only minor development was observed for interpersonal and normative competencies.
- Successful to assign survey-ID to the students to be able to match responses before and after the module. It is however still a challenge to reach a high response rate. Letting the students respond to the survey during scheduled time seems to be one solution to increase the rate.

More details about the evaluations performed at LiU can be found in 2.1.3 and 5.6.

Overall learnings and future development of the evaluation tool

The evaluation tool can successfully be used to indicate students' development of sustainable entrepreneurship competencies as well as be used for learning about previous knowledge and therefore both be useful for teachers and students. However, there are challenges which must be managed:

- Identify the key questions/criteria and simplify the questionnaire to reduce the response time.
- To ensure high response rate, integrate the survey into the module as part of the feedback system and increase the motivation for the students (e.g., couple it to reflection exercises in the modules).
- To fully evaluate the development of competencies it is crucial that the individual ex-ante and ex-post questionnaires can be linked. Use survey-IDs or personal tokens to connect the responses.

Based on the learnings we will develop a new version of the evaluation tool which we aim to make a bit more simple and easier to use for the students and we aim to further incorporate it in the modules as a reflection tool for the students.



1.5.3 Tool for evaluation of entrepreneurial and innovative traits of students

Background to the tool and the development of the survey

Academic research has shown that entrepreneurship education increases the Entrepreneurial intention (EI) or Entrepreneurial Capacities and to start new ventures (Liñan, Rodriguez-Cohard & Rueda-Cantuche, 2011; Maresch, , Harms, R. , Kailer & Wimmer-Wurm, 2016). In addition, self-efficacy impacts new venture performance (McGee, Peterson, Mueller & Sequia, 2009; Rosique-Blasco, Madrid-Guijarro & García Pérez de Lema, 2017).

Entrepreneurial traits are often mentioned as an antecedent of Entrepreneurial Intention (EI). While there is broad consensus among researchers on the importance of EI in relationship to the creation of new ventures, the relationships between entrepreneurial and innovative traits and venturing performance remains unclear. We therefore study these relationships. Apart from entrepreneurial traits and EI, we involve the 'discovery' and 'delivery' facet traits of the Innovators DNA scale in our analysis (Dyer, Gregersen, & Christensen, 2009b). Discovery facets are important at identification of opportunities: associating, challenging the status quo, experimenting, networking, observing, and questioning. Delivery facets are essential at capturing value: analysis, detail orientation, and planning.

How has the tool been used?

We use a sample of 222 entrepreneurial students across three universities in the Netherlands, Belgium, Germany, and Sweden who participated in the period 2017-2020 in a co-creation game with a high-tech company. We asked the students to develop highly innovative business models to solve sustainable challenges and test these in the market.

Our research questions are (1) which innovative and entrepreneurial competences contribute to new venture performance; (2) how do innovative and entrepreneurial competences correlate; (3) does participation in a serious venture game have an effect on innovative and entrepreneurial competences.

We took as our dependent variable predicted New Venture Performance. This is operationalized as the degree of novelty, feasibility, sustainability, and the use of technology of the developed business models, as assessed by the company, coaches and students (N=47). Age, country of birth, and gender served as control variables.

Overall conclusions and learnings

Discovery traits correlated positively with entrepreneurial attitude, entrepreneurial capacity, locus of control and the willingness to take risks. In contrast, 'delivery' traits as analysis, detail orientation does not correlate significantly with these entrepreneurial traits. Answering our second research question: contrary to our expectations, we could not find an increase in entrepreneurial intention after our venture contest, neither in attitude, nor entrepreneurial capacity, locus of control or risk-taking propensity. In our regression models, gender was significant: female students performed better. In addition, 'discovery' traits were important for new venturing performance; in contrast to 'delivery' traits and attitude, capacity, Locus of Control and Risk attitude. To our surprise, younger respondents were less inclined to challenge the status quo. Detailed results will be published on the S4S-website and in conference papers.

As a theoretical contribution of our study, we indicate the value of researching the combination of innovative and entrepreneurial traits in the analysis of venture performance. The practical impact is



to include the development of 'discovery' competencies at the individual and team level, e.g., through skills classes in which creativity is trained.

1.6 DATABASE OF TOOLS AND APPROACHES FOR COLLABORATIVE GREEN VENTURING

WP3 seeks to develop new, innovative approaches and tools for teaching and learning sustainable entrepreneurship and collaborative green venturing with universities and business partners. To be able to develop such new approaches and tools, it is essential to map out existing tools and approaches for sustainable entrepreneurship and collaborative venturing. The target group for this mapping as presented in a database is teaching staff and company managers interested in collaborative student-business venturing activities. The purpose of the database is to provide an overview of tools and approaches for collaborative (student-business) green venturing for managers and teaching staff.

To build the database, a brainstorming session was held by the higher education institutes involved in the project to list all approaches and tools that they are familiar with reference to sustainable entrepreneurship. This initial mapping was then complemented by a mapping exercise of tools and approaches during a networking workshop for Swedish universities teaching sustainable entrepreneurship. The aggregated list was finally complemented with an internet search for tools and approaches for sustainable entrepreneurship. The database is hosted at the S4S project website and is connected to WP3 which focuses on developing innovative approaches and tools in collaborative green venturing. Specifically, the database is deliverable WP3.1. The database is reachable on the S4S project website reachable via <https://www.scaleup4sustainability.eu/database-tools-approaches/>

The database consists of 67 different approaches and tools for teaching sustainable entrepreneurship. This list consists of 5 kinds of lectures – a discourse given before an audience or class, 7 kinds of methodologies – a body of practices, procedures, and rules used by those who work in a discipline or engage in an inquiry or a set of working methods, 11 pedagogic methods – parts of the pedagogic strategy of a module, 7 toolboxes – a set of different models, 26 models – a representation of how concepts are related to one another and 11 workshops – self-contained, participatory lecture aimed to acquire certain skills.

Finally, the database presents the purpose of each tool and approach, how sustainability is integrated into the tool and approach, how the tool and approach can be used to facilitate student-business collaboration, phase of entrepreneurship in which the tool and approach could be used, user manual or guideline to the tool and approach and then references upon which the tool and approach is developed.



2. Implemented innovative approaches to collaborative green venturing

This chapter describes the development and implementation of approaches in the S4S project. First is described the development of three pre-existing modules and the development of one new. Thereafter we present five learning units and extracurricular activities. The last chapter reports five company specific activities or projects related to the business partners of the project. For most of the described approaches more details such as fact sheets and playbooks can be found in chapter 5 (appendix).

2.1 NEW AND REVISED MODULES (FULL TERM)

2.1.1 Module "Eco-Venturing": Sustainability-oriented ideation and business model development

Introduction

Eco-Venturing is a project-oriented Master's module that has been conducted at the University of Oldenburg since 2009 in close cooperation with the Chair of Entrepreneurship and the Adjunct Professorship for Innovation Management and Sustainability. Students of the Master's programs in Economics and Law, Sustainability Economics and Management, Business Informatics and Management Consultancy develop innovative business ideas of practice partners with a high sustainability relevance. The core of the concept is that these ideas should be realized and thus generate real added value for the company. More information about the module is to be found in the fact sheet (see Appendix, Section 6.2) and in the evaluation report of WP2 (Fichter et al., 2020).

What were the development needs?

Before the further development within the framework of S4S, the module was structured as follows:

- Scouting phase: Through various channels (personal known entrepreneurs and founders, start-up platforms, cooperation with the university's start-up centre or the technology and start-up centre of the city of Oldenburg), practice partners were sought who wanted to contribute a task to the module. The task was specified in advance between the lecturers and the practice partners.
- Kick-off: In a two-day event, the students were given teaching input on the topics of business model development and sustainable management in a condensed form, the company projects were presented, and the project groups were formed.
- Project phase: The project groups worked together with the practice partners on the agreed task. If necessary, further input was provided through coaching. The Sustainable Business Model was used as a methodology, and numerous additional materials are available in its online version.
- Presentations: An interim presentation in December and a final presentation in February.
- Examination: Interim presentation, final presentation, and project report.

The following needs of development had been identified within WP2:

Adjust teaching content and the schedule to individual student needs: Due to the breadth of the project tasks and the diversity of the practice partners on the one hand and the different study



programs of the students on the other hand, the compressed input of sustainable entrepreneurship concepts as well as methods and tools for sustainable business model development in a two-day kick-off did not turn out to be optimal. It was too demanding to provide all input in a two-day kick-off event. Since it was not clear to the students at this point what methods and tools, they would need to complete their tasks, some of the teaching content was not cognitively absorbed. One need was therefore to restructure teaching content, make it more flexible in part and present it differently in terms of time.

Revise workload and effort: In the summative evaluation of the module as well as in the evaluation within WP2, the students have confirmed for several rounds that the module is perceived as very interesting, challenging, and instructive and that the work with practice partners is appreciated, but that the workload is perceived as too high for 6 credit points and too high compared to other modules. There was therefore a need to ease the workload for the students without minimizing learning effects.

Include expectation management: During the explorative interviews and the conducted survey, students stated a lack of clear expectations and insufficient feedback processes. As Eco Venturing is conducted in team-teaching, two chairs and often 3-4 teachers are involved in the module. In the evaluation, students demanded equal assessment standards and better communication processes between the involved chairs.

Expand the scope of tasks and include ideation: In the past, it was a prerequisite that the business ideas to be dealt with already had a sufficient margin of maturity at the beginning of the module and that the task could be described as concretely as possible. The students' own ideas on how the problem underlying the business idea could possibly be solved differently were not given sufficient space. Therefore, there was a need to make the task broader in the sense of challenge-based learning and to give the students opportunities to develop their own ideas in an ideation phase.

Also include incumbents: In recent years, business ideas from start-ups or those interested in founding a company that were mission-driven and had a high sustainability potential have been increasingly processed. There was a need to integrate established companies in the region in the module in transforming their business fields to become more sustainable, too.

Implementation and testing

Involved partners, process, steps, time frame

During the S4S project time the module Eco-Venturing was conducted for times, each time with different adaptations. Following partners have been involved:

- 2018: EWE (EiVi, participants of EWE's incubator program) and BÜFA as well as other companies from the region of Oldenburg (Timbercoast cargo under sail UG, BIO-LUTIONS International AG, DISCO Streetwear).
- 2019 + 2020: CEWE.
- 2021: CEWE as well as other companies and start-ups of the northern Germany (HAIP solutions GmbH, kompakt61 GmbH, supazone UG, vertikali GmbH, Purpose Products GmbH).

What? How? When?

During the project duration of S4S the module was revised partly different times. Changes are shown in Figure 3.

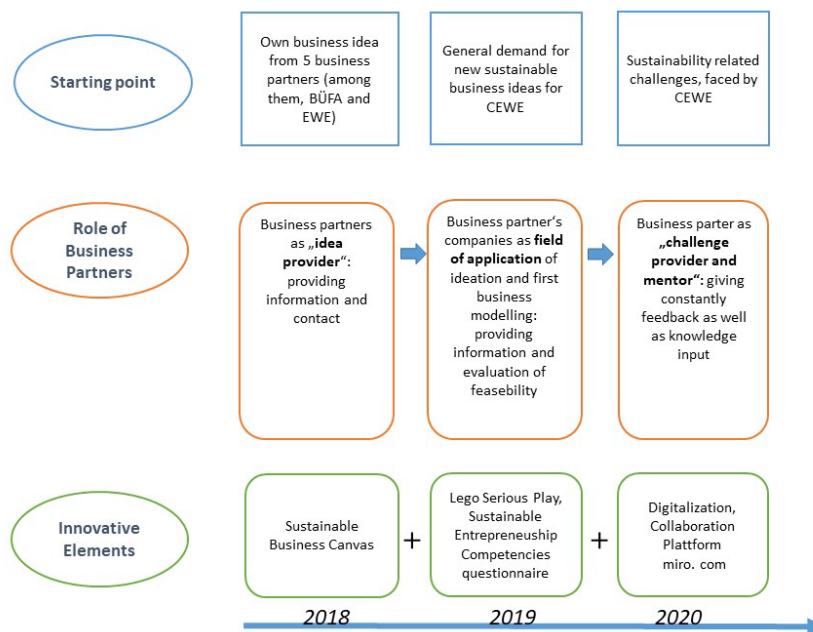


Figure 3. Conceptual changes of the module Eco-Venturing

Evaluation

How did it go?

Teaching content, module structure, workload, and effort: By revising the module structure, the before identified needs (see Introduction above) could be met. In particular, the teaching of knowledge was stretched over a longer period of time (instead of a two-days fulltime teaching unit). Smaller units are better absorbed by the students and - since they are now taught at a time that is oriented to their individual projects - better implemented in the actual project work. For lecturers, this means greater flexibility in the scope of the offered teaching content, as the methods of sustainable business development required for the current challenges can be addressed in a targeted manner. The new module structure has led to closer “in-class coaching” (all teams are coached during the sessions, more peer feedback, and more feedback from lecturers during classes), so that students have earlier clarity about project assignment, implementation and required workload. The (non-formal) feedback given at the end of the module, does not concentrate on too high workload anymore, although the overall demand for project work has not decreased.

Managing expectations: It has been possible to create a comparable approach of coaching. Closer agreements between the persons (and chairs) involved as well as the use of uniform evaluation and feedback forms have contributed to this. In addition, a checklist not only for students, but also a checklist for business partners explains the module requirements and expectations. Communication between lecturers and business partners during the module has been improved but could still be intensified.

Change in the scope of tasks: Regarding this point, different approaches had been tested. In 2019, an open ideation phase was included into the module for the first time. So, students were introduced to the company’s portfolio, strategies and current business model and then asked to come up with completely new ideas of sustainable products or services that would fit to the business partner. We found that although it was fun for the students, they also were very insecure if their ideas would be interesting to the company and felt inhibited to innovate. After this ideation phase and the selection



of the most promising ideas there was – compared with former runs – less time to develop the business models. The degree of elaborated details was lower in the end. For the business partner this was an interesting learning experience, but the project results had not been followed up. As it is a core idea of Eco-Venturing that student's projects results will be implemented in the company's business, the scope of the module had to be changed again. Now business partners bring in either a detailed sustainable innovation idea or a sustainability related challenge they are faced with, and students add their own ideas of solutions. So, ideation is part of the beginning of the module, but closer to the challenges provided by the business partners.

Type of business partners involved: During S4S we worked with incumbents (larger companies of the Oldenburg region) as well as with start-ups. A key finding is that the module structure works with both types of companies.

While working with established companies a key contact person (for lecturers and students) is necessary who promotes the student projects within the company. It has been possible to involve a larger number of managers from different functional areas of CEWE as project mentors. In 2020/21 students presented their project results additional to the (assessed) final presentation a second time (online) in front of the CEWE management and interested CEWE employees.

Evidence-based insights - Students' perspective

The module Eco-Venturing was evaluated after each consecution in different ways to assess the newly implemented features as well as to include the feedback into the ongoing development.

Students' perspective was evaluated by:

- (1) non-formal in-process evaluations
- (2) accompanied by formal module evaluation of the University of Oldenburg
- (3) using the Sustainable Entrepreneurship Competencies Questionnaire.

a) Non-formal in-process evaluations had been used to steer the specific conditions as well as demanded content of the lectures to be followed.

Most of the students highlight at the beginning that they would love to collaborate with business partners on "real world problems". In addition, a majority is interested in solving sustainability related challenges by developing new product ideas or business solutions.

After the final presentation (before submitting final reports) students were asked for feedback again. During classroom teaching this was organized as oral feedback, during online modules the voting platform mentimeter.com was used. Therefore, students regularly highlight again the cooperation with business partners, highly practical relevance, and increased method knowledge for business model development. As also asked for feedback for project individual needs of content, the teaching team was able to adapt teaching content.

b) Formal Module evaluations constitute an important part of a comprehensive teaching evaluation, whose goal is to continuously improve the quality of academic experience at the University of Oldenburg by giving students a chance to share their perspectives on the quality of modules and instruction. Modules to be evaluated are chosen by the University Management, so not each module is evaluated in every year. For Eco-Venturing, a central module evaluation took place in 2019/2020 and 2021/22. 2019/20, 12 out of 12 students of the module participated in the evaluation and graded the module as better as the reference group (= all module evaluations within the Department of Business Administration, Economics and Law).

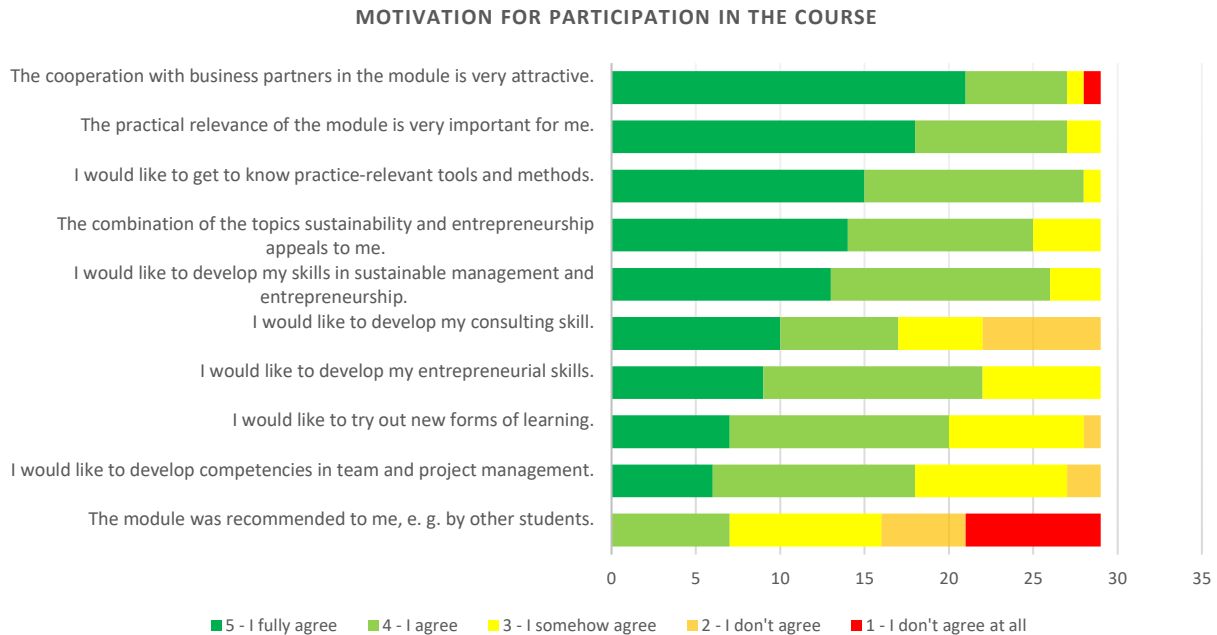


Figure 4. Motivation for participating in module Eco-Venturing (UOL), n=29 (2019, 2020)

c) The Sustainable Entrepreneurship Competencies Questionnaires had been used since 2019 to evaluate the competence development of the students during the module. Over all runs, 51 students had filled in the questionnaire at the beginning of the module. 42 students completed the questionnaire at the end of the respective module.

Over all modules, a significant development of competencies can be observed. Though the development differs within the examined field of competencies. For Eco-Venturing the most relevant development of competencies had occurred in the field of “system thinking competence” and “strategic thinking competence”. This corresponds to the learning objectives of the module and can be seen as an indication that the contents of the module are suitable for achieving these. Detailed evaluation can be found in appendix 5.3.

Evidence-based insights - Business partners’ perspective

The Feedback at the end of the final presentations from all participating members of CEWE was very positive. The creative ideas, intense analyses and professional presentations were highly appreciated.

For a more in-depth evaluation, the interview guidelines from WP2 had been used. Interview partners had been Dr. Matthias Hausmann and Sylvia Vespermann from CEWE who organized and supported Eco-Venturing from the company’s side.

Main objective for CEWE within this collaboration was “to get to know new perspectives from outside the company on company’s issues, get fresh knowledge and inspiration from a target group that might become customers, provide business insides as learning objects.”

The biggest challenge: “The biggest challenge is time, so good planning is extremely important. Both for CEWE and for the student side. It is important to make it clear to the students that it is not only about the credit points, but that it is also a unique opportunity to learn in a different way.”



What could be improved? “Active participation of more CEWE employees. Sometimes appointments could not be kept. Board members should not be scheduled.”

How important had the results been for the company? “Medium value. Difficult to get to know the company so well within a short time that ground-breaking innovations can be developed. It is more important for CEWE to offer a non-university place of learning and to receive feedback itself. Expectations on the part of the company must not be too high.”

Most important learning outcome/experience for the business partner? “New challenge that promotes individual development without being able to name it exactly. Insight into the Lego Serious Play method. Large interest in getting to know other methods as well.”

Contribution of the project results to the SDGs: “Good that the ideas had to be linked to Sustainable Development Goals. Therefore, the awareness of sustainability needs within the CEWE employees could be increased.”

Learnings

What is new and innovative compared to the earlier module

1) Intensive/exclusive cooperation with an established company:

With the exclusively cooperation with CEWE we changed the concept of the module. In retrospect, advantages and disadvantages can be observed.

Compared to mission-driven start-ups, CEWE is a long-established incumbent and European market leader in photofinishing. The need to transform the company towards more sustainability and climate friendliness has long been recognized by the management board. However, the product range itself has only been changed gradually in the past - on a large scale, sales are offset against CO₂. The understanding of sustainability requirements as well as the willingness to make fundamental changes to the product range varies within the company.

The students were confronted with these conditions to a greater extent than in previous years when mission-driven start-up project ideas were often provided. In this way, they learned to take in different perspectives and to better communicate concerns of sustainable business model development. In this way, students are better prepared for their role as future change agents within established companies.

Another advantage is the integration of company employees from different functional areas into the module. On the one hand, the experiences and implementation knowledge from practice could be integrated as teaching input. On the other hand, decision-makers in the company were sensitized to the issues of sustainable business model development and so the module could support the transformation process.

It can be seen as a disadvantage that the spectrum of different business ideas is limited to one industry. Students love working with young start-ups and often are more motivated to become active in a young business environment themselves. Through a portfolio of project ideas, the individual project works cross-fertilize each other and for the participating business partners, the view beyond the horizon during the project presentation is very interesting, too.

2) Competence assessment

It is common practice that all modules offered at the University of Oldenburg are reviewed by a central module evaluation. This central evaluation was always supplemented in the Eco-Venturing module by non-formal feedback from the students. What is new and innovative is that for the past



three years an assessment of the development of the students' sustainable entrepreneurship competences has been carried out. The aim is to check whether a desired development of these competences takes place through the teaching module and in which competence areas this occurs primarily. Challenges faced with the implementation of the competence assessment have been described in 1.5.2.

3) Challenge-based Learning

The content of the module has evolved from case-based learning to challenge-based learning. Whereas in the past students were presented with very concrete business or innovation problems, in the past two years the projects were designed more as open challenges. By this, more room was provided for the students to create innovative and sustainable solutions. Also, more attention was paid to the evaluation of different possible solutions and the further development of a favoured variant. This trained strategic competences of students in particular.

4) Digitalization

Forced by the Corona pandemic, a fast development of digital teaching and working took place. These aspects were not intended beforehand but led to several learning effects in the design of the module in 2020/2021.

Online teaching in video-conference sessions: A major advantage is that the time required for all participants, especially also for company employees, to attend an online instead of an in-class event has been reduced due to the elimination of commuting time. A very large number of company employees were motivated to participate in the module last semester. Even a subsidiary company based in Paris could be integrated without any problems. An additional project pitch was organised in which the project results could be presented to other managers of the company. To make it possible for many employees to participate in such presentations, such low threshold forms of presentation are very advantageous.

Online-coaching: The student's possibility to meet their coaches via online-coaching was highly appreciated by them. Since there were only a few groups, appointments could be made very flexibly and often at short notice. Especially in the second half of the semester, this possibility was frequently used by the project groups.

Online-collaboration: Online-collaboration had to be learned by all participants. Of module, this was not limited to the module. However, the selection of suitable tools was challenging at the beginning. On the one hand, work processes should be as similar as possible to those previously, possible even at a physical distance. On the other hand, various technical prerequisites had to be considered among the participants and it had to be considered that everyone was currently facing with various tools, which could lead to a kind of "interface losses". A smooth collaboration platform was needed, where student teams could work on during the entire process (together at the same time as well as remote) and necessary tools for the venturing project could be inserted. After investigating the market miro.com was chosen by the teaching team and adapted to the module needs. The collaboration within the project teams via Miro worked very well for ideation and structuring the project management and was highly appreciated. But there were some concerns on the part of the company to post company internals there. So before choosing online tools, the confidentiality needs of the practice partners must be assessed and the right conclusions drawn.

5) Organization

The schedule was restructured to make it more flexible. The bi-weekly sessions allowed reacting to the concrete needs of the students for tools and methods for the respective project. The digital version made simultaneous teaching sessions in breakout rooms possible. So different input could be



provided at the same time, and student teams could split and gain knowledge that they could assemble in the teams as needed. The previously obligatory interim evaluation was changed to an interim presentation with peer feedback. It is likely that this has reduced the pressure of assessment and the time to prepare the interim presentation.

In the case of S4S, it was an advantage to work with a large and established business partner over several years. The S4S team member was able to bundle the information from the university and convey it into the company. The assignment of "challenge mentors" in the company promoted a sense of ownership and positively supported the additional coaching.

Furthermore, it should be mentioned that the organization of the module has been improved. More frequent coordination intervals between the participating chairs, as well as collegial feedback could improve the "teaching from a single source".

What is new and innovative compared to other HEIs

Eco-Venturing, which is being offered since 2009, was the first module worldwide with students developing sustainability-orientated business concepts in co-operation with business partners aiming at the promotion of tangible green business start-ups and new business units. The further development of the Eco-Venturing module within WP 3 and 4 make the module still a unique curricular offer in collaborative green venturing. Besides the new elements and features described above, the conceptual framing of the module as an approach of challenge-based learning seems an important step ahead. The module is still unique compared to other HEIs, because it offers a continuous and regular curricular offer to master students from different disciplines to develop their sustainable entrepreneurship competencies and interests in a real-world collaborative learning setting with business partners.

Feasibility? Scalability? Transferability?

The module in its current form remains a work-intensive combined learning, teaching and transfer format. Success stands and falls with a good selection (and also supervision) of the practice partners in advance, the individual coordination of project goals and assessment principles, individualized teaching content and intensive coaching. Hence, an adequate number of teaching staff must be planned for. Standardized templates (e.g., for project management) and digitized module content from which students can choose as needed can reduce the amount of work required each year.

A sound network of potential practice partners in the region and an increased awareness of the collaboration approach over time facilitates the scouting process. Therefore, good networking facilities within the start-up ecosystem but also the transfer actors of the university as well as the business development support system of the region are advantageous.

In general, it would be desirable to offer the module to more study disciplines to make it more transdisciplinary. At the University of Oldenburg (UOL), we realized different hurdles for this intention. One is, that UOL does not offer technical studies. Other hurdles occur due to its nature as curricular approach. There are different internal restrictions to be changed if students of other study modules would like to implement the module Eco-Venturing into their curriculum.

To scale the approach, the project materials produced by Scaleup4Sustainability will motivate other higher education institutions to adopt this teaching approach. We consider the concept to be transferable to many other HEIs.



Future activities

The Eco-Venturing module will continue to be offered as part of the regular study program, but under the new title “Sustainable Venturing” to emphasize its holistic sustainability demand.

The restructuring of the lectures will be retained. There are also many advantages in the (forced) digitalization. While a minimum of presence at the beginning and at the end of the module is considered mandatory also for personal contact and social interaction, it is planned to maintain the bi-weekly teaching activities in the first half of the module online.

An additional presentation to other interested staff members of the business partners as an online format will be tested next year.

The linking of different modules within the consortium via a Europe-wide digital competition (European Sustainable Innovation Contest, see 2.2.1) is to continue. It gives students additional motivation for project work and the opportunity to discuss in international and interdisciplinary mixed teams and to develop their language and collaborative skills. Therefore, a mandatory video pitch as part of the assessed final presentation is planned.

Our experience shows that a fully free ideation phase for the students which is not guided by a real-world challenge in the beginning of the module decreases the chances of meeting actual market or social needs and reduces the potential viability of sustainability ideas substantially. Therefore, we are critical of the inclusion of a “fully free” ideation phase for the students as part of the Sustainable Venturing module. The testing of different degrees of guided ideation in WP 3 and 4 shows that it needs a well-balanced combination of a rather concrete real-world based sustainability problem description (the challenge) and an ideation phase for students clearly oriented to the defined challenge.



2.1.2 Digitalizing and Upscaling of the module “Fujifilm Future Challenge (FFC)”

Introduction

The FFC-program is about sustainable entrepreneurship, the creation and exploitation of technology-intensive business opportunities to develop sustainable products and services for customers. The module provides insights into the process of “green” ideation and customer validation at a high-tech company (Fujifilm).

Fujifilm is the world's largest photographic and imaging company. In addition, they are leading innovators in the fields of bioengineering, energy and environment, medicine, and membranes. Fujifilm has a mission to improve the quality of life for people worldwide. To do so they need the assistance of students, who are challenged to re-invent the future and develop (radical) new solutions to big societal problems.

The goal of the Fujifilm Future Challenge is to co-create with Fujifilm to develop new sustainable business. The best idea is awarded the Fujifilm Future Innovation Award. The best team is introduced to the European top management at Fujifilm during an all-expenses-paid trip to Barcelona.

Entrepreneurial students from universities within and outside Europe participate. The program leads to new and tested business models for Fujifilm. This requires a fruitful co-creation between student participants and R&D-managers of Fujifilm to develop radical new ideas, which are economical feasible and technological viable. Simultaneously, the proposed business models are tested using the feedback of real (potential) customers. The proposed business ideas should contribute to the solving or alleviation of a societal, ecological, or social issue. The module provides a broad range of insights in creativity, innovation, and design thinking. The plenary sessions in combination with coaching, teamwork and self-study enable the participants to critically evaluate and discuss sustainable entrepreneurship. In Table 4, we summarize the developments of the Fujifilm challenge in the period 2018-2020.

What’s new?

- The FFC focuses on radical ideation and system innovation (in contrast to product or process innovation).
- In contrast to hackathons, initial business models in the FFC must be tested at ‘real’ potential customers and consequently adapted.
- The FFC focuses on wicked sustainable or societal issues.

Development needs

We formulated the following development needs:

- Improve process coaching of student teams.
- Improve innovativeness of ideas (training, tools).
- More in-depth analysis of the business ideas.
- More added value of learning communities.
- Larger international scale.
- New digital format.
- New tools (checklists, templates, progress monitor).



- More diverse teams (variety in functional background and nationality).
- Increase the added value for Fujifilm.
- Lower drop-out ratio of student teams.

Table 4. Developments of the Fujifilm Future Challenge in the period 2018-2020

Nature of the challenge	New sustainable applications in general	New technical applications of membranes etc	Sustainable applications in healthcare, environment, energy
Role of the business partner	Passive answering Q&A, tech answers only	Semi-active answering Q&A; tech answers + info concerning markets	Active co-creation; tech answers + info concerning markets + coaching
Teams of participants	Mono cultural, 1 university per team, Dutch + Belgian nationalities	Multi- cultural, 1 university per team, Dutch + Belgian nationalities	Multi-cultural, several universities per team, multiple nationalities
Innovative elements	Real-world challenge at high-tech company	New creativity tools including exercises More Fujifilm R&D staff involved	More new tools, Larger scale, Intensify Coaching, Progress monitoring digital edu format, more quantitative business proposals
	2018	2019	2020

The FFC-module has the following learning objectives. Students should:

- understand the theoretical concepts of sustainable entrepreneurship and innovation management
- understand the key aspects of a new venture.
- develop a commercial and financially feasible business model for a sustainable high-tech start-up.

For more information about the module: see the fact sheet in the appendix and S4S-website (educational templates and tools).

Involved partners

With the Open Innovation Hub of Fujifilm, students learn to work with new technologies. Fujifilm's expertise is combined with the fresh new ideas of students in order to contribute to a better world. The students have access to specialists at Fujifilm and will be coached to develop ideas, spot opportunities and test how their ideas could fit on the market in a great international company. They learn about creativity, innovation and acting like an entrepreneur.



Process steps and time frame

The challenge is to develop and test new product ideas based on the technologies of Fujifilm. In ten weeks, students develop new business ideas based on new creativity tools and test these at real customers. We introduce, discuss and experiment with the different phases of creativity, as is illustrated in Figure 5. The students are part of a highly international teams and meet (virtually or in person) with their team members and with all other participating teams. Fujifilm gives direct feedback. Weekly, process coaches are assisting the teams. The teams prepare 2 videos, 2 business model canvasses (one initial and one tested) and a poster presentation. Finally, they pitch their adapted business models to an expert jury. Over a period of three months, they will face all the key facets of innovation and sustainable entrepreneurship.

Implementation

Within the S4S project the FFC-module was further developed. The module contributes to the quality of teaching at Universities in The Netherlands (Universities of Tilburg and Twente, University of Applied Sciences Avans), Belgium (Thomas More University of Applied Sciences), Sweden (LiU) and Germany (UOL), as a practical case study at a real international high-tech company.

The basic structure of the module was developed by VAS in collaboration with the academic partners before the outbreak of the corona pandemic. Meeting our development demands of upscaling and digitalization and due to the Coronavirus, we changed to formula of the 5th edition to fully online.

To professionalize the FFC, several meetings were held to discuss the objectives, content, and tasks for successful implementation. Against the backdrop of the corona pandemic VAS developed a digital version of the FFC with the following module structure:

- Three plenary sessions (kick off, midterm and final).
- Weekly coaching sessions (1h).
- Team learning in frequent team meetings (own initiative and responsibility of the teams).

In the plenary sessions, tools and frameworks were introduced and discussed about creative problem-solving, ideation, how to obtain customer feedback etc.

In the 5th edition of the Fujifilm Future Challenge 2020, 11 international teams developed innovative and feasible “green” ideas for Fujifilm’s healthcare, energy, and environment markets. These markets are increasingly important to implement Fujifilm's mission: to improve the quality of life for people worldwide. In total, 52 students from 5 different Universities created and tested sustainable business ideas in an international setting. Students with the following nationalities participated: American, Bulgarian, Chinese, Dutch, German, Italian, Kosovarian, Polish, and Swedish. The students had various backgrounds: technical, creative, and business. Some teams consisted of students from different universities and met each other only virtually. The Fujifilm Future Challenge (FFC) is a co-creation between industry and academia, a learning community about international entrepreneurship. In the Fujifilm Future Challenge 2020, several virtual plenary tool-sessions were included as well as meetings between team members and their coaches about ideation and customer validation. In 10 weeks, international teams have developed innovative and feasible “green” business models and tested these at real customers. In the 5th edition of the FFC, we gained experience with online tools (Zoom, Mentimeter). The team presented and defended their ideas online in front of a jury (Managers from Fujifilm and the academic partners from S4S). The participating teams quantified their initial and validated business models on paper; they summarized the main aspects in a systemic way included social and ecological implications.



During the kick-off session, the teams presented themselves in short video pitches. The manager of the Fujifilm’s Open Innovation Hub introduced the company and its core technologies. To facilitate the “out-of-the-box thinking”, we introduced creativity tools, aimed to consider different perspectives (“zooming in and out”) and to shift from product innovation to systemic innovation: considering the complete picture of systemic innovation instead of the product aspect only.

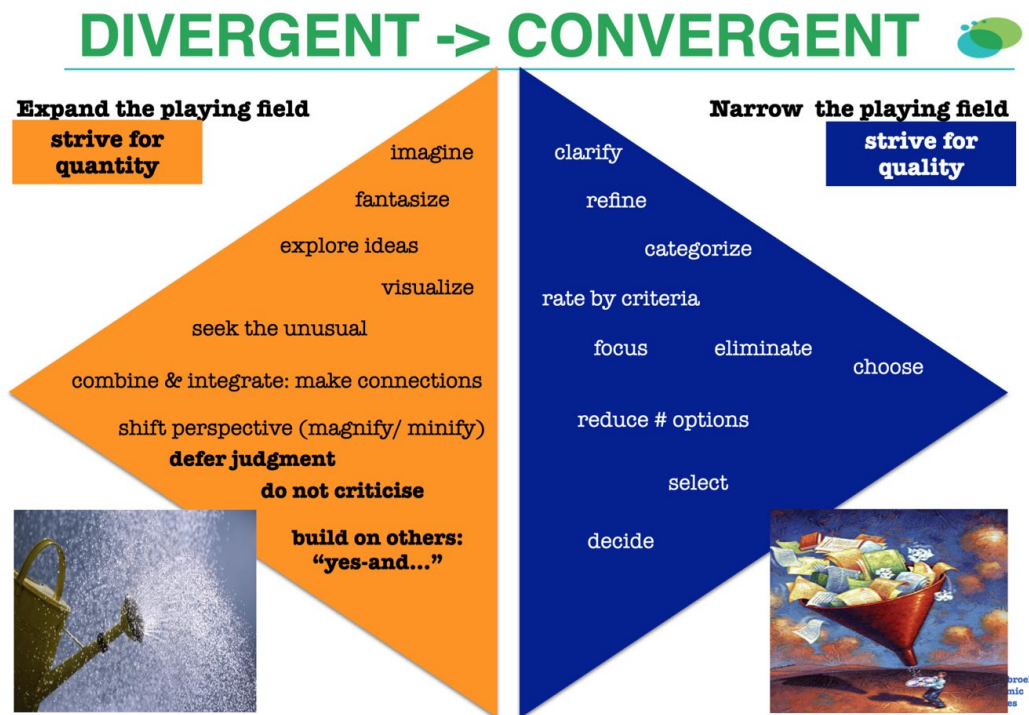


Figure 5. Different creativity tools in two creativity phases

Throughout, five technical experts from Fujifilm gave the participants direct support and feedback. In the 5th edition of the FFC, seven process coaches guided and monitored the progress of the teams. In 10 weeks, they developed new business ideas using creativity and customer development tools. In learning communities, they met with and learned from each other. The teams collaborated and competed at the same time to win the prize: a trip to Barcelona provided by Fujifilm. Participants were encouraged to benefit from each other’s different strengths, background, knowledge, and skills.

As much as possible, we created diverse student teams in which a variety of educational technological, creative, or business backgrounds were covered: multimedia design, (food) innovation, economics, (international) business, entrepreneurship, IT, safety, (chemical) technology, engineering, marketing, logistics, and even cognitive neuroscience.

We encouraged the students to start with a societal problem, and to experiment with idea-networking with people outside their teams. Technology is an enabler, not the main goal of the innovation!

Apart from the creativity tools, we introduced a new tool to finetune the program: a weekly progress monitor (see Figure 6). Using this tool, coaches and participants reflected and tested the achievement.



1. Please rate the progress of your team for the past week

Scale: Never (0%) -Sometimes-About half the time-Most of the time-Always (100%)

- a. The team is committed to achieve its goals
- b. The team works efficiently (divides up the tasks, monitors progress)
- c. The team is quality oriented (is willing to make changes to do better)
- d. The team is learning from experiences (demonstrates knowledge based on reflection and experience)
- e. The team is creative (demonstrates use of non-linear / out of the box idea generation)
- f. The team works according to agreements (tasks and deadlines)
- g. The team puts advice from the coach into practice
- h. The team coaching interaction process is positive (communication and feedback)

2. ***Did the team make progress since the last coaching?*** Yes (1) / No (2)

3. ***Describe the main advice to the team***

Figure 6. Progress monitor of the Fujifilm Future Challenge

According to the monitor, the students learned a lot from their experiences (76.9% score) and they put the advices of the coaches into practice (81.3%). The creativity of the teams varied, as well as their ability to meet tasks and deadlines, and their efficiency. The progress monitor is a useful tool to adjust timely coaching approaches. It supplies frequent feedback during the challenge program.

The participants tested their ideas at real customers. To facilitate this, we introduced Customer Development tools.

In breakout sessions, coaches and the Fujifilm staff assisted the participants to become more aware of their underlying assumptions (Hypotheses) of the defined initial problems in relation to the suggested solutions. In addition, we discussed how at whom to test these assumptions. In the Fujifilm Future Challenge, the teams also were stimulated to increase the economic practicality of their initial business models.

In the Second plenary session, the “Midterm” session, we evaluated the first period of 5 weeks: what were the lessons learned, eye openers and which hurdles had the teams experience. In infographics or short video presentations, the teams presented the value propositions of their business ideas (see Figure 7). In break-out rooms, the teams prepared the second part of the program that involves the validation, feasibility, and presentation of the business ideas.



Some examples of business ideas

Team "InPrimis" of Avans School of International Studies (ASIS) and Linköping University was awarded by the jury for their idea was of a sophisticated contact lens which helps people who are oversensitive to light and certain colours and intensity of light, coined "AUXULUS". They won the Fujifilm Future Challenge: a trip to Barcelona. In addition, based on the assessment of the audience, they won the Scaleup4Sustainability Originality Award.

FUJIFILM Regenerantia

All-In-One Solution for Burn Wounds

- Doesn't stick to the wound
- Relieves pain
- Protection against external influences
- Easy to use
- Little care necessary
- Helps the body to heal faster

Top Layer
part of the pad, protection against clothing, dirt and other external influences

Bottom Layer
To be removed before use, part of the packaging, serves to protect the pad

Main Layer
Hydrogel mixed with Astaxanthin and local numbing agents

The Belgian team "Futureous" from Thomas More University pitched their "REGENERANTIA" idea to develop a patch with artificial astaxanthin, a pain killer and anti-itching integrated for the treatment of patients with burns. Both very good examples of products solving societal issues by using Fujifilm technology. Team "Futureous" won the audience S4S-award with the best total score on novelty, feasibility and sustainability.

created by THE FUTURIOUS

Figure 7. Example of an infographic of the Fujifilm Future Challenge

The most sustainable and feasible plan was developed by the international team "Virtual Brainz", with their idea of Cooltrash Waste collection, the 3rd S4S-award winning team. The Virtual Brainz team consisted of two students from Tilburg University and the University of Oldenburg.



Research

The FFC involves research as well. In a multiyear scientific program of the Fujifilm Challenge, we analyse the impact of the Innovators DNA (Dyer, Gregersen, & Christensen, 2008, 2009) and entrepreneurial orientation, entrepreneurial intention (Linan, Rodríguez-Cohard & Rueda-Cantucho, 2011) and self-efficacy of the participants on new venture performance (McGee, Peterson, Mueller & Sequia, 2009; Rosique-Blasco, Madrid-Guijarro & García Pérez de Lema, 2017). See Section 1.5.3 (Tool for evaluation of entrepreneurial & innovative traits of students).

Content of end presentations («pitches»)

The presentation included a description of the validated business model:

- (1) What do you offer (value proposition, pain in the market /gain)?
- (2) To whom do you sell (customer segments, channels)?
- (3) How do you implement (activities, partners)?
- (4) What are the revenue mechanisms (cost and income categories quantified)?

The teams used checklists developed by the academic partners of the FFC (see S4S-website).

Evaluation

The commitment and the progress of the participants scored high: 79.4%, and 75.0%, respectively. In the ideation phase, participants enjoyed their creative teamwork at a “real” high-tech company. They liked the open character of the challenge and to work on “solutions that matter” in an international setting.

The students mentioned several eye openers regarding ideation: it’s hard to find ideas with great potential; inventing a radical new product is a long and hard process. Moreover, selecting the best ideas is pretty difficult. Team members got inspired by each other to think further, deeper. They learned to respect other team members visions and opinions and being open to each other ideas to find a solution together. Teamwork and planning were considered to be essential, as well as multitasking.

Although teamwork was appreciated, it was difficult as well. Some participants mentioned the need to communicate more in offline meetings. The coaches advised the teams to broaden their scope, to generate more diverse ideas. Some teams focused too quickly on solutions. The coaches also stimulated working together, interacting, and communicating more instead of working individually. Sometimes, it was difficult to give room to the different people in the team, with different interests and expertise. Some teams were advised to be more pro-active instead re-active.

Some students were overwhelmed and did not to know how to start. It was difficult to see the bigger picture of the ‘wicked’ problems. Thinking outside the box in a field you don’t have any expertise in is not easy! The same applied for assessing feasibility and viability based on Fujifilm's core technology. Sometimes, teams struggled to handle a group member who was not active enough, some teams lost team members. Also, time management was quite challenging for some teams.

Teachers evaluated the FFC-program as well. They appreciated the new teaching materials (checklists, playbooks etc.). Given the nature of the challenge (international student teams developing radical innovations), coaching of educational staff is a critical success factor. The teachers valued the training offered to professionalize their coaching skills. The student teams have a substantial risk to under- perform in case engagement, coaching skills or time of educational staff is lacking. Therefore, an open attitude towards learning new coaching skills is essential.



The FFC was carried out as extracurricular program (for A+ honor or challenge students⁵) and as part of existing curricula. The intensity of the FFC requires a substantial time spending. Therefore, it is recommended to organize programs like the FFC as part of curricula in the latter phase of Bachelor programs or in Master tracks.

Regarding the evaluation of the company: Fujifilm considers an attitude of co-organizing and adapting to new requirements an essential success factor for the FFC. A co-creation program is considered to be a joint learning process. Joint learning leads to increased added value for the company.

This implies investing time of educational staff and the company in developing the formula of the challenge program.

Learnings

The following items are new and innovative compared to (a) earlier editions of the FFC; (b) existing approaches at the respective HEI, and (c) compared to other existing forms of student-business-collaboration or the teaching concepts within the field of sustainable entrepreneurship:

- Improved innovativeness of ideas due to creativity training and exercising new tools.
- Explicit co-opetition (Brandenburger & Nalebuff, 1996) learning communities concerning sustainable entrepreneurship.
- Systematic weekly process coaching led to lower drop-out ratio of student teams.
- Use of new guiding tools led to more in-depth analysis of the business ideas.
- Larger international scale was possible with students from various nationalities.
- New digital formats of workshops are essential.
- New sustainable entrepreneurship tools (assessment documents, templates, progress monitor, playbook).

Transferability - Feasibility, and Scalability

Essential critical success factors for transferability, feasibility and scalability are:

- The quality of the partnership with the company (supplier of the challenges); Fujifilm takes an active role in the evaluation and further development of the FFC. The collaboration is long-term and the nature of it is intense. Therefore, Fujifilm is a co-creator of the module.
- Funding of the module. Funding is first dependent upon integration of the module in the curricula of the universities including granting ECTS credits. Therefore, the module must be assessed by examination boards of the universities. The requirements vary per university and educational track. Since it is a resource demanding module, the FFC has further used temporary project funding to add more resources for implementation.
- A development budget (in time and money) should be available. Challenge-based learning programs like the FFC are appealing for students but require substantial time effort for educational (and business) staff. Spending time depends also on the commitment of the involved staff to a module.

⁵ At Twente University, an additional track for excellent students is coined "Honor programma". Avans uses the name "challenge program for comparable programs.



- Digital tools are essential for scalability. Supplying these tools implies online instruction how to use of these. In the FFC, we developed digital tools and gave instructions.
- Feasibility is dependent upon the possibility to make use of a digital platform that integrates process, tools, documents, and deliverables. These have been developed for the FFC.
- Scalability implies the possibility to implement a module online. We found proof to execute the FFC fully online. A hybrid version is also possible.

Future activities

- We will conduct motivation interviews before a new edition starts to recruit and select potential participants.
- We will add more team diversity and larger scale by integrating students from other universities within and outside Europe including technology and creative backgrounds.
- We will introduce new digital tools towards team building of virtual teams and inter-cultural collaboration.
- We will spend more time to prepare coaches and to discuss the results of the progress monitor during the challenge.
- We will introduce a digital tool regarding time-management and will explain time spending more in detail.
- We will supply more digital creativity and customer development content tools as substitute of plenary instruction (videos + exercises).
- We will experiment with a hybrid version: partly virtual, partly physical.



2.1.3 Revision of the module “Environmentally Driven Business Development”

Introduction

This 6 ECTS module has been offered since 2013 to engineering students at Linköping University and is a collaboration between the research groups of Environmental Technology and Management, and Project, Innovation and Entrepreneurship both at the Department of Management and Engineering. It was originally developed as an elective module for students at the Masters’ level for the engineering program Energy, Environment and Management. Later, also students from Industrial Economics Engineering could attend and similar modules are offered to several educational programs at the university but with less focus on environment and sustainability. Number of students have increase from 15 to more than 50.

In short, the module combines environment, sustainability, innovation and entrepreneurship and the students develop their own business ideas that must contribute to solve an environmental problem. To support this development the module combines theoretical lectures, a literature seminar and several practical workshops in which students apply different process and analytical tools on their business idea. NABC (Need, Approach, Benefit, Competition), Sustainable Business Model Canvas and Porters five forces are central frameworks. Idea generation, Shitty prototyping and Value Creation Forum are central activities on top of lectures and workshops. The business idea is described in a report and at the end of the module presented at a fair there the ideas are pitched to students and external guests. The report covers a thorough description and analysis on the idea and its business model, market analyses, organization of a tentative start-up or division of an existing company etc. There is also a written exam to assess the students theoretical learning. Over the years 40 business plan reports have been developed and three student start-ups have developed their ideas in the module. See fact sheet and detailed playbook in appendix 5.5 for more details of the module.

Based on the work in WP2 and our earlier observations we started in the autumn of 2019 to develop and implement some changes to the module. The changes relate to:

- Involvement of a business partner (Tekniska verken) throughout the module. Previously, business partners had mainly been involved at the start of the module and in a guest lecture.
- New format for idea generation seminar.
- Improved format for feedback on project reports.
- Increased focus on sustainability dimensions of entrepreneurship. This to make the module more suitable for students with diverse backgrounds often lacking a deeper knowledge in environment and sustainability.

As for any module we also had to adjust our learning activities due to the pandemic. The overall structure and activities were intact and below we describe the changes implemented 2019-2021. In 2019 all teaching activities were on campus, in 2020 the first half was on campus and due to the pandemic, the second half was fully on-line. In 2021 idea generation seminar, literature seminar and all lectures were on-line, while workshops, a Value Creation Forum, supervision of project reports and final exhibition were on campus.



Implementation

Tekniska verken (see section 1.2) had an interest in testing how students could develop new solutions based on their existing patents and identified challenges. Starting in 2019 they became more involved in the module both to learn how the university educate students in these topics and to add an external business perspective to the module. The collaboration continued in 2020 and 2021.

Early in the module, at an idea generation seminar the provided challenges and patents which the student could use for inspiration, and they also give a lecture on how they work with innovation. This is further described below. When students have worked for some weeks with their ideas Tekniska verken take part at the Value Creation Forum (VCF) and give feedback. Feedback is also given to some groups throughout the module if the idea is close to Tekniska verken activities and competences. Finally, in 2019 and 2021 they provided exhibition space and hosted the final exhibition to discuss and give feedback on the results from the student projects. As of now, Tekniska verken is working internally investigating if some of the student ideas can be further developed.

As describe above we made some changes in the idea generation seminar. The set-up for this 90-minute-long seminar is that teachers introduced the topic and expected outcome of the event. The students are instructed to start thinking of ideas to develop during the module and to form transdisciplinary project groups, i.e., mixing industrial economics students with sustainability engineering students. Some examples of earlier project works are presented and an inspirational film from YouTube is broadcasted (<https://www.youtube.com/watch?v=dfapR1Ev4AE>). After this Tekniska verken present themselves, their activities and especially how they work with innovation and business development. This is ended by introducing the challenges and patents. Challenges have been identified in the areas of solar energy, energy storage, digital transformation, new business areas for biogas, plastic waste utilization, next generation district heating and electricity trade and customer values etc. The patents were in the areas of automated analysis of pipes, balancing of thermal, adaptive cleaning of nitrous gases and energy storage. An example of how a challenge could look like is shown in Figure 8.

The students are not limited to select business cases based on the challenges from Tekniska verken but can identify and develop their own ideas. After forming groups, the students decided one or a few tentative business ideas to develop further. Depending on number of students, approximately 10 new business ideas are identified at the seminar and for each year two to and five of these were based on the provided challenges from Tekniska verken and the rest were the students' own ideas.

Next developed approach was the work with giving feedback on reports written to describe the business ideas. First, we developed the template for report structure and content to clarify the requirements on the report. We also improved the documentation on the learning platform to clarify the connection between the workshops and the report. The last improvement was to change the format of giving feedback to several student groups at the same time to instead give feedback to one group at the time. This increased the interaction between students and teachers and students dared to ask more questions, facilitating increased learning and more clarity on teachers' expectations on the report.



New business areas for biogas

One of the most environmentally friendly fuels available today faces major market challenges. Identify new business opportunities for future marketing of this resource-efficient product.



Figure 8. Example of a business challenge to be used by students as inspiration for their own development of a new business idea.

Finally, earlier student groups had asked for even more in-depth knowledge on sustainable innovation and entrepreneurship. To answer to this request existing lectures were incorporating sustainability to an even higher extent and a new lecture focusing on sustainable and circular business models was developed. The new lecture presented novel research describing typologies and approaches to new business models and connected this to real life cases so that students could relate to their own business development project.

To emphasize the social and ethical dimension of sustainability we further incorporated a seminar on Responsible innovation to make the students reflect upon ethical aspects of their own development project. This approach was the same as described in section 2.1.4 focusing the development of the InGenious Module.

Comment on digitalization

The work of digitalizing the module had started before the pandemic and was motivated mainly by pedagogic reasons, efficiency, and resilience. Having e.g., all teaching material on-line including several recorded lectures made it possible for students to always have up-to-date instructions and workshop materials as well as the possibility to listen to the lectures once more or catching up if they had missed the live lecture. Of course, the pandemic forced us to speed up the process of digitalization and to record all lectures and provide even more on-line tools. We found much of the digitalization as very valuable and will use much of the developed material even if the module hopefully will be offered on campus in future. Some developments due to digitalization is further describe below.

The VCF is a slightly modified workshop (Kingston, 2007) where students develop a graphical presentation which is pitched to an audience (students, teachers, officer from business partners etc). Individuals in the audience gives feedback using different attributes such as coloured hats, sunglasses etc to indicated a given role of the person giving the feedback. We used green hat for the person



finding strengths, a red hat for the more critical but still constructive feedback, yellow hat for the investor and sunglasses for the tentative customers. All feedback is written down and some questions are raised in public at the seminar generating a discussion on what could be developed further. In the original format (used up to 2019) students designed a simple poster and written feedback was given on coloured post-it notes. An online version was further developed where the students instead made a PowerPoint presentation and feedback was given via Microsoft Forms. In 2021 we used a hybrid form combining presentations in front of an audience in a lecture hall, the use of physical hats and written feedback via Microsoft Forms. This made it possible to have a good interaction and discussion but keeping distance between participants.

For on-line workshops we mainly used Mural and created one Mural for each student group on which they had access to templates and instructions for all workshops. Additional material is available at the learning platform. These Murals were used even if the workshops were on campus.

The largest challenge with digitalization was to change the format of the final exhibition. This event is highly appreciated by students and other visitors since it stimulates creativity and lead to high activity among participants. Each student group have an exhibition screen and is free to present their developed idea in any format. It can be using posters, physical artefacts, digital presentations etc. Students are both exhibitors and visitors (they change role half-way through the event) and each visitor have a symbolic amount of money to invest in the ideas in three categories: best idea, best exhibition screen and best pitch. At the end the student team with most invested money gets a symbolic prize. Since this approach was not possible during 2020, we instead developed the first version of a contest using filmed pitches instead of exhibition screens. Each student team made a 3-minute movie describing their idea and a 30 sec pitch. Prior to the seminar each student was instructed to watch all movies and find the top three of the category's best idea and best movie. Thereafter, all students joined an online seminar in which we looked at all pitch movies. Thereafter the students worked in breakout rooms (the same group members that had jointly developed their own idea) and decided on their top three candidates in both categories. After a while the students re-joined the main Zoom room and presented their top three candidates and based on all groups, we found a winner in each category. The three best ideas were also invited to represent Sweden in the European Sustainable Innovation Contest which is further describe in section 2.2.3.

Evaluation

To assess the implemented changes, we used voluntary on-line assessments following the standard routines for the university and assessments done by a student union for management students. The on-line assessment had low answering rates (around 6 students each year) and in the assessment from the student union only a handful of students participated. This can explain that student satisfaction varied over years. Some were very satisfied with the overall implementation of the module rating it between four and five on a scale from zero to five, while some were more critical giving it 3 and in some cases 2. The assessments did not include any specific questions regarding the changes presented above. But from free text answers and the student union evaluation, negative comments were mainly about the time-planning of the module (it stretches over a full semester and could benefit from being more condensed). No negative comments were made related to the changes. On the contrary, feedback on reports and the idea generation seminar were mentioned as activities especially appreciated by the students. In 2020 students were asked if the implementation of the module had worked despite the pandemics and the answers were two each for category 3, 4 and 5 meaning that the pandemic had no significant impact in the implementation.

Further we applied the survey on development of students' sustainable entrepreneurship competencies (skills and attitudes). For 2020 we got an indication of a positive impact but due to



methodological problems it was impossible to see if this was an effect of drop-out (not all students answered the survey both at the start and the end of the module). From this analysis we further developed the survey (see section 1.5.2) and did a new survey in 2021. We were now able to track each student’s answers with preserved anonymity. Figure 9 shows the answers related to Strategic Action Competence from 26 students answering the survey at the start and end of the module. It is evident that for all statements/criteria the students had changed their skills and attitudes showing a positive impact of the module (statistically significant, see further in Appendix 6.6). Strategic Action is the competence that developed the most, however all six categories show a development (not significant for Interpersonal competence, see Appendix 6.6). In addition to the assessed competencies the survey also collects information about the students’ entrepreneurial intentions in the near future (5-10 years). With this module we aim to increase the interest for sustainable entrepreneurship, this was however not observed in the results (Appendix 5.6, Figure 5).

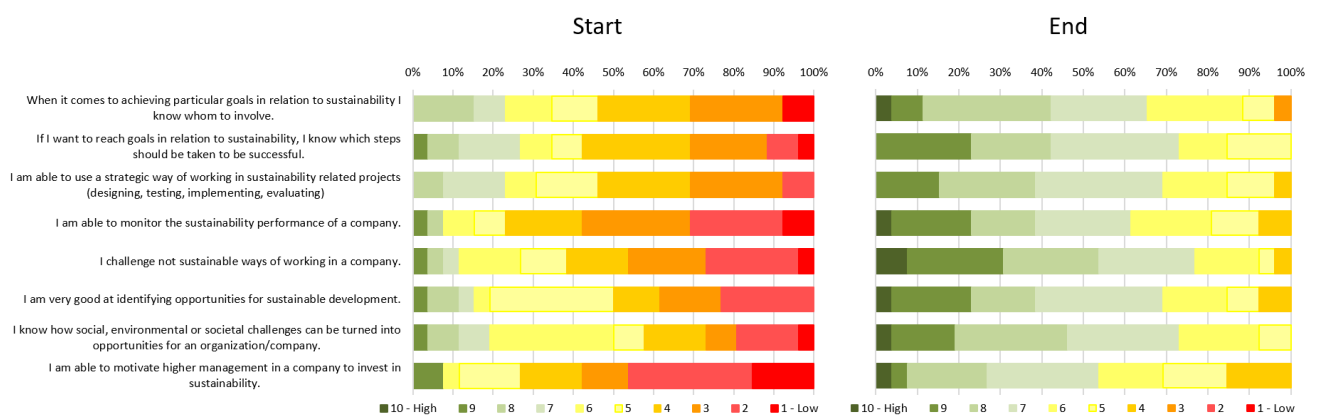


Figure 9. Survey on development of students’ sustainable entrepreneurship competencies (skills and attitudes) connected to Strategic Action Competence in 2021. Graph to the left is at the start of the module and to the right at the end. Green means that students assess their competence as high and red as low.

Regarding the business partner, Tekniska verken found that many ideas generated from students were interesting but not in line with Tekniska verken’s mission and should probably be commercialized by other types of organizations, even though the challenges were based on the business challenges of Tekniska verken. Some suggestion for preventing this issue in further module collaborations might be to introduce the business challenges more clearly through e.g., study visits at Tekniska verken or by spending more time coaching the groups throughout the project. Something that was hindered by the pandemic.

Teachers found the developments as good and experienced a positive attitude among the students in relation to the changes.

Learnings

The implemented improvements were of high value for the students even if not of a radical character. The focus on the whole process from idea generation of students’ own ideas to a tentative start-up is at least in Sweden rather unique with a few sister modules on two other universities. In 2019 we made an extensive benchmark of similar modules at Swedish HEIs and found that many modules were under development or just implemented for the first time (Larsson, 2020). Our module is thus pioneering and could serve as inspiration for similar teaching activities at other HEIs. Based on the benchmark we formed a national network for teachers in sustainable



entrepreneurship and managed to meet for a two-day workshop before the pandemic. When physical meetings are possible again, we will restart the network.

Given the developed structure of focusing students' own ideas and supporting their development by lectures, workshops and exercises the module is easy to upscale and transfer. This is further facilitated by the digitalization of teaching material such as lectures and workshop materials. On top of having teachers within the combined areas of sustainability, innovation and entrepreneurship, a challenge for those wanting to implement a similar module would be to help the students in qualifying their ideas. This could be solved by using the concept of an external business partner providing a context and serve as a mentor. Further students should be encouraged and supported to start talking to tentative customers early in the process. This to hinder them to develop unrealistic ideas focusing a too small or non-existing customer segment.

The approaches implemented in this module would also work if the initial development ideas were provided by external actors. It is our experience from other modules where we used that approach, that it takes much time and resources for teachers to find and qualify external ideas. Not at least if all students should have the same chance of a successful project that can influence the final grade of the module. Also finding ideas for many students could be challenging. Therefore, we will keep the focus on students' own ideas. The inclusion of an external challenge provider such as Tekniska verken has shown to spark interesting ideas among the students and gives them a first notion of a market niche to focus on. Regarding scalability, this practice has shown great potential.

As described above we found digital tools such as Mural for documenting workshops and pre-recorded lecturers as valuable teaching materials which will be further developed and used even in on-campus mode. The scalability of the module is also strengthened by developing the digital spaces and practices to be able to run the module in hybrid mode, i.e., having students joining workshops and lectures both physically and digitally simultaneously.

The field of sustainable business modelling is moving fast right now, with several prominent researchers publishing interesting articles and findings every year (cf. Bocken et al., 2014, Geissdoerfer et al., 2020, Hansen et al., 2020, Henry et al., 2020, Kanda et al., 2021, Kuckertz et al., Wagner et al., 2021). One future development is to oversee the curriculum of the module, to update the theoretical as well as the workshop parts of the syllabus with the latest in knowledge and practice.

On this track, one future development idea is to develop an individual reflection portfolio where each individual student describes and reflect upon his or her development journey as an environmentally driven entrepreneur. The basic idea is that the portfolio starts with the initial reflections the students do on their unique competences (in the beginning of the module) and that they throughout the module should reflect upon the development of their business idea in relation to their own and the groups learning process. This reflection portfolio can support the individual assessment of each student and at the same time contribute to an increased understanding of the connection between theory and project work and support the students in their learning process as reflection can contribute to in-depth learning (Pettersen, 2008). How this portfolio should be designed and graded remains to be discussed.



2.1.4 Increased focus on sustainability in the cross-disciplinary module “InGenious”

Introduction

The main goal of the module is that the participants shall, with the help of previously acquired knowledge and abilities and divided into interdisciplinary teams, develop solutions to problems, or challenges, provided by external parties and be able to communicate the results achieved. Through the interdisciplinary project work, the students will develop skills, reflect, discuss, and grow as individuals.

An interesting aspect of this overall goal is that it points out that the students should be given the ability to grow as individuals. The overall goal is also broken down into specific learning goals that relate to the different activities in the modules.

The development needs of the module were initially to work with the sustainability and ethical issues. We needed to better relate the module to the UN SDGs and find models and tools to help students connect to the goals and to visualize the connections. Furthermore, we needed to improve the modules on ethics - i.e., what we label as responsible innovation. Later in the project we realized that we must improve and refine the way we work with Challenge-based learning (CBL) and how to make more transparent and clear templates for assessments – especially regarding skills, which needs formative assessment models.

The partners involved in this has been LiU and InGenious East Sweden, which is part of Almi Företagspartner Östergötland AB. We have also collaborated with other teachers within the S4Sproject, Teacher (or teamcher, see Eldebo et al, 2022 and the appended play Book in 5.7.2) networks within the ECIU and with InGenious colleagues at Twente University.

Implementation

The detailed play book in appendix 5.7.2 gives a comprehensive overview of how the module is currently run. Already from start the module has been run in collaboration with LiU and InGenious East Sweden. We have, during the years improved the collaboration and have formed a seamless team of teamchers – as cross disciplinary compiled as the student teams in the module. This have been a challenge in itself, and a lesson learned.

Evaluation

Module evaluations have shown upon improvements, however the number of respondents in the official ones are commonly rather few. From discussions with students and through the individual reflections we have got a receipt upon that we are on the right track – the report learnings that are well in line with our intentions.

According to the reflections handed in by the students in the InGenious module we can see clear evidence upon that the students experience that they have gained skills in several areas. Below some citations are displayed (we picked about every third in the list of submissions and copied citations listed under what they mentioned as learnings. Some citations were written in English and others are translated from Swedish):

- My greatest learning is about how different people are and how this really affect the project.
- For me the two main takeaways from this module are the ability to work in interdisciplinary groups and see how everyone can contribute in different ways with their previous knowledge and experience; and learning and training how to pitch an idea.
- What have developed most for me is myself as a person.



- I really improved my oral speaking.
- Overall, I consider that the greatest learning from the module is the true to life feeling of how it is to work in a project, which I will take with me to my future work life.
- I can say with certainty that this is a module that I've learned a lot from. As discussed in the first chapter, I have become much better at speaking in front of people. But I have also learned a lot about group dynamics that, according to me, you miss when you work in a group consisting of only members from similar university programs.
- I have learned to work with people with other apprehensions than me and to formulate my opinions so that others can understand what I mean.
- This type of group dynamics [the cross disciplinarity] enhanced not only critical thinking, but also contributed to a cognitive development where I got a deeper understanding of differences between disciplines and how this could be utilized to solve our challenge.
- Throughout these last five months I have learned and grown personally and professionally. Becoming aware of my own skills and how to use them when working in a team.
- I was able to utilize my knowledge and sharpen my skills during this project while gaining new skills such as the art of pitch, RI analysis, and preparation of pitch deck.
- At an overall level I feel that I have developed a lot, not only as "pitcher" but also as team member.

If the citations are synthesized, we can see that the students have gained skills related to group dynamic aspects – e.g., they have become more skilled into working in groups. They have also improved their communication skills, both related to group communication and to communication from stage - i.e., their pitching skills. Critical thinking and ability to take advantage from differences in case of competence and personality is also lifted. Hence, we can conclude that also the students report that the InGenious module has given them what is labelled as 21-century skills.

A major problem is the recruitment. Although students who have participated recommend the module to others it is hard to reach out. This is as all modules are equally treated at LiU and therefore we cannot get extra media space even if the InGenious module is not an ordinary entrepreneurship module.

Learnings

What since start has been new and innovative is that we work with CBL and did so even before we know that this label existed. The module is based on experiential learning and CBL is a learning approach under this umbrella.

Parts from the module, e.g., shitty prototyping has been transferred to other modules, so also the CBL approach which now signifies also the modules TEIO94 "entrepreneurship and idea development", and TEIO 06 "innovative entrepreneurship". TEIO 06 is now listed in the module list of ECIU and based on our experiences from InGenious, also this module has been redesigned and developed.

In the upcoming work we will continue to develop the CBL competences and continue to spread our experiences. We will also continue to develop the assessment and make it more transparent.

Finally, we will strive to help students who have developed innovative ideas to continue developing these into innovative ventures. Hence, we have learned about the importance to connect to the eco system of entrepreneurship and innovation that surrounds LiU. We will also strive to keep and enlarge our international network as this enable us to stay in the forefront of CBL.



2.1.5 New Module "Digital Transformation: Strategies and Sustainability"

Introduction

Since the winter semester 2019/20, a new master module "Digital Transformation: Strategies and Sustainability" is offered by the Chair of Management at the University of Oldenburg. The module provides insights into the role of digitalization for companies and the associated social and ecological challenges. The digital transformation leads to the emergence of new business models, markets, and forms of interaction. This requires comprehensive changes in strategic orientation as well as in business processes and structures. In addition, new regulations and standards are required at the societal level to meet the ethical, ecological, and societal challenges of digitalization.

The module has the following learning objectives. Students should:

- know basic definitions, trends, and application areas of digitalization
- be able to assess the economic effects of digitalization
- understand corporate strategies and business models in the context of digital transformation
- know how companies should design processes and structures to promote digitalization in organizations
- have an overview of social, legal, and ethical aspects of digitalization
- assess the environmental impact of digitalization
- evaluate digital products, services and business models using ethical and sustainable guidelines
- independently develop proposals for integrating ethical, social, and ecological criteria into digitalization projects and processes.

For more information about the module, see the fact sheet in Appendix 5.8.

Interests and motivations of participants

The lecturers had the ambition to develop a new module focusing on two Grand Challenges: Digital Transformation and Sustainability. A first draft of the module concept included case studies. However, the Green Venturing approach of the S4S project generated a lot of interest among the team members of the Chair of Management. Therefore, in collaboration with the S4S project team, an approach was developed to integrate a business partner into the module. The topic of digitalization is linked to many sustainability issues and is characterized by high agility. Therefore, it is very interesting for a new module to include competencies and topics from the business environment.

The business partner EWE was interested in getting new perspectives on its innovation process, new ideas for sustainable and digital ventures and insights for validating and developing possible business models.

Students can gain practical experience with new agile methods in the context of digitalization and sustainability.

What were the development needs?

The module was developed from scratch as part of the S4S project. The module contributes to the quality of teaching at the University of Oldenburg, as the challenges of digital transformation and sustainable development have not yet been combined in a management module. The systematic



integration of digital transformation approaches with the development of innovative sustainable solutions was therefore the central development need of this approach.

The basic structure of the module was developed by the Chair of Management in collaboration with EWE and the Adjunct Professorship of Innovation Management and Sustainability before the outbreak of the corona pandemic. Several meetings were held to discuss the objectives, content, and tasks for successful implementation. Against the backdrop of the corona pandemic, the Chair of Management developed a digital version of the module. EWE also developed a digital solution of a coaching program for the student teams. The following module structure was developed for the first round of the module:

- 1st half lectures and company case studies.
- 90 minutes per week: lectures to discuss important terms and frameworks from the relevant literature in the context of: digital trends, economic consequences of the digital transformation, digital strategies and business models, organizational structures and processes for digitalization, social and legal aspects of digitalization, ecological aspects of digitalization.
- 90 minutes per week: company case studies to raise and discuss important issues in the context of digital transformation.
- 2nd half practical projects.
- 3 challenges for the student teams: design a sustainable 1) living 2) mobility 3) smart city experience for people in an interconnected world lying ahead!
- 7 EWE coaches - 30 students.
- Design thinking online workshops: 5 meetings of 4 hours each and homework tasks.
- Online tools (Miro, xd adobe, BigBlueButton, Microsoft-Teams).
- Online Pitches in front of a jury (EWE (VC, Head of HR) and University of Oldenburg).
- Writing a term paper that summarizes the process of the practical projects and derives general implications for the integration of social and ecological criteria in the context of digitalization.
- Dissemination of the results within organisation.
- Placement of internships of interested students.

Implementation and testing

What? How? When?

In the first part of the module (led by professors at the University of Oldenburg), students are familiarized with the basics and application areas of digitalization as well as with the economic, social, and ecological implications. To this end, important questions in the context of digital transformation are raised and discussed with company case studies. Exemplary questions addressed in this context are:

- What are the technological drivers of digitalization and what trends can be observed?
- What is the impact of digital transformation on industries and companies?
- How can companies design strategies, business models, processes, and structures to address the digital transformation?
- What are the consequences of digitalization on a societal and legal level?



- How does the digital transformation affect the natural environment?
- How can social, ethical, and ecological aspects be integrated into digital products, services, and business models?

In the second part of the module (led by EWE managers), students develop digital business models in teams under the guidance of experienced coaches, considering economic, ecological, and social/ethical criteria. The business partner therefore acts also in the role of a lecturer within the framework of the module. The results are presented to the other students and company representatives and are summarized in a term paper. An important part of the term paper is the critical reflection of current methods for the development of digital business models under consideration of sustainability criteria.

In the first and second round of the new module representatives of EWE and of a corporate EWE start-up (Codyo: Codyo is a climate app that calculates the carbon footprint of an individual user or a company and accompanies users with personalized recommendations for action in everyday life) gave input in form of presentations (company presentations (EWE, Codyo), learning presentations on prototyping, agile methods, and panel market research) by experienced coaches. Real business challenges of EWE and of the start-up were defined by the corporate representatives and translated into tasks for the student teams.

Figure 10 and the list below gives examples of prototypes developed so far

- Multimodal mobility platform: Recommendations for the choice of a sustainable mobility option, incl. a bonus system.
- Food app: storage, shelf life, recipes, sustainable food.
- App for saving resources in the living context: challenges with other App-users.
- App for monitoring electricity consumption: Saving potential, saving tips, challenges with other App-users.
- Online platform/ App for renting gardens or roof gardens.
- Regional Community Platform: joint leisure activities with sustainability focus.

Outcome - seven product ideas, a lot of learning for students and practitioners (online formats, practicing Design Thinking)

EWE



Figure 10. Examples of prototypes developed so far.



The examination consists of a presentation and a term paper. The following topics should be covered in the presentation and term paper.

Content of presentations («pitches»)

- The presentation should include the following topics:
 - (1) Description of the product or service idea.
 - (2) Description of problem that the solution tackles (including how it considers/addresses important ecological and/or social issues).
 - (3) Description of innovative potential of product or service.
 - (4) Brief description of process that group used to develop idea and prototype for product or service.
 - (5) Description of business model (i.e., how group intends to make money with the solution).
 - (6) Practical recommendations for EWE, Codyo.

The focus should be on the idea and prototype itself, but economic considerations (such as the costs of the product, revenue model, competitors etc.) should be considered

Content of term papers

Term papers have a more academic approach than the presentations and should be structured as follows

- Introduction.
- Literature review “tools and processes for developing digital business models/ products/ services”.
- Description of group’s own process/ tools used to develop digital business models/ products/ services during practice phase.
- Critical reflection of the standard tools used during practical phase regarding sustainability:
 - Are standard tools appropriate for integrating social and ecological aspects? Why (not)?
 - Are specific sustainability-oriented tools/ methods/ processes needed or are they not useful/ necessary? Why (not)? Where?
- Process guideline: Proposal for a process guide that makes it possible to integrate ecological and social criteria into the process of developing digital business models/ products /services .
- Implications for the literature:
 - Which strengths and weaknesses of standard tools have not yet been discussed in the literature?
 - Where is research potential for future?

Evaluation

For the lecturers, the main motivation was to establish a new master’s management module on digital transformation with reference to sustainability. By cooperating with the S4S-project, the involvement and collaboration with a business partner has become much more important. In addition, establishing new business contacts was an additional motivational factor. The involvement of a business partner was not foreseen to this extent when the module originally was developed. However, it contributed significantly to the quality of the module. The S4S project initiated this



process and contributed to the development of the new Green Venturing format. The business partner had a strong interest in the topics and supported the module with several coaches, e.g., the design thinking process was carried out by the business partner.

The results of the module were positively evaluated by the business partner. For example, a new competitor overview, suggestions for improvements based on a panel survey and recommendations for optimizing and differentiating the business model were taken up directly by the start-up Codyo and have been considered in strategic decisions.

Overall, the students gained a good insight into business practice and were able to get practical experience. Students could learn hands-on experience in using agile methods such as design thinking, prototyping, lightning demos and market research methods such as interviews and panel surveys in collaboration with a business partner. Students learned how to develop and validate digital business ideas. For some students, digital transformation is a current and important topic. Therefore, they were also interested in the module. The new format and the possibility of business contacts were additional motivating factors.

Learnings

What is new and innovative?

A unique feature of the module is the teaching and coaching role of the business partner within the module. The business partner is both a challenge provider and a coach and teacher.

In addition, the key topics of the module are innovative. Two grand societal challenges are systematically linked: Digital Transformation and Sustainability. In this way, students learn about the ethical and legal challenges of Digital Transformation. Students can discuss the benefits and opportunities of Digital Transformation in relation to the natural environment and identify the ecological challenges and risks of Digital Transformation. They also learn about the concept of Green IT as a possibility to integrate ecological aspects into the digital processes of companies

Success factors, drivers and barriers for the implementation of the approach

In the first module run, the collaboration with the business partner and the lecturers were divided into separate phases for the students. As a result, the learning objectives were not always clear for some of the students. Therefore, in the second run of the module, an exchange with the lecturers was institutionalized for the entire period of the module. After the Corona pandemic, face-to-face meetings should become a regular part of the module. Personal exchange is also important in a module on digitalization.

The reference to sustainability could be integrated more strongly into the theoretical content of the lectures.

The different expectations for the presentation of practical project and the term paper were not fully understood by all students. Although it was communicated several times.

This type of collaboration requires competencies in business development on the part of the business partner and the university's teaching staff. In this case, for example, the design thinking process was facilitated by the business partner. It should be considered whether it is possible for the coaches to supervise the student teams less closely and provide more specific input and guidance.



Feasibility? Scalability? Transferability?

The module has been offered two times so far. Therefore, the long-term effects cannot yet be assessed. The entire digitalization of the module caused an additional workload for the students, the lecturers, and the business partner.

It has become clear that the module is very feasible. However, scalability is limited due to the high resource requirements for the lecturers and the business partner. The module can be transferred to other universities if the business partner and the lecturers also have the necessary didactical and methodological competencies.



2.2 LEARNING UNITS AND EXTRACURRICULAR ACTIVITIES

This section presents learning units of modules and extracurricular activities. We define a module as a set of independent units of study or training that can be combined in several ways to form a module at a college or university. Completion of a module (or part of it) renders the student a specified number of ECTS (European Credit Transfer and Accumulation System) credits. A learning unit is a unit of a module. An extracurricular activity is differentiated from a module as it does not render ECTS credits.

2.2.1 Climate Challenge as part of the Module "Innovation Management"

Introduction

The Climate Challenge Seminar has been newly developed in the framework of the S4S project and has been integrated as a new learning unit in the master module Innovation Management at the University of Oldenburg. The module has been offered by the Professorship for Innovation Management and Sustainability since 2010.

The new learning unit combines elements of a challenge-based learning with the development of sustainable innovation ideas for a business partner. Here, the results from the extracurricular format of the Green Business Idea Jam (see Section 2.3.1) were taken up and integrated into the curricular Climate Challenge Project Seminar.

Interests and motivations of participants

The S4S business partner BÜFA was keen to continue with the development of the innovation ideas identified during the Climate Business Idea Jam to contribute to BÜFA's climate neutrality strategy. Close coordination with the BÜFA business divisions and the management was necessary to define appropriate challenges for the student teams.

The lecturers were interested in developing a challenge-based learning format that had to be designed as an exclusively digital format. This raised new questions about the appropriate didactical concept and adequate collaboration formats involving students and business partners.

Students were interested in a challenge-based learning format that provides fundamental expertise in innovation management and enables students to work closely with a business partner to develop innovative ideas with a high potential for implementation.

What were the development needs?

There was a need to develop a teaching program that integrates issues of climate mitigation and adaptation into the development of innovative ideas and business models.

In addition, forms of "challenge-based learning" had to be integrated into an existing module on Innovation Management.

Furthermore, the need identified and formulated by the business partner to develop innovative ideas for the realization of their sustainability and climate strategy had to be transferred into an overall module concept.



Against the background, the following concepts and tools had to be developed for the new project seminar:

- Lecture: carbon neutrality of companies.
- Short online assignments with reference to the respective lecture.
- Fact sheets with BÜFA Climate Challenges.
- Guidelines and criteria for pitches and term papers.
- A concept for the Individual coaching sessions for the student teams.
- A concept for the online collaboration with business partners and students.

Implementation

In the winter semester 2020/21, 35 students took part in the module. The number of participants was limited to ensure adequate support for the students by the business partner and the lecturers. The module was divided into two blocks.

In the first part of the module, the basic theoretical concepts of innovation management were covered in series of 12 online lectures. The students had to work on two online assignments per lecture. The tasks were not graded. However, completion of the assignments was a prerequisite for taking the exam. The following topics were discussed in the 12 lectures

- (1) What is innovation? Why is innovation important (for survival)?
- (2) Innovation theory: explanatory approaches.
- (3) Innovation management: tasks and influencing factors.
- (4) The innovation system: actors and levels.
- (5) Triggers, drivers, and barriers in the innovation process.
- (6) Key actors of innovation: entrepreneurs and entrepreneurship.
- (7) Development of an innovation-friendly organization.
- (8) Innovation cooperation, innovation networks.
- (9) Generation of innovative ideas.
- (10) Evaluation and selection of innovation projects.
- (11) Innovation and sustainability: desirable and undesirable effects of innovation.
- (12) Development of a climate-neutral company as part of an innovation strategy.

In the second part of the module, against the background of the theoretical foundations, the Climate Challenge Project Seminar has been conducted. Student teams collaborated with company mentors to develop solutions that contribute to the company's climate neutrality. 35 students worked in teams of 5 on the following challenges:

- Challenge 1 Strengthening climate awareness among company employees (company site.)
- Challenge 2 Strengthening climate awareness among company employees (mobility).
- Challenge 3 Innovative logistics solutions for the company.
- Challenge 4 Promotion of sustainability innovations by the company.
- Challenge 5 Regional company's climate compensation project.



- Challenge 6 Digitalization processes at company's customer service.
- Challenge 7 Intelligent energy management for a new PV system of the company.

Schedule: Climate Challenge seminar

- **30.11.2020** Introducing of BÜFA and climate challenges during Online Lecture.
- **07.12.2020** Online seminar
 - Team building
 - Introduction of and working on the climate challenges
 - Presentation of the Climate Challenge Solution Paper: structure, content and quality criteria:
 - Time for questions
- **14.12.2020** Online seminar: Project management and group work.
- **11-13.01.2021** Individual coaching of the 7 student teams.
- **25.01. and 01.02. 2021** Online seminar: Presentation of the Climate-Challenge-Solutions.
- **22.02.2021** Submission of Climate Challenge Solution Paper.
- During the entire seminar: individual exchange of the student teams with BÜFA.

Type of module examination: Portfolio

- Includes online tasks after the lecture, a climate-challenge-solution-paper and a short presentation in the seminar.
- For admission to the seminar, all online assignments must be completed.
- Working in teams (5 students), length of the climate challenge-solution-paper approx. 15-20 pages (approx. 4 pages per person, group assessment, paper will be graded (75% of the grade).
- Short team presentation (approx. 15 min.) in front of the company management (25% of the grade).

Structure of the Climate-Challenge-Solution-Paper

- Introduction.
- Very brief introduction to the challenge: initial situation, task, and purpose of the paper.
- Approach and methodology.
- Transparent presentation of approach and methodology.
- Climate-Challenge-Solution.
- Analysis.
- Description of possible solutions.
- Developing of cross-references, explaining, analysing, justifying, arguing, proving, criticizing, etc.
- Conclusion.
- Summary of the most important points.



- Recommendations for action to the company.
- Reflection of the group work.

Assessment criteria of the Climate-Challenge-Solution-Paper

- Research and references.
- Quality, sufficiency, and diversity of references.
- Description and clarity of methods used.
- Explicit explanation of methodological approach.
- Method is transparent and intersubjectively understandable.
- Use of theories/concepts for the analysis.
- Theories and concepts of innovation management are used for the analysis.
- Compatibility of the recommendations for action for the company.
- Recommendations for action are relevant and usable for the company against the background of the respective challenge.
- Stringency of illustration and argumentation.
- Comparisons and cross references.
- Reasonable, logical structure.
- Convincing answers to the challenges.
- Critical reflection.
- Comments.
- Suggestions for improvement or solution.
- Recommendations for action by the company.
- Compliance with formal requirements.
- Length/number of pages.
- Formatting.
- References.
- Spelling.
- Communication.
- Communication within the group.
- Communication towards the company and the lecturers.



Evaluation

Student perspective

After the end of the first part of the module, students were asked for feedback using the Mentimeter tool. They were asked about their satisfaction with the online lecture on a scale of 1 (very dissatisfied) - 5 (very satisfied). Overall, the students were very satisfied with the lecture:

- Content: 4.1.
- Style of presentation: 4.2.
- Involvement of the students: 4.1.
- Duration of the individual lecture: 3.7.
- Technical issues: 4.2.

Some students commented that the online assignments were time consuming. It should be examined whether the number or the scope of the tasks can be reduced. Some students indicated that more time should be allocated for discussion in the online lecture. However, other students pointed out that there were already ample opportunities for discussion, but some of the students did not use them. Student participation in online discussions is sometimes challenging. Ways to encourage as many students as possible to actively participate are being explored. The relevance of the theoretical basis for the seminar could have been made more explicit for a minority of students. It should be examined whether the cross-references between online lecture and seminar can be better accentuated in the future.

Formal module evaluations are an important component of a comprehensive teaching evaluation at the University of Oldenburg. They enable students to contribute their perspective on the quality of the modules. The selection of the modules to be evaluated is made by the university management. Therefore, not every module is evaluated every year. For the module Innovation Management, the central evaluation took place in 2020/21, 5 out of 35 students of the module participated in the evaluation and rated the module better than the comparison group. Due to the small number of participants, the evaluation has only limited significance.

In addition, the questionnaire on **competencies for sustainable entrepreneurship** was used. 34/34 participants of the module filled in the first questionnaire and 30 students also submitted the second questionnaire. Developments were observed in most areas of the competencies for sustainable entrepreneurship, but only a few in the area of "Interpersonal competencies". Not all items changed significantly. The lowest scores in the self-assessment at the beginning of the module appeared in the area of "Strategic Thinking Competencies" and "Systemic Thinking Competencies". After the module, students generally rated themselves as good in these areas as in the other areas. It therefore seems reasonable to assume that the greatest competence developments took place in the areas of "Strategic Thinking Competencies" and "Systemic Thinking Competencies" (see Figure 11).

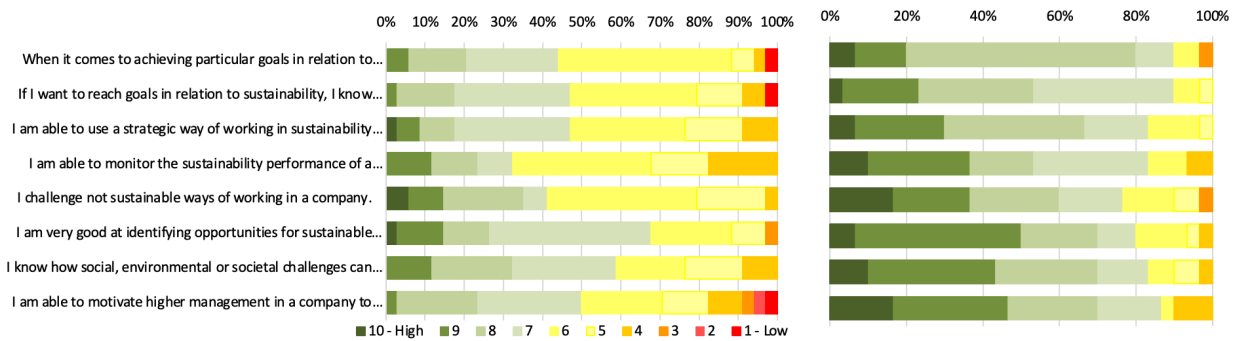


Figure 11. Survey on strategic action competence in winter term 2021. Graph to the left is at the start of the module and to the right at the end. Green means that students agree to the statement and red that they disagree.

Business Partner Perspective

The feedback at the end of the module by the BÜFA Management Board and the participating employees was very positive. On the one hand, the BÜFA management congratulated the students for their presentations and their innovative ideas. On the other hand, the business partner highlighted the overall concept of the module and the quality of the term papers in the follow-up with the teaching team. The identified climate challenges solutions were highly appreciated and some of the ideas were implemented after the end of the module. The feedback addressed the following issues:

- Good, detailed elaborations by the student teams on topics which were partly unknown to the students before the seminar.
- Very good preparation of the presentations and the climate challenge solution papers.
- The student teams organized themselves and managed their time very well.
- Very good communication of the student teams with the BÜFA staff. Despite the fact, that everything had to take place online and the participants of the teams did not know each other beforehand, the communication was very good.
- High quality of results, which can be incorporated into further measures of BÜFA.

Overall, the Climate Challenge Seminar can be considered as a very good challenge-based learning focused format.

Learnings

What is new and innovative?

The combination of an extracurricular "Green Business Idea Jam" with the curricular based "Climate Challenge" was new and innovative. Hybrid teaching formats and pure online formats have been combined. The Business Partner was systematically involved in the ideation process of the student teams. The Business Partner acted as a challenge provider, but also supported the students in familiarizing themselves with the respective topic.

Success factors, drivers, and barriers for the implementation of the approach

It was a challenging task for the business partner to find adequate challenges for the student teams



that can be worked on without technical and process knowledge and whose results represent an added value for the company. The development of fact sheets for the individual challenges requires close coordination between the business partner and the teaching team. In the future, a short handout could be developed for the company explaining the essential criteria for a good student business challenge.

The implementation of the seminar requires a high level of human resources on the part of the business partner. Individual coaching offered by the lecturers requires a high level of personnel involvement. Guiding questions for the coaching sessions could be developed.

If Climate Business Idea Jam and Climate Challenge are combined, there is a risk that the innovative ideas generated in the Green Business Idea Jam may not be appropriate for the Climate Challenge seminar.

Feasibility? Scalability? Transferability?

Students team have been highly motivated, and the business partner is very satisfied with the results. It is planned to continue with the new challenge-based learning format in the future.

To facilitate feasibility, scalability and transferability, the following options for improvements of the Climate Challenge Project Seminar should be considered.

If there are multiple challenges with different topics, several staff members need to be involved in developing the challenges and mentoring the students. It should be examined whether multiple teams can work on the same task. This would reduce the number of staff involved and would allow a comparison of results.

The climate challenge solution papers have a theoretical focus, which makes it difficult for the business partner to read the paper with a focus on the recommendations for action. Here, a summary or an excerpt with the most important points for the company could be useful.

The presentation of the results is primarily directed to the business partner as the target group. The Climate-Challenge-Solution-Paper must also meet the quality criteria of a scientific paper. It should therefore be checked whether the business partners can be involved in the assessment of the presentation.



2.2.2 "Green Creativity" with Lego Serious Play

Introduction

Creativity is an increasingly important 21st century skill to implement sustainable business (World Economic Forum, 2016, 2020). Research about antecedents of team creativity is limited; teams might increase or reduce individual creativity. Therefore, we study team dynamics and team composition, together with cognitive and emotional aspects. Observing these factors simultaneously and in conjunction with physiological measures might offer more accurate insights into how team creative performance can be boosted.

The Lego® Serious Play® (LSP) method is aimed to improve team decision processes resulting in more innovative team performance. LSP can be used to craft strategies or solve so-called 'fuzzy' or wicked problems, characteristic of many sustainable issues, e.g., climate change. A wicked problem is a problem that is difficult to solve since it is highly complex, involves many contradictory interdependencies, with changing requirements that are often difficult to recognize. Wicked problems cannot be fixed with current way of thinking, where there are simple single solutions. Especially in the ideation phase of innovation, the formulation of problems is still fuzzy.

Scientists propose that solving problems using 3D-models is more effective than using 'flat' 2D-models because it is easier to visualize all aspects of a problem and its environment. Using specific Lego bricks, participants of LSP-workshops visualize their ideas, thoughts, and feelings. They build 3D-models or metaphors to express their ideas and explain their models to the team members in a short story. All team members build upon each other's stories. This technique is coined as shared storytelling. The sharing of knowledge and insights using 3D-models is a basis for a group dialogue, inspiration and problem solving. Every workshop facilitated with LSP consists of several "Challenge - build - share - reflect" cycles, in which the perspectives of all team members are discussed in an appealing and playful way. LSP stimulates mutual reinforcement, humour, out-of-the-box thinking, commitment to the team, and fun. Therefore, the LSP method results into more collective imagination, more motivation to engage the joint task and developing solutions supported by everyone of the team.

People usually appreciate playing with Lego. Using Lego creates a relaxed and open atmosphere, that facilitates discussing difficult, complex, or sensitive topics. Within such a context, people are more inclined to build upon each other's ideas. Playfulness stimulates imagination and enables to make the unusual connections necessary to develop new insights. LSP builds upon the factors that enhance individual and team creativity. Therefore, we expect LSP to increase the effectiveness of the three first creative phases of Innovation: idea generation, opportunity recognition and idea evaluation.

Identified needs

- Does LSP increase team creativity when solving sustainable problems?
- Does LSP reduce free ridership and promote synchronicity when finding possible solutions for wicked problems?
- Does LSP improve team building at creative problem-solving?
- How important is commitment in creative problem-solving?
- What is the impact of social cultural diversity in creative problem-solving?
- Which tactics, dynamics, and behaviours and processes contribute to increased team creativity?



Core competencies to be developed:

- Ability to develop, implement, and support an environment that nurtures creative thinking.
- Learn a practical skill set for individual and team ideation and problem solving in a sustainable context.
- Ability to define complex problems, to generate creative solutions, and to transform solutions into action.
- Learn theories and models for managing and coping with change in a complex world in need of more sustainable business.
- Increased effectiveness in creative decision making within teams.
- Learn to nurture the creative talent of others i.e., to build upon creative ideas within teams.

Involved partners, process, steps, time frame etc.

Green creativity workshops were conducted at CEWE and at Twente University. At CEWE, the students developed business ideas to improve sustainable practices. At Twente University, students developed business ideas to solve or alleviate Sustainable Development Goal # 4 (Education for all). We asked the participants to develop new and feasible solutions for the problem of accessibility of education in low-income countries. This is important because knowledge, and skills are key factors for developing and improving young people’s lives. Improving education is essential in eradicating poverty and hunger. Education therefore has been identified as one of the UN development goals: “Ensure inclusive and quality education for all and promote lifelong learning.” Despite many efforts, especially in low-income countries, education is still not accessible to all. Currently, 260 million children do not get any education (World Health Organization, 2021). Education is still denied schools e.g., across sub-Saharan Africa: one-in-three youth people are not able to visit a school. Despite decades of efforts to get every child into the classroom, progress has come to a standstill, according to data from the UNESCO Institute for Statistics.

Implementation

In the workshops “Green creativity” students are asked to develop new and feasible solutions to sustainable “wicked” problems using special Lego® Serious Play® bricks. First, they build an individual model (“metaphor”) to visualize their initial solution. Second, they combine the individual models and build a joint shared model. Third, they discuss internal and external relationships to the shared model and discuss “What-if” consequences to test the robustness of the solution. Last, they evaluate and present the solution to the challenge provider.

In an ideation workshop, students from the Eco Venturing module of the University of Oldenburg developed creative ideas to make CEWE, the largest German photobook supplier, more sustainable. Using the Lego Serious Play method, they visualized their ideas and highlighted the most important facets and aspects of these ideas. Asking many “what-if” questions, the rigor of the ideas is tested: if external conditions change, to what extent are the ideas still desirable, economically viable and technically feasible (see Figure 12).

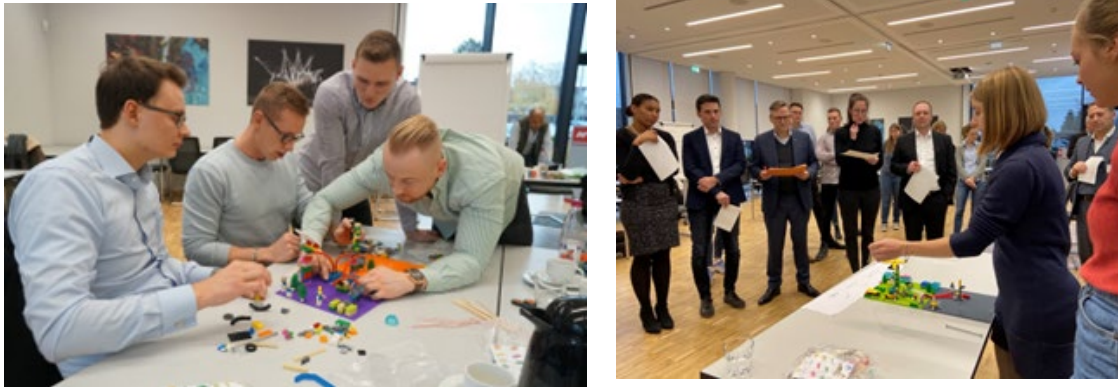


Figure 12. Managers from CEWE assess the ideas and select the most promising ones. Three ideas are further explored and operationalized.

Apart from the workshop for CEWE, 299 Master students from Twente Universities experienced the LSP method. Using LSP, they developed in teams of 4-6 students new and feasible solutions to the accessibility of education for all boys and girls in low-income countries (UN Sustainable Development Goal #4). Of some teams, arousal levels were measured with wristbands (see Figure 12). The impact of team diversity, team climate, arousal levels on creative output will be analysed and reported in 4 Master theses of change management students at the University of Groningen. We use the following theoretical constructs; Personality (Big-6 – Ashton & Lee, 2009); Team Psychological Safety (Edmondson, 2009); Participative decision-making (Muehlfeld, et al. 2011); Voice (Zhou & George, 2001); Commitment (Carson et al., 2007); Collaboration Styles - Dual concern theory (De Dreu et al., 2001); Self-Efficacy (Chen, Gully & Eden, 2001); Emotional intelligence (Wong & Law, 2002); and Team performance (Gibson et al., 2009).

The green creativity project consists of the following main elements:

- Literature review, transcription, coding, and qualitative analysis of creative processes in teams.
- Quantitative analysis of personality, team climate and team creative performance.
- Shared story telling using Lego Serious Play (LSP): video pitch.
- Measuring arousal levels during creativity.

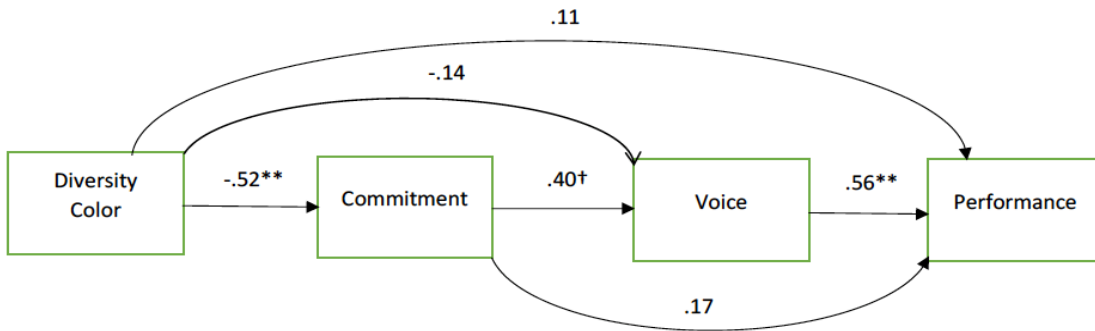
Evaluation

From the green creativity project, we learned the following (see Figure 13):

- Team diversity influences indirectly team performance because it correlates highly negatively with someone’s commitment to a team.
- Lower levels of commitment lead to less “voice” in a team.



- Voice is a strong predictor for team performance.



** $p < .01$; * $p < .05$; † $p < .01$

Figure 13. Path model of creative team performance

These results will be presented at the ISPIM 2022 conference in a paper presentation: “Upside and downside of team diversity for creative team performance”.

In ongoing research, we evaluate arousal levels of team members during the creativity phases of Lego Serious Play and will report in a mixed method (quantitative/qualitative) research paper the results. We build upon earlier research of Hoogeboom & Wilderom, 2019. In Figure 14, we illustrate an arousal flow diagram of a creativity game.

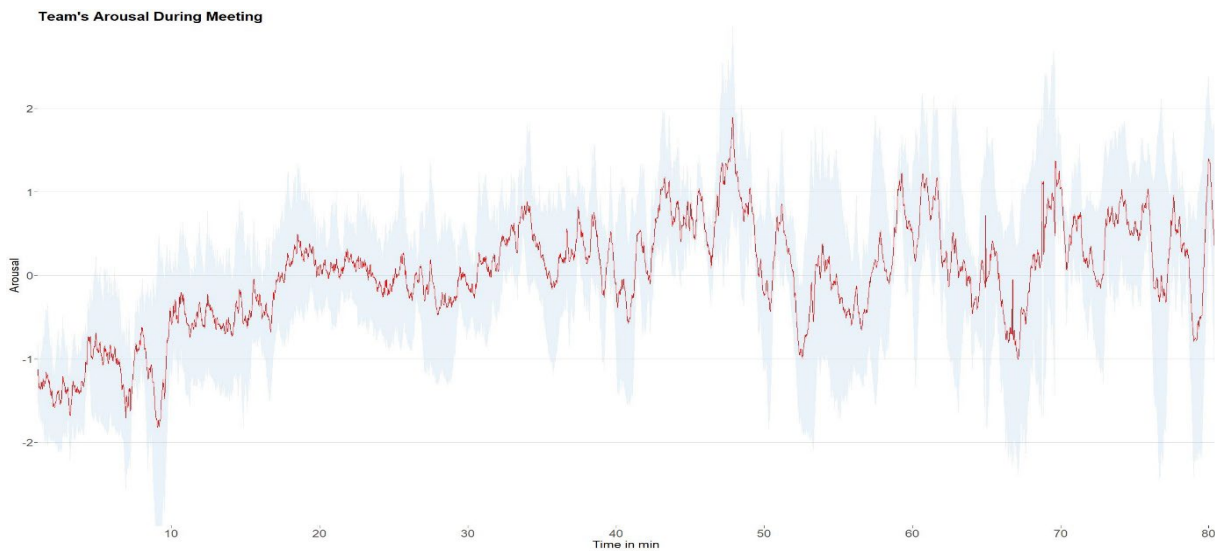


Figure 14. Example of arousal during team creativity exercise

Follow up: research

The results of the green creativity activities will be used to generate Master theses. Students at the University Groningen prepare qualitative or quantitative studies of:

- Examining the team flow of Lego Serious Play as means to foster sustainable problem-solving.



- Exploring the influence of psychological safety on creative team performance.
- The trade-off between team diversity and individual commitment affecting team creativity.
- The importance of socio-cultural diversity in relation to creativity in groups, when aiming to solve sustainability problems.

What is new and innovative?

- Using visual shared story telling (i.e., LSP) to solve or alleviate sustainable problems
- Applying social psychology, biology and innovation theory simultaneously to solve sustainability problems

The green creativity project has the following main outcomes:

- 3 new business ideas for CEWE.
- 4 Master theses (2022).
- Insights in drivers and blockers of creative team performance (team composition, personality, team climate).
- Increased understanding of the dynamics of task and relationships of creative problem-solving.
- Improvement of creative problem solving in sustainable settings.

Feasibility, Scalability and Transferability

Essential critical success factors for feasibility, scalability and transferability are:

- Funding of the learning unit. The LSP workshop can serve as a creativity exercise within an entrepreneurship or innovation module. Due to the short-term character (duration of 2 hours – 1 days), limited funding is necessary. ECTS credits will be granted at a module level.
- The LSP is only possible offline. The LSP method concerns shared storytelling using metaphors of special Lego® bricks of the Lego Serious Play® product line. Therefore, it cannot be conducted online. Making use of this method implies investing in these special bricks.
- An LSP workshop consists of many small phases in which the participants are getting used to work with the method. Therefore, feasibility is dependent upon of an experienced LSP facilitator. A training is required to become a LSP trainer.
- Feasibility: an investment in LSP bricks and a facilitator training is necessary.
- Scalability implies the possibility to implement a learning unit online. This is not possible with LSP. The maximum group size of an LSP workshop is 20 persons (ideally 6 per facilitator).

Future activities

- 4 Master thesis projects concerning creativity and LSP (Groningen University, 2022)
- LSP is a well-known creativity tool that can be used at companies and universities; the knowledge of this green creativity can be transferred into these activities.
- Documentation is available at the S4S-website.



2.2.3 European Sustainable Innovation Contest

Introduction

The S4S-project had the ambition to increase mobility and learning between students from the participating universities. Since travel was not possible due to the covid pandemic, one of several approaches developed to replace travel, but still stimulating learning between students from different universities, was the creation of the European Sustainable Innovation Contest (ESIC). The contest was based on the concept of the famous Eurovision Song Contest in which countries qualify songs for a joint European contest to find “the best song”. In the ESIC student teams competed by sending in pitch movies to a joint half-day event with the possibility to win prizes. A similar approach had been tested in the modules “Environmentally driven business development” and “InGenious” (see section 2.1.4 and 2.1.5). Some further development was needed to make the contest international and involving more than one module.

The contest involved 2-3 student teams and their teachers from each university, and CEWE who provided prizes for the best student ideas. The event was also open to anyone interested and advertised via e-mail, LinkedIn and the S4S homepage.

Implementation

The event took place in March 2021 using Zoom as the digital platform. Before the event all three universities already had qualified up to three ideas each to take part of the contest. Even if the basis for the selection was the module students attended, the participation was voluntary and not part of the syllabus. The date for the event was decided by the time-plans of the different modules leading to that some students had to wait some months after the finalization of the module and the contest. In total the event attracted 35 registered participants including seven student teams from four countries. Students further were attracted to the competition by the possibility to win prizes from CEWE in the form of vouchers for photobooks, canvases etc. Other participants were invited to get inspired by innovative students solving sustainability challenges and meet likeminded people around Europe interested in upscaling sustainable innovations.

The actual contest was implemented as follows:

- Before the event all student teams had produced and prepared a 3-minute pitch movie in English describing the idea. The movies were uploaded on YouTube or shared with the host of the contest in advance.
- At the day of the event the host welcomed the participants and presented the agenda. The three modules were also shortly described to set the context of the competition.
- Thereafter each student team made a short introduction of themselves before the movie was streamed on Zoom.
- Each participant was asked to assess all ideas from the perspectives of Best Sustainable Solution, Best Movie, and Most Original Idea.
- After all movies had been broadcasted each participant joined a break-out rooms with three-four more members to jointly assess the ideas and find the number one, two and three in each category. These jury groups were formed with the ambition of creating as diverse teams as possible when it comes to country, student or not, educational background etc.
- After some time of discussion in the jury groups, everyone met in the main meeting room and each jury presented their votes. 5 points for the best, 3 for number two and one for number three. When all votes had been given, it was possible to find the winners.



- Finally, a company representative from CEWE awarded the winners which were Team Imprimus who won in two categories, Most Original Idea and Best Movie for an idea about sophisticated contact lens which helps people who are oversensitive to light and certain colors and intensity of light. Most Sustainable Idea was awarded GOLOWCO2 for an app to display climate footprint of food.

Evaluation

No formal evaluation was done at the occasion of the event. In a follow up meeting with all three universities, we discussed the event and found some strengths and weaknesses to be developed (see below). The event was well received and liked by all participants giving an extra dimension to the learning activities of the modules.

Learnings

The novelty of the event was the international and competitive dimension added to the syllabus of the modules.

The approach is both easy to scale and transferable to others depending on some important conditions. First participating universities must have suitable modules in which students develop ideas around sustainable innovation and entrepreneurship. This to make the preconditions comparable to the ideas sent in by other universities so that students attending have had enough time and resources to develop and present their ideas. This also includes the task of making a pitch movie, which for the 2021 contest was mandatory in the syllabus of two of the modules but an extra task for students from one module.

The on-line design makes it possible to involve student teams irrespective of distance and time-zones. Technically a contest can be much bigger involving more modules and student teams. But many participants and especially competing student teams, can lead to a too long event which might risk the focus of the event.

Finally, timing is a challenge since the time between the modules in which the ideas are developed and the contest cannot be too long to keep the interest of student teams to participate. Timing issues lead to that no competition was possible in the setting of S4S during 2022 since time-plans for the three modules were changed thus leading to too separate implementation of the modules. Anyhow the contest is easy to implement if the preconditions above are fulfilled.



2.2.4 Negotiation Festival

Introduction

In an era of global challenges – pandemics, climate challenge - effective global negotiation becomes increasingly important. What is the impact of personalities and cultural backgrounds of negotiators and their counterparts on negotiation performance in two contexts: distributive (zero-sum or win/lose) and integrative (win-win) negotiations?

Educational concepts

To improve sustainable practices, the negotiation festival is aimed to develop Attitudes, Behavioural Skills, and Cognition (the ABC-factors) of Cross-Cultural Competences. First, Attitudinal aspects involve the willingness or motivation to adapt to others. Elements are e.g., empathy, trust, acceptance and respect, cultural sensitivity, uncertainty tolerance, and resilience. Part of this adapting is a delay of judgment of different cultures (Brislin et al. 2006; Thomas et al., 2008). Second, behavioral skills make it possible to connect to people with a different cultural background. These skills involve, e.g., intercultural communication, relationship building, influencing, negotiation, conflict handling, and creative problem-solving. Cross-cultural behavioral skills include the ability to interpret behavior of others, i.e., relational skills about how someone develops and maintains relationships with others and to adapt and adjust someone’s social interaction to new culturally different situations (Thomas et al., 2008). Third, cognition comprises of general knowledge about similarities and differences between cultural values, beliefs and norms, and how cultures influence behavior.

These three facets (Attitudinal, Behavioral, and Cognitive) of Cross-Cultural Competences to are summarized in Figure 15. Recognizing, adapting, and connecting effectively with members of different cultures cannot be separated because they are influencing one another (see arrows in Figure 15).

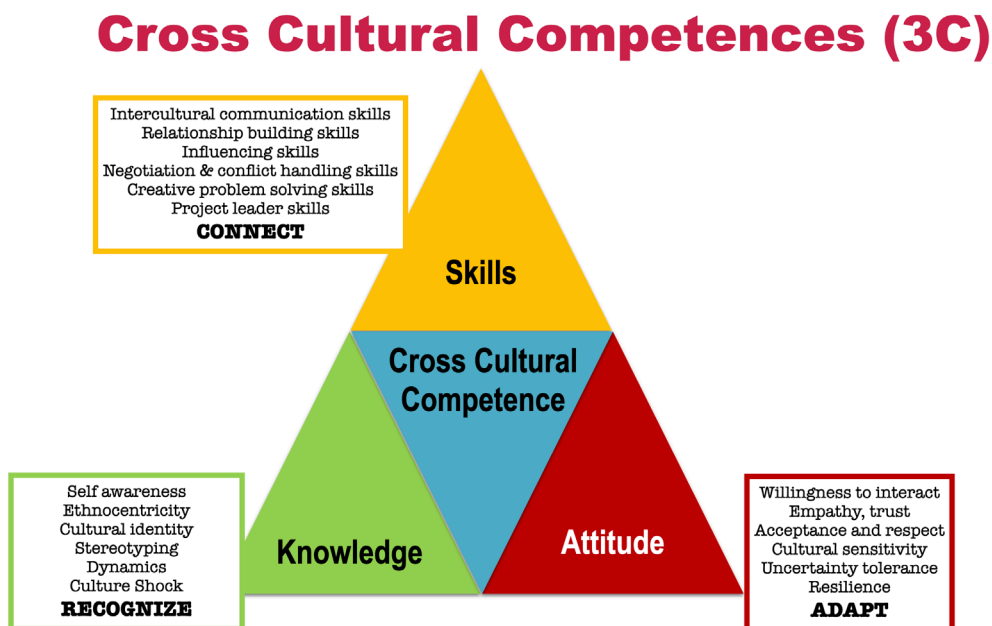


Figure 15. Cross Cultural Competences



Figure 17. Participant at the Global virtual program

They discussed, experienced, and evaluated global negotiations. They gained practical and theoretical insights into which personality traits contribute to negotiation. It was an extracurricular 1-day workshop with a 8 hours workload.

We exercised with global collaboration in different time zones. We presented negotiation research concerning negotiation performance in different countries. Can people predict their negotiation performance? What is the influence of personality and culture upon negotiation performance in distributive (“win-lose”) and integrative (“win-win”) negotiations? The SVI (subjective Value Indicator), which measures expectations of negotiation outcome and relationships, is a highly significant predictor of negotiation performance. In impact of personal traits on the SVI varies per country.

It is important to know personal strength and weaknesses and your counterpart and establish trust and relationships. Sometimes when innovating task conflicts can increase team performance (“creative friction”), while relationship conflicts mostly reduce team output.

CEWE and Fujifilm gave testimonials of their cross-cultural negotiation experiences. Prof. dr. Will Baber, associate professor at the graduate school of Management of Kyoto University and international negotiation expert, reflected upon this.

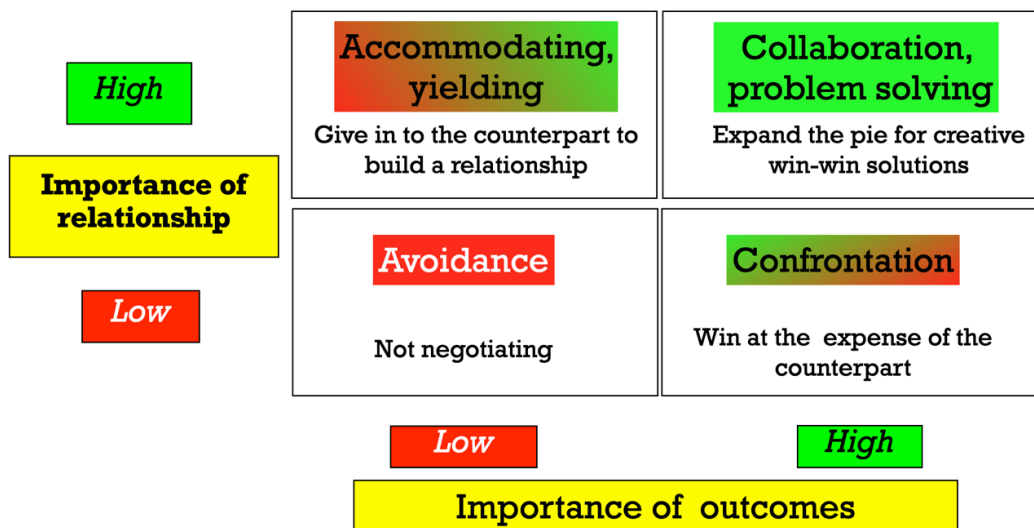
HR-manager of ECOR and the University Twente summarized their best tips of dos and don’ts regarding job interviews. The participants practiced with a tool kit of partner assessment. In teams, the exercised the selection process of foreign alliance partners: strategizing, speed dating, negotiating, selection and choice.



Conceptual frameworks

In the negotiation games, we build upon the Dual Concern Theory; this theory is a solid basis for assessing cooperation within teams. A high concern for self and low concern for others results in a preference of forcing one's will on others (a confrontation style). A low concern for self and others results in a preference of reducing the importance of the issues and avoiding discussion (avoidance).

De Dreu et al., 2001 distinguishes two prosocial cooperation styles: collaboration and accommodation. The first combines high concern for others with concern for self: a preference for problem solving towards an agreement that satisfies one's own and the other team member's wishes with an exchange of information about priorities and preferences. Only high prosocial - with a low concern for self - results in an accommodating orientation: focus on accepting the other's will. See Figure 18.



Adapted from: De Dreu et al., 2001; Lewicki, 2016

Figure 18. Dual concern during negotiations

It is important to know personal strength and weaknesses and your counterpart and establish trust and relationships. Sometimes when innovating task conflicts can increase team performance (“creative friction”), while relationship conflicts mostly reduce team output. In serious games, we trained our participants to identify BATNA (Best Alternative to Negotiated Agreement = No-Deal Option) of negotiators, to become more aware of non-verbal communication aspects, ethical, and cross-cultural aspects. Although preparation is important, one should be flexible at the same time: modify perceptions, provide alternatives, and be creative. Considering the other’s viewpoint increases your own benefit!

During an alliance game, all participants acquired new negotiation tools. They exercised the selection process of new international business in which organizational and relationship dynamics play a role. In speed dates, they negotiated crucial collaboration aspects with potential foreign partners based in Scandinavia and Hong Kong. Using an alliance scan, they selected and pitched their choice. Ultimately, we discussed success and failure in a partnership. Representatives from various nationalities played roles as potential partners.



To train alliance competencies, we developed the co-innovation scan. With this tool, one can determine the suitability of potential business partners. The scan consists of 4 “fits” or fields of compatibility: a combination of task and relationship related issues and intra-organizational (within-company) and inter-organization aspects (alliance and market). Task-related aspects are for instance a strategic compatibility between partners (strategic fit), or the ease of operation and achieving results (operational fit). In the strategic fit, the compatibility of strategies, business models, systems and procedures of the partners are assessed. In the operation fit, the ease of operations, the balance of power, and drive to continuously improve are evaluated. Relationship issues are included because at implementation, people make the difference. Interpersonal relationships are important because without them, potential synergies from the alliance are likely to remain dormant, which could result in an underperforming alliance. We distinguish interpersonal aspects as trust, commitment, and personal ‘click’ (personal fit) as well as sharing and developing knowledge with networks (network fit), as is illustrated in Figure 19.

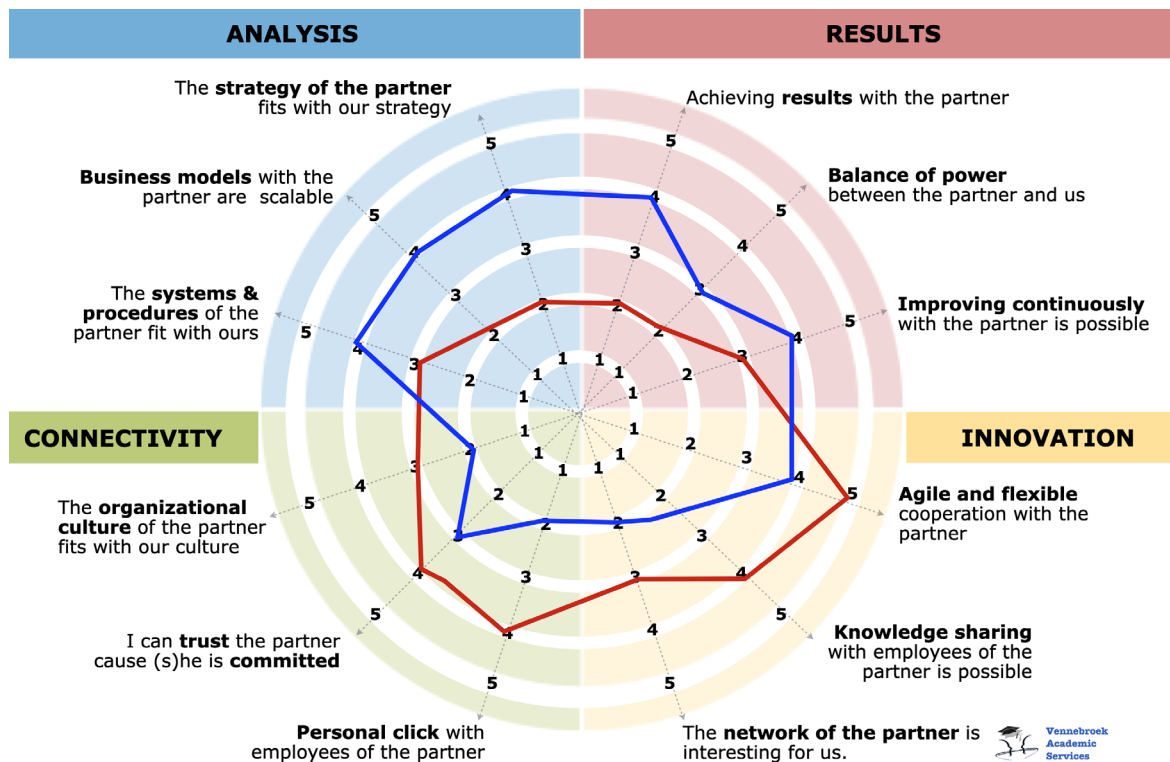


Figure 19. Alliance scan to train alliance competences.

Evaluation

The participants valued the program with an overall rating: of 7.3 (scales 0-10). Their commitment was 8.0. The event scored on interest: 7.5 and on complexity: 4.8.

In the event, we reached the following goals:

- Improvement of negotiation skills in international business setting.
- Increased understanding of the dynamics of negotiations task and relationship related issues.



- More awareness and skills concerning distributive (“zero sum”) and integrative (“win-win”) contexts.
- Insights in drivers and blockers of international partnerships.

Learnings

Learning outcomes are as follows:

- The content was relevant and appreciated.
- To make upscaling possible, some organizational changes are required.
- The program 9:00-17:00 CEST was too long and impossible to conduct in different time zones.
- Cultural / religious aspects deserve more attention (prayer time, Ramadan, etc.).

Transferability - Feasibility, and Scalability

Essential critical success factors for transferability, feasibility, and scalability are:

- The quality of the network to find the enough competent role players (alliance game) and managers (testimonials).
- Funding of the learning unit. The Negotiation festival should be part of a module and therefore financed by the HEIs.
- Feasibility can be increased by reducing the time spending of the learning unit and increasing pre-recorded statements / testimonials of role players and managers.
- The Negotiation festival is possible online and is therefore scalable. The Alliance game can be played with a total of 6 teams of 4-6 members.

Future plans: the Negotiation festival will be repeated in a different form: we will separate the alliance game from cross-cultural negotiation exercises and negotiation testimonials.

Follow up: research

Based on the experiences in the negotiation festival, we identified the following research projects:

- What is the impact of emotional intelligence on negotiation outcomes?
- How do cultures influence negotiation outcomes?
- How do negotiation strategies influence intra-group conflict?
- What is the influence of Honesty-Humility on negotiation outcomes?

Students from the University Groningen will focus on these research items resulting in qualitative or quantitative Master theses (June 2022).



2.2.5 Role of Ecosystems at Upscaling Upcycling

Introduction

Many companies use a business ecosystem to enable upscaling of their activities e.g., to boost the impact of sustainable business models, identify opportunities and develop capabilities. Even for companies that have moved from start-up to scale-up, the quality of their ecosystems (or the support systems), are essential for their success. In a combined educational-research project, we focused on sustainable ecosystems in which societal and environmental contexts were into account.

This program was a research-oriented activity aimed at creating knowledge about the role of ecosystem when upscaling upcycling activities: (1) creating a manual to conduct international comparative case studies; (2) guiding student teams in several countries who are conducting these comparative case studies; (3) organizing international feedback workshops; and (4) writing a scientific paper.

The workload of the students varied between 40 - and 840 hours (0-30 ECTS), sometimes carried out extracurricular (in Sweden and at Twente University) and sometimes curricular (Master theses at the University of Tilburg). In total 6 Master students participated in this project (3 teams of 2 students). In addition, 4 academic partners (6 staff) were involved and 6 business partners (20 staff).

Development needs

In the project we focused on these research questions:

- (1) What are the key actors in the business ecosystem for upcycling companies?
- (2) What kinds of support functions do ecosystem actors offer to upcycling companies?
- (3) How do upcycling companies perceive the effectiveness of business ecosystem support?

Implementation

Through case studies, three student teams - from the Universities of Linköping, Twente, and Tilburg – described the roles of ecosystem partners at upcycling businesses good practices. In interactive virtual workshops, we exchanged experiences and discussed the implications of the results of the studies with students and businesses.

The main elements were:

- Developing of a research manual.
- Preparing, presenting, comparing, analysing case studies.
- Multinational exchange of knowledge: cross-country student / business research and workshops.
- Discussion of Engagement Diagram tool.
- Writing of a scientific paper.

In the case studies, the following actions were taken:

- (1) *Define the focus*: Specify the goal and scope of the project.
- (2) *Map structure of the ecosystem*: Identify the different key actors, their position and how they interact with the ecosystems. The mapping of the structures is important for identifying and selecting stakeholders for in-depth data collection and analyses later. This was done through face-to-face interviews and email contact.



- (3) *Map functions of the ecosystems:* Identify and describe the ecosystems functions. The aim is to identify what support is offered, when it can be offered, and how. This was done through face-to-face interviews and email contact. After conducting the mapping, the data was structured and analysed. The data gathered during step two and three was compared to get an overview of the overlaps and gaps in the support system. In this overview clarification of what support each actor provides regarding a particular function was made.
- (4) *Assess the support system.* The perceived effectiveness of the support will be assessed through conducting interviews with the companies in focus. The challenges of the upscaling companies were described to identify potential gaps.
- (5) *Formulate recommendations.* Recommendations were presented to the companies in focus.

Development

In the research, we located actors in the ecosystems on their level of support (e.g. EU/National, Federal, local/regional, etc.) along the value chain of the company.

Evaluation

The students are very satisfied and motivated and “self-starting”. They were graded “excellent” (Sweden); 8 - 8.5 of Master theses (Tilburg University).

Learnings

Ecosystem partners and provide support various support functions: *forecasting and road mapping* information gathering and dissemination, *piloting and prototyping*, technical consulting, resource mobilization, *commercialization, and branding and legitimation*.

In a workshop, Richard Martina, researcher at the Amsterdam University of Applied Sciences HvA introduced the “engagement diagram” as developed by Oskamp (2020). The students mapped the ecosystems of their case studies using the engagement diagram.

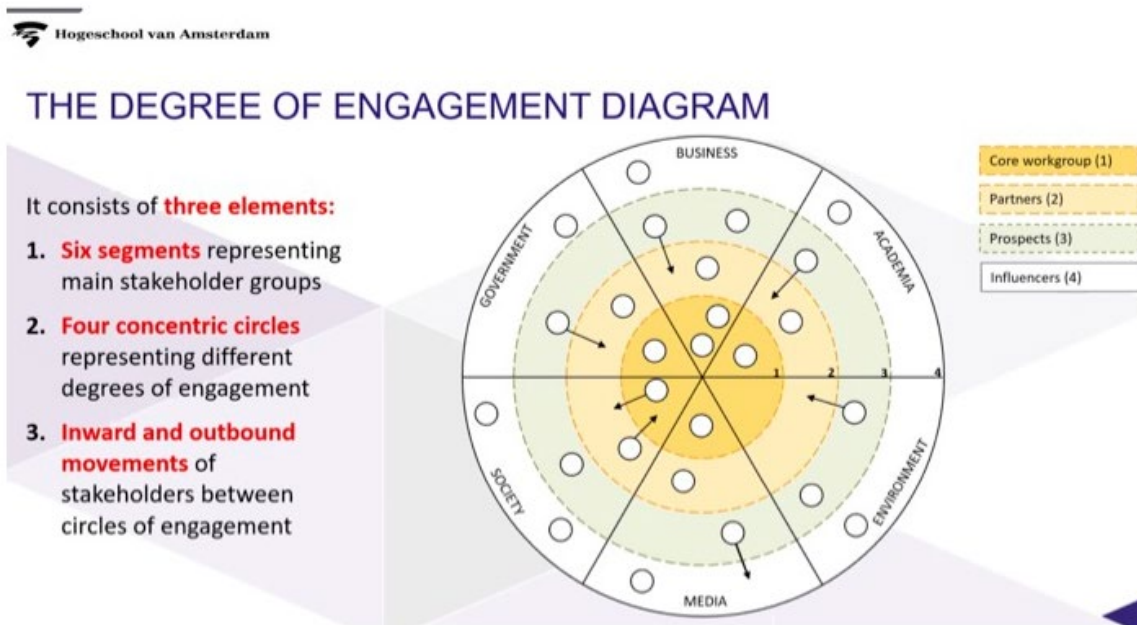


Figure 20. The Engagement diagram (Oskamp, 2020).



Klara Smeds and Nathalie Martin, Master students from Linköping University conducted case studies at a start-up (Againity) and a large company in the upcycling business (Tekniska Verken). They compared the ecosystems of these companies and distinguished typical Swedish characteristics. According to one of the respondents “the support did not enable the upscaling but made it possible to save time and simplify the upscaling process”. Timely market entry is important to gain competitive advantage. Trade organizations can be crucial. They provide useful information, contacts, and lobby for policy instruments. For instance, policies regarding taxes on energy will impact the upscaling process of upcycling companies. The significance of actors for the upscaling process varies depending on the availability of internal resources. In both Swedish cases, it was relatively easy getting access to the support functions since they are considered to be relevant in the market. The companies are also active in industries working for a common goal – sustainable development. This facilitates collaboration within ecosystems.

Rosan Verbaak and Mart Morsfieft, Master students from Twente University’s green hub followed the same pattern. They made a case study of a start-up (ECOR) and a large company in the upcycling business (Twence). They found that *prototyping and piloting* assistance is crucial for a successful upscaling process as well as *fostering networks and partnerships*, although the relevance is depending on internal competences. Support by academic institutions in the idea and design phase was important for both, the start-up as well as the established company. It assists a quicker development of innovations and can lead to easier investments by other companies as well as more time available to develop a company.

For an established company, it is easier to receive the support necessary. This support concerns both the idea phase, as well as financing projects. An established firm usually is better known.

The Twente team confirmed one of the Swedish conclusions: with the growing importance of sustainability and acting responsibly in the corporate world, offering solutions that not only recycle, but also upcycle several products can provide several benefits. In general, establishing collaborations is relatively easy for an upcycling company since the world is in demand for sustainable solutions.

We observed some similarities between the Swedish and Dutch case studies: fostering networks, prototyping, and piloting are considered to be crucial support functions within ecosystem. However, there are some differences between the two countries: trade organizations are the most important actors in Sweden whereas academic institutions, media and governmental organizations are considered to be crucial in the Netherlands.

Next to that, it is mentioned that it is relatively easy to retrieve the support needed for the studied companies in Sweden. For the established company in the Netherlands this would be the same. However, as for ECOR, it is mentioned during the interviews that receiving support could be quite difficult, especially regarding financial support. The fact that Twence had less problem receiving support might be since it is a company that is regionally and locally focused as well as that the main shareholders are the municipalities in this region. Therefore, for Twence, it is often easier to require the support needed.

Our case studies have shown several crucial factors for a successful upscaling process. The most important factor that should be considered crucial is the amount and types of support present during the upscaling processes. Next to that, the actors involved in the upcycling processes can also be seen as crucial, albeit depending on the type of actor as well as the amount of support given. Lastly, the phases in which actors give support are also important for a successful upscaling process.

The most important actors with regards to a successful upscaling process would be academic institutions for the further development of innovations, whilst the support of governmental institutions is essential for the actualization and implementation of the upscaling process. Support



from governmental institutions is needed because of financial subsidies and other regulatory frameworks, such as permits. For a company that is more regionally focused, it is important to note that societal actors are also of importance for a successful upscaling process, since they decide upon the image that a company has.

The most important support functions present are the *fostering networks and partnerships* as well as the *prototyping and piloting*. Both are needed to enable the technological and commercial growth of a company. Both Dutch companies had fairly easy access to these support functions. In addition, the support was considered to be effective.

This research has been an addition to the Swedish case studies. For our comparison, we aim to increase our research to more countries within outside of (Western) Europe because the Netherlands and Scandinavian countries might resemble.

In her Master thesis, Nienke Verenjans from Tilburg University researched the collaboration in ecosystems and the corresponding scale-up abilities. She concluded that entrepreneurs' vision on circularity differ, as was visualized in engagement diagrams.

Alexander Smaal from Tilburg University researched the selection process of business ecosystem partners and the influence of the identity of founders in these processes.

Lastly, we discussed and exchanged experiences of the case studies. We concluded that apart from the roles of ecosystem partners, also the dynamics in the ecosystem is relevant. Most of the ecosystem actors are concentrated in the early phase (i.e., idea and design phase) of innovation. Academic and governmental actors are important. Academia for the in-depth sustainability knowledge and governmental agencies for regulation. Business partners in ecosystems supply another type of support, e.g., financial, or logistical strength.

We discussed the optimal size of ecosystems (big is not always beautiful), the links with entrepreneurship theory, and new avenues for research (see Figure 21).

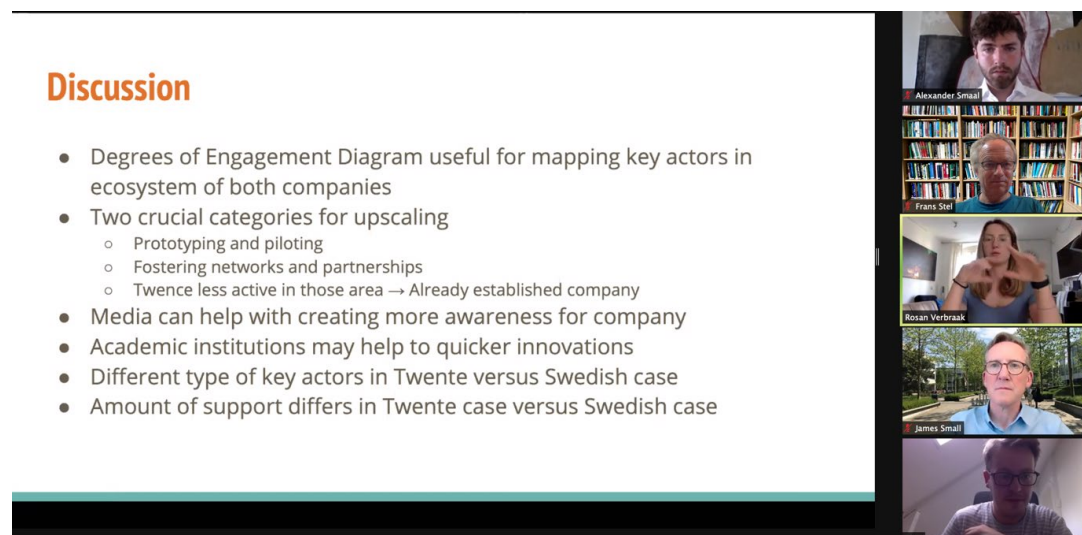


Figure 21. Discussion during the cross-country comparison of case studies



At the website of Scaleup4Sustainability, more information is available (including video recording of conclusions; <https://www.scaleup4sustainability.eu>).

Feasibility, Scalability and Transferability

Essential critical success factors for feasibility, scalability and transferability are:

- Funding of the activities. The activities of this project are an integral part of educational curricula. No additional funding is necessary. ECTS credits will be granted if/when the activities take place as part of the curricula (e.g., writing Master thesis).
- The activities can be organized online.
- Feasibility: it was possible to organize cross-country comparative case studies and obtain feedback from and to the different research teams using a common manual.
- Scalability depends on the availability of educational staff and students.

Future

The research can be expanded to other countries and research groups via academic conferences.



2.2.6 Idea Jam for a Sustainable Society

Introduction

To engage with students from different educational backgrounds and from all parts of Linköping University we created an extracurricular event in the spirit of S4S.

UKE AB (The Energy Development Cluster), a subsidiary to partner Tekniska Verken, and Apotea AB supplied students with 14 challenges from the energy sector and from the logistics sector. Students were recruited from an existing international entrepreneurship master's module and from Navitas, a student association that focuses on Sustainable Development at Linköping University, with 1000+ members. The project also engaged business coaches LiU Innovation and LiU Student Innovation (supporting researchers and students in entrepreneurial endeavours at LiU) as well as the University Incubator LEAD. The event was held at DoSpace, a creative co-working space in the heart of the startup community in Linköping.

Identified Needs

Tekniska verken (S4S) and Apotea AB had expressed interest in engaging with students to inspire solutions for sustainability. Tekniska Verken chose to engage their corporate venturing company UKE AB, which is active in innovative projects for the energy system. Both companies are interested in engaging in student projects and theses

LiU Innovation and LiU Student Innovation as well as LEAD incubator has a need for entrepreneurial students to match with startups, and to find individuals with ideas for sustainability innovations.

Students from Navitas have expressed interests in both starting their own entrepreneurial projects as well as being put in contact with companies which work with sustainability challenges.

The Idea Jam for Sustainability was a pilot for an arena to bring all these parties and needs together in a methodology showed in Figure 22.

Implementation

The event was held in a hybrid mode, although most participants were on site. Groups were formed either online or onsite, no hybrid groups were allowed to keep the workflow simple. Online participants had been announced beforehand.

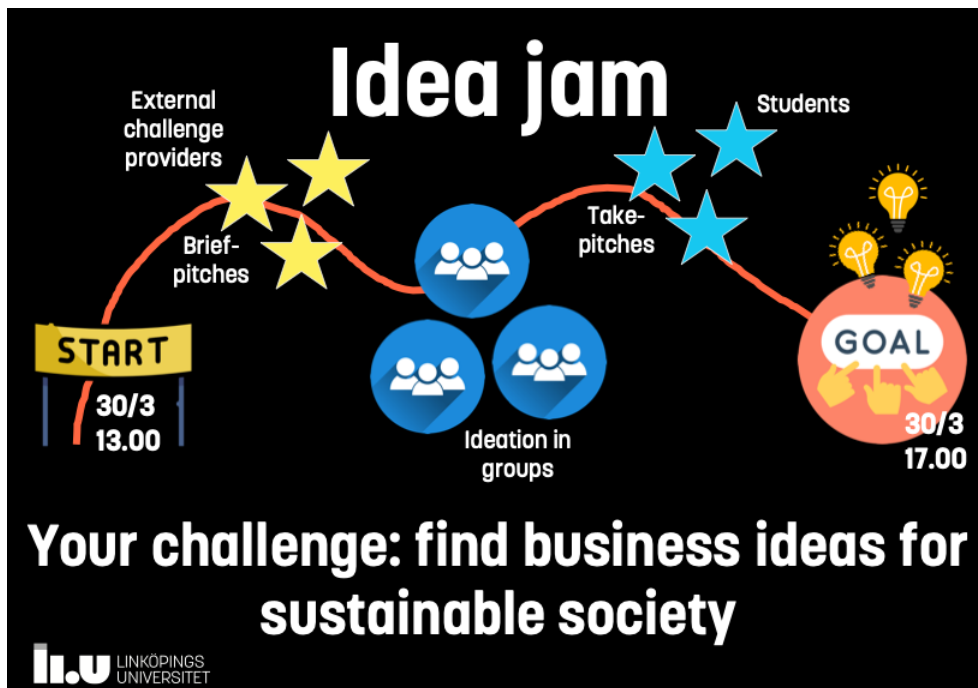


Figure 22. Structure of the Idea Jam

Schedule

13.00 - 13.15 Gathering and online check-in.

13.15 - 13.20 Welcome and introduction.

13.20 - 13.35 Challenge provider 1: CEO of Apotea Pär Svärdson gives an overview of challenges related to e-commerce and logistics.

13.35 - 14.00 Challenge provider 2: Lukas Wärend Rylander and Oliver Cedenheim from "The Energy Development Cluster" gives an overview of the energy value chain from generation to consumption and the challenges within this chain. "Energy systems of the future".

14.00 - 14.30 Students on site and online engage in grouping process (14 challenges).

14.30 - 14.45 Introduction to group work (NABC model and ideation questions).

14.45 - 16.00 Group work facilitated by external coaches – online and onsite.

16.00 - 17.00 Idea pitches on stage from 25 groups, 1 minute each.

Teaching material used

14 one-page challenges created by the challenge providers.

NABC model – the frame for pitching.

Ideation toolbox – to create ideas from challenges.

Evaluation

The event was successful with 130 participating students, 12 people from 2 different regional support organizations (the University incubator as well as TTO) and engagement from LiU Teachers as well as visiting teachers from the ECIU Community (Online).



Preparations took time, but the final setting was very successful with well-prepared challenges as well as a methodology for mixing and matching the students in 23 different teams, addressing 12 of the presented 14 challenges.

Students were outspokenly happy about the arrangement and the challenges, and the challenge providers were very satisfied with the amount of interest they received for their participation. Finally, contributing business coaches from the support system were very content with the marketing they received for their respective organisations.

Learnings

The extracurricular activity was a new approach to engage students for sustainability challenges. We successfully mixed students from entrepreneurial modules on the technical faculty and students from other disciplines. We are practiced in mixed modules from the InGenious module, managing it in an extracurricular event was new to us and the students.

The challenge-based approach has been used in the modules InGenious and in Environmental Driven Business Development. But the large-scale approach with 130 students and 14 challenges in one-pager format was a new setting.

Feasibility

The event provided a successful platform for both students, companies, and regional support organizations. The contacts made in this event hopefully will spawn new collaborations, start-ups, theses, and employments.

Scalability and Transferability

As the event was held in a hybrid mode and in cooperation with the HEInnovate project Boogie-U, we were able to invite international guests from the ECIU community. In the ECIU there are many extracurricular events focusing on sustainability, and the successful implementation of this event opens for future collaboration with the ECIU organization, especially among the universities in the Boogie-U project.

Scalability of this event is large due to the hybrid mode. We are looking into possible collaborations with other sites, running the event on multiple locations with online collaboration between teams. A large-scale event like this needs many hands-on decks from the regional support system, i.e., the University Tech Transfer Office, the local incubators and accelerators, and other business support organizations. The engaged organizations saw this as an opportunity to market themselves to students, and we therefore think that the possibility to scale this even further is feasible, through engaging even more of these support organizations.



2.3 COMPANY SPECIFIC ACTIVITIES

This section describes five development projects designed and implemented according to identified needs by a specific business partner. They are thus very different in character but can serve as inspiration for other businesses having similar needs.

2.3.1 Green Business Idea Jam: Co-ideation of students and company employees at BÜFA

Introduction

The BÜFA Group is an independent, medium-sized family business in the chemical industry. The Oldenburg-based company has its roots in the trade of dyewoods, oils and chemicals and was founded in 1883. Today, BÜFA offers a wide range of products, services, and support internationally in its three business areas of chemicals, cleaning, and composites. BÜFA has set itself the goal of making the emissions in its direct sphere of influence climate-neutral from 2021. In July 2020, a working group (The BÜFA Climate Task Force) consisting of employees from management, purchasing, marketing, ESHQ and business development met for an initial strategy meeting to put this plan into action.

Interests and motivations of participants

The lecturers identified the need to develop and test new formats of challenged-based learning within the S4S project. It was intended to test the feasibility of a one-day, extracurricular workshop concept to develop green venturing processes in collaboration of a business partner and students.

BÜFA expected that the students' external perspective on BÜFA's carbon neutrality strategy would provide input on how to implement the strategy.

The students were interested in new practical experiences. Due to the fact that the format did not include grading, the focus of the workshop was on creative innovation processes and trying out new ways of working together.

What were the development needs?

The workshop format was completely new, so the learning objectives and the expectations of the business partners had to be aligned. In addition, the schedule for the workshop had to be developed. It was also necessary to recruit BÜFA experts to participate in the workshop. A new methodology for the idea generation process was also needed. Additionally, because it was an extracurricular format, a concept for addressing the students has been developed.

Implementation and testing

What?

The Green Business Idea Jam was developed by the University of Oldenburg together with the S4S business partner BÜFA. The target of this format was to support the company in its transformation process of becoming more sustainable by:

- Identifying sustainable innovation ideas to reduce BÜFA's corporate carbon footprint.
- Enhancing competencies for BÜFA and students.



- New perspectives on BÜFA's strategy to achieve climate neutrality and search for "radical" innovation ideas.

How?

Co-ideation: Green Business Idea Jam

Mixed teams of corporate staff members and students worked together to develop innovative ideas and measures to reduce BÜFA's corporate carbon footprint. This specific type of ideation workshop mixed academic and non-academic staff members from BÜFA with students from the University of Oldenburg.

Objectives of the Green Business Idea Jam:

- Identification of sustainable innovation ideas to reduce BÜFA's carbon footprint.
- Successful ideation workshop with mixed teams (company employees/management and students).
- Competence enhancement for company and students.
- New perspectives on corporate strategy to achieve climate neutrality as well as search for "radical" innovation ideas.



Figure 23. Presentation of the first results of the Green Business Idea Jam

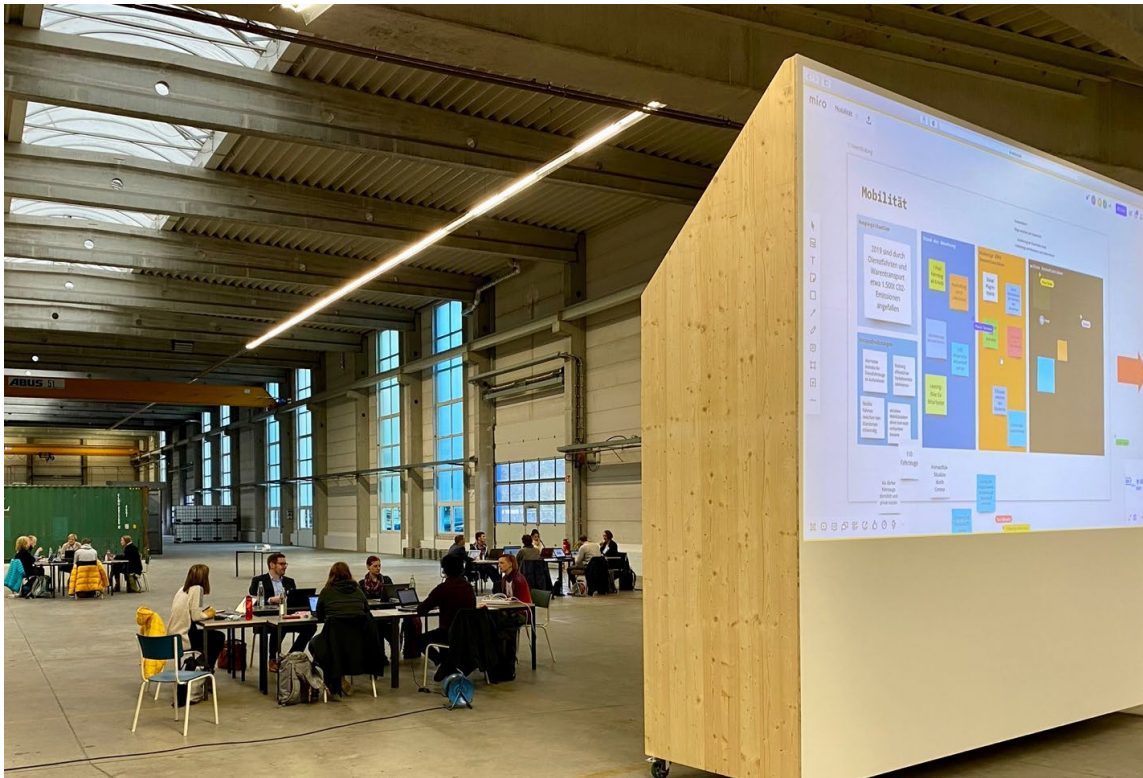


Figure 24. Mixed teams of corporate staff members and students develop innovative ideas

When?

The Green Business Idea Jam (as an extracurricular activity) was successfully held within mixed teams of 7 BÜFA employees and members of the management board and 11 students with different study backgrounds. On the 8th of October 2020, all participants met in the incubator ZUKUNFT.unternehmen, a new sustainability-oriented incubator, run by a spin-off of the University of Oldenburg, located in an old glass factory hall of BÜFA.

How did it go?

Online kick-off and fact sheets

In an online event, BÜFA presented the company, its strategy and the measures taken so far to achieve climate neutrality. The university team presented the Green Business Idea Jam process and students had the opportunity to ask questions.

After the kick-off event, students received fact sheets. The fact sheets summarized potential challenges and first ideas for BÜFA in achieving carbon neutrality. Thus, the fact sheets deepened the students' topic-specific knowledge in advance. All fact sheets had the same structure (an example is provided in the annex):

- Topic and current status.
- Thematic challenges.
- Status of implementation.
- Possible innovation ideas.
- Topic related links and resources.



Students also had to use the fact sheet to identify topic preferences they wanted to work on during the workshop.

Green Business Idea Jam: Face-to-face event

The management board provided insights in their business segments as well as the corporate strategy and challenges in the field of sustainability. After the warm welcome by BÜFA’s top management all participants worked in mixed groups of BÜFA employees and students on the topics of “Mobility”, “Operating power” and “Compensation”.

The moderated sessions followed the same structure:

- Discussion of already existing ideas in the company and adding new ideas related to the specific challenge.
- Clustering of ideas by type of contribution to GHG reduction and amount of contribution to GHG reduction.
- Multi-point assessment to narrow down ideas for follow-up activities.
- Assessment of selected ideas by using an innovation radar method and guiding questions.
- Presentation of ideas and their assessment to the BÜFA top management.
- Evaluation and feedback by the top management.
- For the ideation process, the online collaborative whiteboard platform Miro was used. The University of Oldenburg prepared customized Miro-templates for the Green Business Idea Jam. Due to the Covid19 restrictions, the teams were thus able to work together on the challenges while maintaining hygiene rules (keeping distances). In addition, the results were documented and presented in Miro.

The following climate potential template was used to cluster all the ideas being collected in the different teams. Only the most promising ideas regarding the climate potential were analysed in the next step.

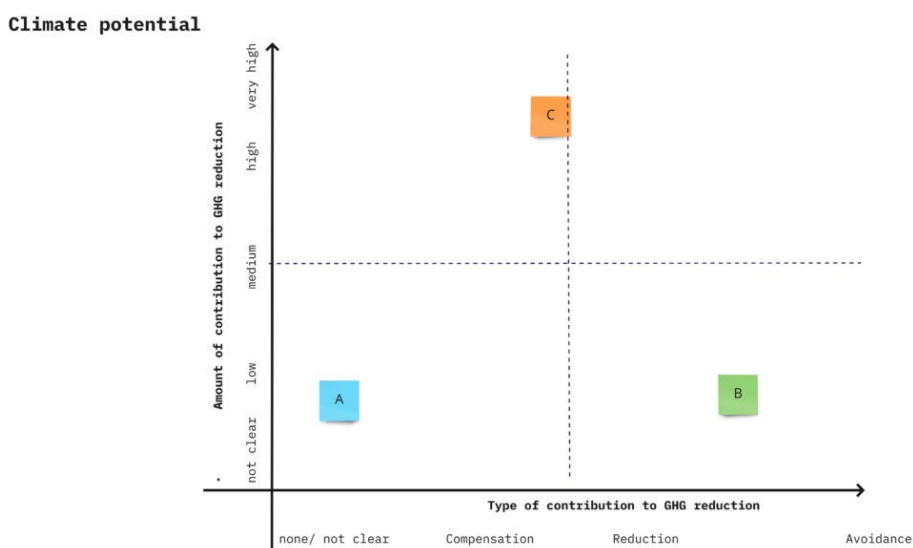


Figure 25. Customized Miro Template “Climate Potential”



With the innovation radar, the ideas examined can be evaluated in detail. Based on a guiding question, the criteria were discussed individually and evaluated according to the given scale. The arguments for this evaluation were documented in an accompanying table.

Innovation Radar

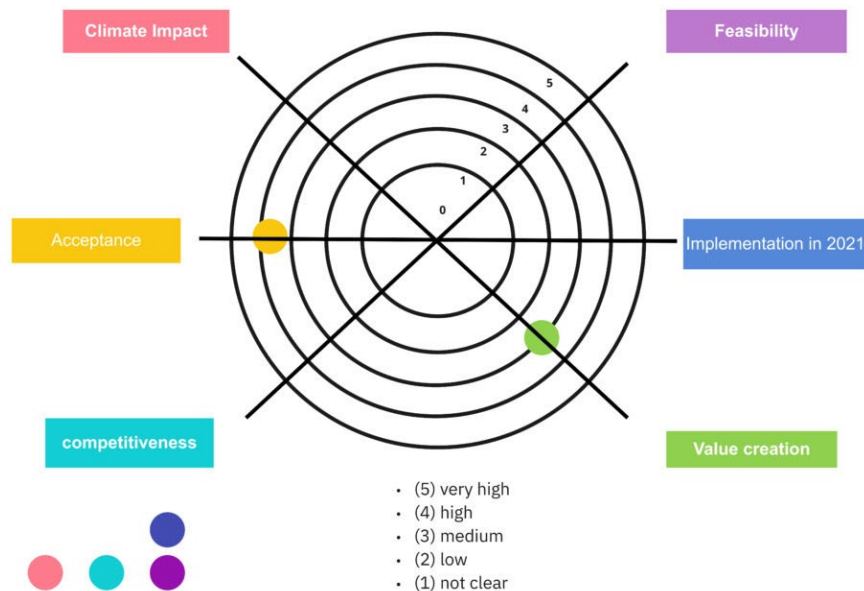


Figure 26. Customized Miro Innovation Radar Template

Evaluation criteria for the innovation idea

- Corporate climate impact: How high is the strategic fit with regard to the impact on the goals of the company's climate neutrality strategy?
- Degree of feasibility: How high is the degree of feasibility (e.g.: technical, organizational, financial) for the company?
- Probability of implementation in 2021: How likely is it that the innovation idea will already contribute to the company's climate neutrality strategy in 2021?
- Value creation: How high is the positive contribution of the innovation idea to the value creation of the company (e.g.: possible cost savings and revenue potential)?
- Competitiveness: How relevant is the innovation idea for strengthening the competitiveness of the company being evaluated?
- Acceptance in the company: How high is the estimated acceptance of the innovation idea among the company's employees and management?
- The best innovation ideas were presented by the teams in a plenary session. The BÜFA management selected their favorites and explained the ranking of the ideas.
- The innovation ideas were taken up in the master's module "Innovation Management" (see Section 2.2.1). Over a period of several weeks, the students developed solutions for the identified innovation ideas in collaboration with lecturers and BÜFA (see Section 2.2.1).



Evaluation

During the Green Business Idea Jam, seven new and sustainable innovative ideas were developed to reduce BÜFA's carbon footprint in the areas of mobility, energy and carbon offsetting. The evaluation of the selected ideas with an innovation radar was a very useful method. The follow-up discussion with the business partner indicated that the workshop contributed to the competence development of the employees. Interaction with students encouraged staff to prepare topics for the new target group. This allowed the staff to reflect on their own perspectives and ideas. For most students, the workshop situation was a new challenge. They had to take on several roles at the same time: Student, Expert and Consultant. The feedback session at the end of the workshop showed that students were able to deal with this challenge.

The follow-up of the developed approaches in a "Climate Challenge Seminar" as part of the curricular master module "Innovation Management" in 2020/21 led to a high implementation rate of the ideas. The 7 ideas were prepared as a fact sheet for the seminar and represented the basis for the work of the student teams.

At the end of the workshop, a Mentimeter survey was conducted. Students and BÜFA management had the opportunity to rate their satisfaction with the workshop on a scale of 0 (total disaster)-5 (very satisfied). 17 people participated in the survey. Satisfaction with the workshop was very high. 5 participants were very satisfied, and 11 participants were satisfied. Thus, BÜFA management was very satisfied with the results of the Green Business Idea Jam and promised to implement some of the ideas in 2021. The students were also very happy with the format.

Learnings

What is new and innovative?

There are four innovative elements in the Green Business Idea Jam approach:

First, the format of the Green Business Idea Jam which systematically links students and business partners in the search of innovative ideas for green business strategies as such is completely new and was developed and tested for the first time.

Second, the innovative ideas and measures to reduce a company's carbon footprint were developed by mixed teams of corporate staff and students. This special type of ideation workshop mixes academic and non-academic staff members from a company (BÜFA) with students from higher education institutions (University of Oldenburg).

Third, the participating students had very different academic backgrounds. The heterogeneous mix of students was very helpful for the idea generation.

Fourth, the developed ideas of this extracurricular format were picked up and followed up by the module "Innovation Management" and its seminar "Climate Challenge" of the University of Oldenburg (see 2.2.1). Thus, an extracurricular format was systematically connected with a curricular format. This overarching "workflow" from co-idea generation between business partners and students (ideation) to formulating sustainability challenges by a business partner as a student task to the development of innovative sustainable solutions across different extracurricular and curricular formats is a fully new approach in collaborative green venturing.



Success factors, drivers and barriers for the implementation of the approach

For the one-day workshop concept, a well-prepared schedule is an important success factor. It should be ensured that mentors and lecturers have good skills in facilitating different types of sessions. In addition, the technical equipment for a hybrid workshop concept must be provided. The business partner must be willing to engage in a very open format. There is no guarantee of success for the workshop, as students and staff do not know each other beforehand and need to establish forms of collaboration in a very short time.

Feasibility?

The preparation effort should not be underestimated. The identification of relevant topics, the development of fact sheets and the coaching of the moderators and mentors require substantial preparation and coordination activities. Setting up new Miro templates for customized formats can be time-consuming. On the other hand, if the Miro template is filled out, it is very good for presentation and discussion, as well as an efficient way of documentation.

Scalability?

Scalability depends in particular on the number of company representatives who can support the process as mentors. In addition, the workshop is designed as a one-day event. Thus, it should not be overloaded with too many topics. The combination of Miro with a face-to-face workshop generated very good results. A purely online format would limit the depth of the discussion, for example.

Transferability?

The Green Business Idea Jam can be adapted to other sustainability-oriented co-ideation formats with business partners and students and is easy to transfer.

Future activities?

The Green Business Idea Jam was the kick-off and preparation for the new mandatory seminar “Climate Challenge” for master students (see 2.2.1). Approaches were followed up by 35 students during the “Climate Challenge” –within the study module “Innovation Management” in the winter term 2020/21. Potential implementation into the module Innovation Management is to be discussed.



2.3.2 Co-Design Workshop “Circular Challenge” at ECOR/Noble

Introduction

We organized two Circular Challenges: one virtual edition in September 2020 and a physical challenge in July 2021. In total 56 Master students participated in these extracurricular activities. We gained experience with 1- or 2-day programs with a workload between 8-16 hours. In total 4 academic partners (10 staff) participated and 5 business partners (10 staff).

Development needs

- Develop a real-world challenge in a short-term (pressure cooker) format of 1 - 2 days.
- How can students assist companies to increase their sustainable practices or solve / alleviate sustainable issues?
- Which organizational lessons can be drawn?
- How should the challenges of companies be defined?
- Which new tools are helpful (playbooks etc.)?

The main elements of the circular challenges were:

- Student teams developed innovative and feasible ideas and presented these to expert juries.
- We focused on sustainable innovation process instead of supplying content only.
- Participants had different backgrounds (acad. / national) and collaborated in interdisciplinary teams.
- Companies and coaches assisted the teams on demand, both virtually (first CC) and on campus (second CC).
- We had intense discussion of the results with jury of circular experts and businesses (challenge providers).
- We experienced with digital tools (Mentimeter - barriers, drivers of implementing circular challenges).
- We provided the participants with certificates of participation / winning.

In total, participants developed 7 new business ideas. The participants made an inventory of the most important barriers and drivers of circular business. Barriers are e.g., existing policies, lack of interest of stakeholders, low prices of raw (“virgin) material, switching costs, or technology. Drivers are e.g., increasing demand, external pressures, and support from top managers.

The participants developed their solutions, using the following UNIDO model of circular business (Figure 27):



Figure 27. UNIDO model of circular business used. Source: <https://www.unido.org/unido-circular-economy>

Circular business models start at the design phase. In joined presentations, the teams pitched their circular ideas, followed by a Q&A of the businesses and the expert jury members.

What's new?

- We developed new educational formats of Student / business collaboration in green venturing.
- We experienced the differences of digital or on campus programs.
- We changed our role: students of the green hub Twente organized a CC; we provided knowledge and facilitated an event.
- Businesses provided coaching during the sessions.

Implementation

On September 11th and 12th, 2020, students from Sweden, Germany and The Netherlands collaborated in five international teams to develop new ideas to improve the circular business models. During the first day, three companies (ECOR, CEWE and DSM Niaga) presented their cases. During the second day, the teams developed new innovative and feasible ideas and presented these to an expert jury. Every team consisted of members from a different academic and national background, making it an interdisciplinary team: they benefited from each other's different strengths, background, knowledge, and skills. The international student teams could make use of technical experts of the companies and process coaches. Ultimately, the companies commented on the proposals, and the expert jury selected the winning team.

An overview of teaching materials and implementation tools (playbook, teaching material etc.) can be found at the S4S-website.



We organized a second Circular Challenge on campus together with the Green Hub Twente. It took place at the Design Lab Incubation Space of the University Twente. Some twenty students and business representatives from India, Botswana, Kenya, Italy, USA, and the Netherlands collaborated to develop new ideas to improve the circular business models for two start-up companies.

Two companies (ECOR and IMPULSE) presented their cases. Teams developed new innovative and feasible ideas and presented these to an expert jury. In truly making it an interdisciplinary team with members from a different academic and national backgrounds, the team members benefited from diversity. The international student teams could discuss intensively with representatives of the companies. Ultimately, the companies commented on the proposals, and the expert jury selected the winning team.

ECOR (Enabling co-Creation co-Operation co-Responsibility) is a company active all around the globe with a unique technology to convert cellulose-intensive waste into sustainable products.

IMPULSE is an awarded start-up of UT students Creative Technology and Advanced Technology, one of the five most promising sustainability web start-ups. IMPULSE offers consumers the opportunity to offset the exact CO₂ emissions of consumer goods upon purchase. IMPULSE provides carbon compensation services to companies. It is a free addition to Corporate Social Responsibility strategy of companies. IMPULSE aims to “make the supply chain at retailers more sustainable with at least one million tons of CO₂ within five years.

Assessment (scale from very poor; 0, to excellent; 10)

- overall rating 8.9
- commitment 8.7
- enough time 6.6

In their feedback the participants reported their main eye openers: “It was interesting to learn about these types of start-ups and discussing with people from different (cultural) backgrounds”.

The companies valued the new ideas in circular economy and even were excited about these.

The one-day event was considered too short; several participants indicated to need more time to develop their plans or to involve customers in it. The overall opinion was positive: “very interesting and great place to let the creativity flow” and “...it was good practice ...” *“The counsellors were helpful”*.

The Circular Challenge programs are mostly suitable for students with high entrepreneurial attitude.

We learned that even well-established companies struggle with implementing circularity. Although time pressure is part of the challenge, more time is appreciated and more attention towards time management is needed. In the future we will supply more content by e.g., adding a toolkit to structure ideas. In addition, we will add more aspects: more detailed company information, we will include the consumer viewpoint, and possibility to network with companies. We will build upon our experiences in the Erasmus + (Cooperation Partnership) project: “Challenge4Impact” (2022 – 2024)

Some learnings from the students:

- “Learning how to work with people from different backgrounds and solving real case studies is fun”.
- “Useful, enjoyable, helps you gain lots of experience and a deeper understanding of circular business”.
- “Circular challenges can be solved with out-of-the-box creativity”.



- “In a short time creating innovative and real solutions is possible”.
- “The counsellors were helpful”.

Transferability - Feasibility, and Scalability

Essential critical success factors for feasibility, scalability and transferability are:

- The quality of the partnership with the company (supplier of the challenges); the relationships with ECOR and CEWE are excellent. They took an active role in defining and the execution of the Circular Challenges. The other suppliers of circular challenges were on a short-term involved and on a transactional basis (focused on the event).
- Funding of the learning unit. The Circular Challenge formula can serve as a kick-off or warm-up activity for a sustainable educational track. Due to the short-term character (duration of 1-day or 2-days), limited funding is necessary. No ECTS credits will be granted.
- The Circular Challenge is possible online or offline. As kick-off or warm-up activity, an offline version is recommended. In the Circular Challenges, the need for digital tools is limited. For an online version, a Zoom-platform (or equivalent) with break-out rooms is sufficient.
- The feasibility is dependent upon challenge providers, and organizational matters (availability of facilities, time in an educational institution etc.)
- Transferability. Engagement of companies is vital. The learning unit is easy to organize with a limited preparation time. Companies should be present during the event. Instruction time is limited (“learning by doing”).
- The scalability implies the possibility to implement a program online. Circular Challenges can easily be organized online.

Future activities

The next step could be to organize Circular Challenges with mixed teams of students and company employees. This might increase the cross-fertilization of the learning unit and the added value for students and businesses.



2.3.3 Improving Corporate Venturing Processes at Tekniska verken

Introduction

Tekniska verken had several initiatives where ideas are generated from students, including hackathons, InGenious and master theses. The problem lies in transforming these ideas to innovations within the company. Tekniska verken's vision – to build the world's most resource-efficient region, sustainability is always a consideration in the operations of the company. The asked outcome from the project was to understand how venturing is performed in the company, both within the company but also with the interacting outside the company. What would a preferred venturing process for Tekniska verken look like was essential understandings, focusing on student/company and academia/company collaboration.

The Business Development Department at Tekniska verken (TV) support projects initiated and sponsored by the different Business Units (BU), i.e., works as "internal consultants" in projects developing more incremental innovation or ideas. This is what is called the "Catalyst role", which thus has the purpose to try to increase speed and quantity of innovations from the idea stage to solution. However, there is also a need for, and a demand from the superior management at Tekniska verken that the Business Development Department (BDD) should initiate, develop, and scale innovative solutions that extends the existing product strategies. It is not evident that these solutions are commercialized in, or sold by, any of the existing Business Units but the idea could instead lead to a new BU or cooperation with an external business partner. The development and scaling of these more "radical" solutions is what we call the "Incubation role". The Business Development Department believe that the activities related to the Incubation Role could be more effective and generate better solution. To be able to learn from these initiatives and empower more of these activities, it is important to map how the working operation has looked like and how one can further develop it and thus accelerate the "Incubation role".

Tekniska verken has an official innovation process meant to guide an idea to the launch of a competitive offer. The process contains of four activities; 1. generating and prioritizing ideas, 2. developing a concept, 3. realizing the offer and 4. launching and commercializing the offer. Ideas can be generated both by internal and external actors. An idea analysis is performed on received ideas, including background of the idea, affected stakeholders, social, environmental, and economic effects of the idea, a SWOT-analysis, and if the idea interacts or counteracts other initiatives within the organization. Ideas are then prioritized based on the resources needed to realize the offer and the effects the offer would have on Tekniska verken's current range of offers. In the prioritizing, factors such as sustainability, profitability, feasibility, and innovativeness are also considered. When an idea is selected for development, the idea is further developed into one or more concepts for the offer using a concept analysis. The concepts are then tested, evaluated, and compared, and based on this information a decision is made on whether or not the concept should be realized into an offer ready to be launched. In this step, funding for the projects should also be determined. When an offer is realized, it's developed and packaged in a way that suits both internal and external interests. A communication plan for the offer is also developed. The offer is then launched in a commercial setting where it's available for end users. The launch of the offer is evaluated to make sure it reaches its objective, and if this is not the case the offer is adjusted, modified, or shut down.

Tekniska verken is collaborating with small companies and start-ups on "green venturing" projects, exchanging mainly information, technology, and money. Tekniska verken's partners in these projects expresses the benefits of the collaborations as getting a reference case for future sales, getting access to Tekniska verken's large customer base and accessing knowledge. The partners also experience problems with the projects, such as differences in industry pace. Another lesson from this



project is that Tekniska verken's adsorptive capacity depends on their ability to recognize the value of external information.

Implemented activities

To understand the current venturing within Tekniska verken, a document analysis was performed together with interviews related to current innovation projects within the company. After gaining the background information another study was with the purpose to further explore the current situation and suggest how to further define, develop, formalize, and accelerate the "Incubation Role" of the Business Development Department. In the report, the following research questions should be answered:

RQ 1. How and why were the different ideas initiated?

RQ 2. How were the different ideas financed?

RQ 3. How did the decision-making look like?

RQ 4. What was the key factors for the success?

Four larger projects that were identified as successful of the interviewees were investigated, together with three projects that were identified as less successful, based on them being delayed or shut down within Tekniska verken's formal business development process. Based on the responses from the interviews, the following implications about Tekniska verken's venturing process were produced:

Successful venturing often starts with a strategic opportunity being identified by Tekniska verken and when this opportunity is connected to the right partner, Tekniska verken start to pursue the opportunity. In most cases, collaborations have been initiated by an external party who has identified the same opportunity and contacted Tekniska verken. In most of the successful projects, the main risk taker was not Tekniska verken, but another party within the partnership.

In the successful projects that were analysed, the technological innovation has mainly been incremental, while the business models and partnerships of Tekniska verken have been more disruptive and pioneering. Many of the new concepts resulting from Tekniska verken's venturing have a potential to decrease the profits of other parts of Tekniska verken's business and even making the current competence of Tekniska verken's in certain areas obsolete. But in some of these projects, it is recognized that if Tekniska verken did not further develop a concept, then someone else would, taking business from Tekniska verken. In successful projects, the objectives of the project were defined early on and where shared by all parties. In most of the successful project, a predetermined process was not used, but in the same project's formal agreements where present throughout the projects.

Common for all successful projects was the fact that the main objective was not to gain profit in the short term. The most valuable outcomes could instead be for example gaining knowledge, new partnerships, and contacts. The projects could also lead to an appealing offer for the customers and synergies between different offers, such as a long-term relationship with customers instead of a single point of access. All the successful projects were identified as giving environmental benefits when implemented, although this was seen as an indirect benefit of the project and not the primary driving force.

A common factor for many of the successful projects is fitting human resources, such as competent project managers, the involvement of individuals in strategically important positions and commitment from all organizations within a partnership. In less successful projects, lack of fitting



human resources was identified as an obstacle. It was common that less successful projects didn't have a clearly appointed manager and that it was unclear who should be the manager, based on competence within the specific area and interest in the innovation. Lack of human resources was in one case seen as related to high turnover within parts of Tekniska verken. Resources provided in the projects from different parties include competence, access to customers and money. In one of the projects, a lack of internal resources that were promised to the project was described as an obstacle. In all the less successful projects, the idea itself was seen as making the project more difficult. It could be that the idea was trying to solve too many problems at once, that the idea was not concrete enough or that the idea wasn't based on an existing problem. Another common factor of the less successful projects was that the benefits of the projects for Tekniska verken were not clear.

Evaluation

Tekniska verken provided innovation challenges for the students based on the real business challenges the company is facing. The students who chose to work with challenges from Tekniska verken were provided with feedback on their projects, both in the form of individual groups meeting with experts throughout the module but also on students' final presentation of their projects. During the module collaboration, we found that many ideas generated from student were not in line with Tekniska verken's mission and should probably be commercialized by other types of organizations, even though the challenges were based on the business challenges of Tekniska verken. Some suggestion for preventing this issue in further module collaborations might be to introduce the business challenges more clearly through e.g., study visits at Tekniska verken or by spending more time coaching the groups throughout the project.

RQ 1. How and why were the different ideas initiated?

The ideas have been initiated and motivated by needs or requests from customers and the internal organization but not as a part of a business expansion or development process. Overall, what could be said regarding the Idea generation is thus that the ideas have been initiated in an ad hoc way, rather than being planned or associated with a strategy development. The ideas have further been initiated by individual employees.

RQ 2. How were the different ideas financed?

The business models for the ideas are all different. One is based on a part ownership of the Energy Cluster that co-owns the initiative. Another is based on a Power Purchase Agreement, where TV AB owns 20 percent and an infrastructure fund the other percent. And a third is financed through R&D development, Patent fees and recruitment of a new employee, the business model is moreover based on a license agreement with partnership company as a license holder.

RQ 3. How did the decision-making look like?

The decision-making process have in detail been different for the different ideas. However, on a higher level two projects could be said being similar as they were based on internal decisions whether the ideas should be taken action on, then the TV AB board and the Municipal Council had to agree on the decision. What can be mentioned about the decision-making process is that it was slowed down by the fact that it had to go through the Municipal Council. To speed up the process, the ideas could be managed and owned by an owner structure like the Energy Cluster instead. Although for the third case, the decision was made in the Patent Council and partly by the former CEO. Further in regards of the project's time frames, the ideas show similarities.



RQ 4. What was the key factors for the success?

The ideas can be said being very different in their nature, they were initiated through different needs, they have different business models and the process of the development of the ideas is differing. Moreover, it is difficult to evaluate whether the business ideas have been successful or not, since not all of them are commercialized and their success have not been analyzed and evaluated. More important, the ideas have mainly been driven by individuals with personal interest in the specific field or business model. This have most likely been crucial for the idea's success. For the different ideas, the preconditions for an efficient intrapreneurial activity have been different. Support from management, Goals and Values of the Company, Inner motivation and knowledge of the employees have been important. Sometimes intrapreneurs also expressed a resistance against Intrapreneurship in the organization and that the employee instead must fight for the projects, something he claims not all employees can handle. This confirms the suspicions that there are low rule breaking tolerance, low support from management and that the working conditions do not favor Intrapreneurship. Moreover, what can be concluded is that the analysis model of Stage-Gate was not so applicable to analyse these types of radical ideas that are developed iterative and without any governing process surrounding. The Incubation Process from Vinnova however, is better suited to analyse these, more iterative processes.

Learnings

By reviewing literature and best practice from other companies and discussing the findings with a HEI representative from Linköping University, a variety of ideas for how Tekniska verken can improve the collaboration with students and academia were collected.

- Engagement from top management is needed for academia and company collaborations to succeed.
- All collaborations need to be based on the company's needs and strategies.
- It is important to have clear targets for the collaboration that are monitored continuously. The company need know what they want to prioritize within the collaboration, and which needs the university can help the company meet. Prioritize and needs must be communicated to the university.
- The collaboration needs to create value for both parties.
- The decision to continue a collaboration should not be made by people participating in the project.
- The collaboration should be led by someone on a strategic management level within each organization, supported by an individual within the operational management.
- The partnership should be managed on the strategic level, but decisions within projects should be made as far down in the organization as possible. Bottom-up initiatives are positive but should always be in line with visions for the collaboration.
- Evaluating the work within the collaboration is extremely important. Check progress and priorities. Qualitative key performance indicators (KPIs) should include different views, scientists, students, HR, and management.

Best practice in academia-company collaboration

- Choose a university based on it being distinguished in the area the company want to promote and make sure the ambitions of the company and the university are shared. Choose only from national universities since an international collaboration might decrease efficiency. Connect with the top universities by sharing knowledge and resources with them.



- By setting up a budget that can only be used for common projects, collaboration will be encouraged.
- Influence education in a way that benefits the company. Let company staff hold guest lectures at the university or be in charge of parts of a module.
- Make sure that the academia-company collaboration also leads to increased cooperation between different parts of the company.

Possible activities

- Letting employees mentor students majoring within areas of strategic importance for the company, giving the employees insight into current research within the area and students insight to the company. Creates bonds between the university and company.
- Part time job or mentorship during two semesters at the company, then writing thesis for the company.
- Module collaboration during the first year of a student's masters, then developing projects further in their master's thesis at the company.
- Help developing a research area, and you will get new knowledge in return. Interact with researchers regularly.
- Researchers at the university having lectures at the company to spread knowledge.
- Knowledge transfer partnership (KTP), graduates are in charge of strategic projects within their area at the company, supported by their former university. The projects last up to two years and can lead to further employment for the graduate at the company after the project ends. Can lead to increased sales or profit, the company gaining knowledge, possible spin-offs, and development of new products.
- Workshops between employees and students to spark employee creativity and increase students understanding for the business challenges of Tekniska verken.

How can one further develop the working process and thus accelerate the "Incubation role"?

To develop the working process of the Incubator role, the right preconditions need to be in place. By fostering a good working culture where the employees become the right tools and coaching so that the employees possess the right knowledge, skills, and creativity. Additionally, the inner motivation and the attitude of the employees are important, which could be displayed clearly in several cases of success. To strengthen and improve these preconditions even more, it is important to attract suitable resources, establish networks, training, and mentor sessions for the potential intrapreneurial employees.

Moreover, the goals and the values can as in the examples, be of importance to foster Intrapreneurship and by communicating and integrating these in the organization. Additionally, what is crucial for generating Intrapreneurial activities and thus accelerate the Incubation role, is support from the management in combination with an agility and rule breaking tolerance. This could in the interviews, be very important and is something that has been working well, but in some cases needs to be even better.

To improve this, a combination of "carrots and sticks" could be implemented. In order to speed up the processes, there also must be a clear and efficient decision-making process and what can be concluded from the projects is that the process, including decision-making both in the board and the Municipal Council, was rather slow. Moreover, the decision-making process must be clear and well



known, so the Intrapreneur and other employees easily can navigate through the process. In those cases, where investments can be done outside of the company, the investments should be done in the way the Energy Cluster was done.



2.3.4 Internationalization Strategies of the Cleantech Company Againity

Introduction

Againity AB is a Swedish cleantech company which develops technology based on the Organic Rankine Cycle (ORC) to convert low-grade heat into electricity. Againity AB wanted to investigate the possibilities of expanding into international markets. However, the company had limited resources and knowledge of international markets. Thus, their participation in this project was based on their need to investigate the technological and economic conditions under which their technology can be installed in international markets. The focus of Againity is to expand their business activities in the district heating market to countries in northern Europe. Another important focus area for Againity is small scale waste incineration with electricity production in developing countries where improper waste management is a problem.

Development needs

- For students: Market research exercise for students to get a real understanding of market dynamics in different countries: in high tech markets, regulation differ, as well as the industry structure, energy transition etc. The technical complexity of the Againity case was new to the students (usually fast-moving consumer good analysis).
- For company: market opportunities in Europe including feasibility to implement these.

What's new

- Market research in technical complex ecosystems.
- For the company: larger scale: 165 students were involved.

Implemented activities

This internationalization project with Againity was conducted by student groups together with Againity and with supervision from teachers at Linköping University and Avans University of Applied Sciences. One of student groups focused on the technical aspects and the other group focused on the business aspects. Even though the studies were carried out as case studies in selected countries, the insights generated were abstracted to a level that can be applicable to other cases outside the studied countries.

The completed activities based on collaboration between Againity and S4S partners are:

- Bachelor project: General market and competition analysis:

Students:	Ella Eriksson Sjögren, Herman Holmberg, Josef Jansson, Martin Lillhager, Beatrice Ronsten, Gustaf Sundbue
S4S:	Wisdom Kanda and Olof Hjelm
Againity:	Joakim Wren and Elin Ledskog
- Technologies for electricity generation from industrial excess heat (Bachelor thesis):

Students:	Josef Jansson, Martin Lillhager
S4S:	Wisdom Kanda and Olof Hjelm
Againity:	Joakim Wren
- Drying and combustion of sewage sludge (Bachelor thesis):



Students: Ella Eriksson Sjögren, Beatrice Ronsten
S4S: Wisdom Kanda and Olof Hjelm
Againity: Joakim Wren

- Analysis of the European ORC-market – A study of the market’s driving forces and obstacles, stakeholders, and potential future development (Bachelor thesis):

Students: Herman Holmberg, Gustaf Sundbue
S4S: Wisdom Kanda and Olof Hjelm
Againity: Joakim Wren

- Againity goes international:

Students: Avans University of Applied Sciences
S4S: Rogier de Jong
Againity: Joakim Wren, Elin Ledskog, Kristina Pettersson

- Investigation of expansion of Againity into east European countries and the waste to energy market:

Students: Jonas Lundberg, Gabriel Segergren, LiU
Researchers from S4S: Wisdom Kanda
Againity: Joakim Wren

- Upscaling upcycling business - A study of support business ecosystems for upscaling upcycling businesses:

Students: Nathalie Martin and Klara Smeds
Researchers from S4S: Wisdom Kanda
Againity: Joakim Wren

Evaluation

We collected viewpoints from students, teachers, and the company (Againity) regarding how they experienced the collaboration activity. These viewpoints are presented concisely below.

From a student perspective:

- It was interesting to work closely and get direct feedback from companies.
- It was insightful to get a glimpse into the business ecosystem in Linköping.
- The workload was high since we got a lot of feedback on our report and participated in extra activities such as presenting the results to the company and other students.

As teachers, we observed that:

- It was a challenge to deliver a single report which meets both academic requirements and company expectations.
- The composition of student teams both in terms of cultural background and academic background was particularly influential on the outcomes of the student projects.



- The benefit of involving students is that the topic fits the profile of their studies and thus will allow them to apply their knowledge on practical challenges, deliver in-depth results to the company while learning.

From a company perspective,

- Timely delivery of reports and outputs are particularly important for the success of such student-business collaboration.
- The activities together with Avans sort of died out due to the involved personnel quit Avans, and we did not get any feedback during or after the collaboration.
- The cooperation with Liu went really smooth and without administrative burdens. Information and directives were clear, and Linköping University showed a good understanding of incentives and outcomes from a company point of view.
- The students were interested and focused, and in general performed very well. This facilitated a good cooperation and subsequently results outcomes that was used and implemented by the company in a straight-forward way.
- The company believes that the project tasks assigned to students together with supervision from academia and discussions with company representatives stimulated a really good learning environment with fruitful outcomes for all parties.

Learnings

Based on these student-business collaboration activities as part of S4S, Againty developed an internationalization strategy. This includes:

- An overall analysis of the European ORC market.
- Alternative technologies and competition in northern Europe.
- Mapping of heat producers, including yearly production (GWh heat/year) and installed power (MW).
- Regulatory aspects, electricity prices, taxes.
- Specific projects on waste-to-energy in south-eastern Europe and electricity production from sewage gas.

Transferability – scalability – feasibility

- **Transferability:** The case descriptions and assignments should be well-described, both on paper and in presentations.
- **Scalability:** internationalization assignment is easily scalable. Bottleneck is to assess the assignments and implement the advises by the company. In order to solve this, the student advises should be categorized, and evaluated by educational staff and transferred more structurally to the business partner.
- **Feasibility:** short term exercises that can easily be integrated in a larger educational module.



3. Discussion and Conclusions

Chapter 2 presented the development, implementation, and evaluation of several new approaches in student-business collaboration in green venturing. The approaches are different in many ways and implemented in varying contexts. The learnings are thus often rather case specific, but in this chapter, we discuss more general learning outcomes of WP3 and WP4. It starts by discussing the innovativeness of the developed approaches followed by a discussion on learnings from the separate evaluations made with a focus on scalability and transferability of different approaches. Separate sections are dedicated to the role of the teachers and challenge providers (i.e., our business partners) in green venturing activities. The chapter ends with the conclusions and future activities.

3.1 INNOVATIVENESS OF DEVELOPED APPROACHES

To start the discussion on innovativeness, it is important to define the term innovation. Based on Brennan et al. (2014) we relate the term innovation to academic institutions and define the term related to HEIs as “a new or significantly improved product, process, organisational method or an organization itself developed by or having a significant impact on the activities of a higher education institution and/or other higher education stakeholders”. This implies that an approach does not have to be “new to the world” to be labelled as innovative, instead it could be about adaption and implementation of something that is new to the context. However, and following the Schumpeterian definition of innovation (Schumpeter, 1934; Fagerberg et al, 2012) it implies that the, to the context, new material, must have been implemented/used. The S4S-project has resulted in one new module and several new extracurricular activities. We have also developed new learning units within existing modules as well as significantly improved already existing modules. Teachers and business partners have together developed new forms of collaboration and gained new experiences and learning outcomes. Finally, students have participated in transdisciplinary and transnational collaboration activities enriching their education leading to improved skills and capabilities in green venturing.

In WP3 and WP4 we worked with four existing modules and developed one new. Departing from the conclusion from Fichter et al. (2016) that university support systems for promoting sustainable entrepreneurship and eco-innovation in Europe was at its infancy, we made a benchmark in Sweden to find out how common it was to offer modules combining sustainability and entrepreneurship (Larsson, 2020). We identified around 30 modules at 19 universities. Most of the modules had been offered only a few times or were to be offered for the first time. Two thirds of them included some project works but it was not possible to see if this involved external businesses or not. A more in-depth analysis of ten modules showed that business partners most often were involved as guest lecturers or coaches but only a few brought cases that students developed within the module. Most had a focus on environmental sustainability as well as learning about green venturing rather than practising green venturing. The general conclusion was that there existed modules like ours but that it was not mainstream.

3.1.1 Benefits of new forms of business-student collaborations

All business partners in S4S had some previous experience in student-business collaboration, often in the form of guest lectures and thesis projects but also more advanced collaborations such as employing student co-workers (e.g., Tekniska Verken) or existing green venturing activities (e.g., Fujifilm Future Challenge). Throughout the project such collaborations were deepened and



broadened and new were started. For many businesses partners collaboration became closer than before S4S. They took a more active role and provided more content to the modules and activities, shared knowledge and experiences, and actively coached students. This resulted in new ideas and ways of working and existing ways of working were confirmed as successful or in need of development.

Students on the other hand got real life data such as potential customer feedback further strengthening the ideas they developed. They also often got the opportunity to stay in the companies' premises and not only meet business partners at university campuses. Together, these collaborative green venturing activities generated a mix of benefits for the involved partners including competence development for students, as well as learning and reflection for business partners, stimulating and accelerating innovative ideas.

Further the collaborative green venturing activities can be seen as a hybrid form of teaching, learning and transfer leading to a new innovative form of combining teaching and transfer activities of universities.

3.1.2 From case-based to interdisciplinary challenge-based education

Sustainability oriented entrepreneurs often have a challenge to translate sustainability ambitions into customer value (Keskin et al., 2013). They often compete with already existing products and services with lower sustainability performance making it more challenging to both be attractive to customers and maintain a high sustainability profile.

Educating students in green venturing must deal with such wicked sustainable societal issues and we have noted that this often calls for more radical system innovation in contrast to mainstream product or process innovation. Green venturing is thus in its nature interdisciplinary, and students must gain and apply knowledge in varying disciplines such as environmental sciences including biology and chemistry, economics and business administration, engineering, social psychology, innovation, entrepreneurship etc. to solve sustainability problems.

The wicked nature of green venturing means that business partners must be open to unexpected solutions to ideas they bring to the collaboration activities and not have pre-defined answers they want students to confirm. This must also influence how they act as students coaches meaning that they do not tell the students what to ask and what to do but rather guide them with an open mind. In a similar way teachers become more of coaches than in traditional higher education since they cannot provide the right answer to questions and problems but must encourage and guide the students to become co-creators of solutions. This is further discussed below under the heading "Teacher knowledge development".

One of the learning outcomes of the S4S project is that it can be beneficial for green venturing education to embrace the concept of challenge-based learning (CBL) to better reflect its complexity in terms of interdisciplinarity and unpredictability. Challenge-based learning and other approaches to bring practical relevance to higher education is gaining more and more recognition (O'Mahony et al., 2012; Heikkinen and Isomöttönen, 2015). Such approaches are characterized by students working together often in transdisciplinary teams to propose solutions to real problems and possibly also act in solving them. CBL is now core of e.g., the module InGenious and has become more prominent in several other modules and teaching activities.

Moving from case-based learning to challenge-based learning can also be challenging since the business partners can experience less direct benefit of the student-business collaboration and students will have to move out of their comfort zones since the problem solving and learning



outcomes are not so well defined at the start. This is since when students work with a defined task from an industry actor, they work more as “consultants”, searching for “the solution” rather than “a” solution, while the CBL-process is more of the opposite and entails an open innovation process, that not always favours the dedicated challenge provider. Hence, when working with CBL alignment of expectations among challenge providers are crucial. But rightly applied CBL can further add to learning and skills development for all included in the process.

3.1.3 Towards digitization and digitalization

As described in chapter 2, the pandemic and following lockdowns have been forcing teachers of a all modules, teaching units and extracurricular activities to make lectures, seminars, workshops, etc digital. Thus, much new development was focusing how to cope with digitization and digitalization. For a more in-depth discussion on the concepts digitization and digitalization see Parviainen, et al., (2017) and examples below.

We have been working with several new services and methods. For example, using Mentimeter for feedback and student interactions in lectures, Mural.com, Miro.com etc for workshops and student collaborations, Microsoft Forms for feedback in pitching seminars and other platform tools to have meetings and seminars with external parties and students. We have recorded lectures and set up strategies to coach students online. The learning platforms have been developed to include literature, thorough instructions for lectures, workshops, and seminars, and to enhance student collaboration.

Most of these changes have been a part of moving existing structures online. This would be called “digitizing” – when an analogue practice moves to digital, but the practice remains the same. This has been challenging for teacher teams as well as students, and all under the chaotic environment of the pandemic.

There have been several positive outcomes of this movement to digitization and online education: The transferability (as discussed in the next section) has increased, as we have been able to copy best practice from our colleagues without any major changes and allow students participate in events arranged at other universities. The user friendliness has in some cases been enhanced as for example the recorded lectures which students can watch several times or go back to a certain explanation if they need to. Overall, we have learned many things that will stay in the curriculum post-pandemic.

But full digitalization means not only to digitize the analogue, but to grasp the full potential of the digital world. Internet and digitalization provide two major changes in the way the world works: We do not have to be in the same physical space to interact, and we don’t have to be there at the same time. Space and time are not constraints anymore.

An example on this are bulletin board discussions, one of the first things internet was used for. Instead of meeting to discuss a topic, the online world made it possible to interact with several people from all over the world, asynchronous.

To fully grasp the possibilities of digitalization in education, there are several tools that can be used. As we now have moved into a digitized version of modules, teaching units and extracurricular activities, we see possible future developments which would enhance the scalability and transferability of the modules. One would be to use digital platforms to get asynchronous feedback from business partners, market experts, and other student groups (for example www.Loop.me). Another future development for scalability would be to find best practices for hybrid-mode teaching and coaching, and structure facilities for this. This combined with digitalized workshop areas could enable new possibilities for both students, teachers, and business partners.



3.2 SCALABILITY AND TRANSFERABILITY

Table 5 gives an overview of all green-venturing activities developed in the S4S-project. The table is structured according to if the activities are curricular or extracurricular, number of universities and business partners involved, how resource demanding they are to implement per student, the time frame for implementation, transferability, and their scalability. The discussions below will refer to that table for comparison between activities.

To be able to scale-up and transfer teaching activities it is of value to reflect a bit on the feasibility, user friendliness and effectiveness of the developed teaching activities. Ideally, teaching activities should require reasonable resources in form of time, money, and knowledge and leading to measurable effects such as improved skills and competences among participants. This in turn should lead to creation and upscaling of business ideas, career development of students etc.

Our experience is that collaborative green venturing is resource intensive but also learning intensive (getting a lot of knowledge) at the same time. To lower the resource intensity, it is important to not only focus on teaching materials such as lectures, instructions to students, templates etc. but also, to allocate sufficient resources to prepare the teaching activities well in advance and make sure that the commitment of teachers and business partners are clarified. A clear understanding of all parties' expectations combined with clear guidance has been identified as success factors in the S4S project.

Funding of green venturing activities is different in case of short-term or long-term programs. The latter is dependent upon integration to educational programs in the curricula of the universities including granting ECTS credits. Some short-term activities can serve as a kick-off or warmup activity for a sustainable educational track. In these cases, ECTS credits will not be granted separately. For short-term programs (duration of 2 hours – 1 day), limited funding (only for developing and maintaining programs) is necessary and ECTS credits will be granted at a module level. In most cases extracurricular activities require project funding often from external sources or dedicated funds within the universities.

The S4S-project has included teaching activities based on both external organisations' challenges and challenges formulated by students themselves. Both approaches have challenges and opportunities. To start with using external challenges this requires a broad and active network for teachers to identify and qualify challenges. This is time-consuming and have implications on both scalability and transferability. Having real problems of real organisations is however often appreciated by student and gives an extra motivation for hard work. But if the challenge-provider is perceived by students as uninvolved or slow responding, there is a risk that students become disillusioned. Therefore, it is as discussed above important to clarify expectations and roles for the challenge-provider. Using students' own ideas has other challenges such as students developing unrealistic ideas without any market potential or the opposite, ideas without any edge. This can be dealt with by letting external partners from business and other organisations pitch challenges at an inspirational seminar and let students use that as inspiration for finding ideas to develop. This is further discussed by Norrman and Hjelm (2017).

Another crucial resource in green venturing is coaches. Both teachers and business partners can act as coaches and have complementary roles. Being a coach is challenging due to the complexity of the challenges (to solve wicked societal problems) as well as to manage new or complex tools (e.g., Lego Serious Play). Thus, we believe training is required to become a successful process coach or tool-specialist trainer.

Scalability depends on several aspects often in combination. One decisive factor is the workload per student which is the reason why curricular activities often are more difficult to scale (see Table 5).



We use the relative scale low, medium, and high to estimate the workload per student. Typically, large modules using external challenges are labelled as work intensive since finding and qualifying challenges and clarifying challenge-providers expectations and responsibilities requires much preparation time etc. Arranging extracurricular one-day events on the other hand is labelled as low even if such events of course need careful preparations to be successful.

For all types approaches the availability of educational staff and students is important to consider and in many cases availability of challenges is crucial. The latter since working with challenges is resource intensive requiring active networks and eco-systems. Digital tools are essential for scalability to implement a program irrespective if it is on campus, online or in a hybrid form and can add to resource efficiency. Supplying such tools to students, teachers and external partners implies online instruction how to use of them since the usefulness is dependent upon the possibility to make use of digital platforms that integrates process, tools, documents, and deliverables.

Transferability depends on similar aspects as scalability but also the context where the green-venturing activity is implemented. As seen from table 5 company specific activities are less transferable as compared to modules and teaching units. This is of course expected since the approaches were implemented under very specific conditions. Anyway, it is possible to transfer parts of the approaches also to other business contexts. All developed modules or teaching units are transferable to other HEIs but is of course dependent on the availability of dedicated teachers, students, and challenge providers. Digitalization is also here an enabler that facilitates transferability to other contexts. Since setting up green-venturing activities are resource intensive we recommend that an implementation budget (in time and money) should be available. Green-venturing programs are appealing for students but require substantial time effort for educational (and business) staff.



Table 5a. Overview of green-venturing modules developed in the project Scaleup4 Sustainability. For details on each activity please consult appendix in chapter 5.

Type	Activity	Curricular	No of universities/ business partners usually involved	Workload per student*	Time frame/duration	Scalability	Transferability
Module	Eco-Venturing	Yes	1/6	High	Long	Low/Medium	Medium
Module	Fujifilm Future Challenge	Yes	4/1	High	Long	Low/Medium	Low/Medium
Module	Environmentally driven business development	Yes	1/NA	High/ medium	Long	Medium/High	Medium
Module	InGenious	Yes	1/	High	Long	Low/Medium	Medium
Module	Digital Transformation: Strategies and Sustainability	Yes	1/	High	Long	Low/Medium	Medium

*Workload per student is a qualitative estimation how much resources (mainly in working hours) it takes to implement the activity. **Low** refers to a workload of a few days and **high** that several days must be spent on top of the normal teaching activities such as lectures, seminars, exercises and examinations. Normally this refers to preparations to find and qualify external cases or challenges and increased administration due to several actors involved. **Medium** is in-between but still a rather resource demanding task.



Table 5b. Overview of green-venturing learning units and extracurricular activities developed in the project Scaleup4Sustainability. For details on each activity please consult appendix in chapter 5.

Type	Activity	Curricular	No of universities/ business partners usually involved	Workload per student	Time frame/duration	Scalability	Transferability
Learning unit	Climate Challenge	Yes	1/1	Medium	Medium	Medium	Medium
Learning unit	Green Creativity	Yes	2/1	High	Short	Low/Medium	Low/Medium
Learning unit	European Sustainable Innovation Contest	Yes/No		Low	Short	High	High
Learning unit	Negotiation festival	Yes/No	2/4	Low	Short	High	High
Learning unit/ extracurricular	Role of ecosystems in upscaling upcycling	Yes/No	6/NA	Medium	Medium	Medium	Low/Medium
Extracurricular	Idea Jam for a Sustainable Society	No	1/2	Low/ Medium	Short	Medium/High	Medium/High

*Workload per student is a qualitative estimation how much resources (mainly in working hours) it takes to implement the activity. **Low** refers to a workload of a few days and **high** that several days must be spent on top of the normal teaching activities such as lectures, seminars, exercises and examinations. Normally this refers to preparations to find and qualify external cases or challenges and increased administration due to several actors involved. **Medium** is in-between but still a rather resource demanding task.



Table 5c. Overview of company specific green-venturing activities developed in the project Scaleup4Sustainability. For details on each activity please consult appendix in chapter 5.

Type	Activity	Curricular	No of universities/ business partner usually involved	Workload per student	Time frame/ duration	Scalability	Transferability
Company specific activity	Green Business Idea Jam	No	1/1	Low	Short	High	High
Company specific activity	Circular Challenge	Yes	1/1	Low	Short	High	High
Company specific activity	Improving Corporate Venturing Processes	No	2/1		Short	NA	Low
Company specific activity	Internationalization Strategies		2/1		Short		

*Workload per student is a qualitative estimation how much resources (mainly in working hours) it takes to implement the activity. **Low** refers to a workload of a few days and **high** that several days must be spent on top of the normal teaching activities such as lectures, seminars, exercises and examinations. Normally this refers to preparations to find and qualify external cases or challenges and increased administration due to several actors involved. **Medium** is in-between but still a rather resource demanding task.



3.3 TEACHERS' PERSPECTIVES ON GREEN VENTURING

All modules in this project can be described as mission-based or in some cases Challenge-Based Learning (CBL), or Challenge-Based Education – a relatively new way of working with entrepreneurial education, and popular when entrepreneurship and innovation is combined. As discussed above this is teacher and student intensive and the time needed to be invested by teachers influence the scalability of the modules negatively.

For teachers, this way of working is multi-faceted, and the role of the teacher might be unclear. The teacher team must master the theoretical space of entrepreneurship, understand the technological space of innovation, coach the teams of students and organize the external contacts as well as the curriculum. The teams working with the modules in S4S were combinations of seasoned researchers and university teachers, as well as people with a business background. This is not a coincidence, but a strategy that we have worked with to ensure the effectiveness of the module.

One of the learnings during the S4S project is that this teacher role is not as well defined as one might had thought. To develop the teacher team and support the individual teacher in her/his work, we have had cross-university interviews and workshops on the subject, and the outcome of this work is a model for teachers which we are presenting on the CDIO Conference in 2022 (Eldebo, et al., 2022).

This section aims to analyse what roles are needed in the team that organizes a CBL module or event. It also aims to share our experience and provide advice on working with CBL in entrepreneurship modules. To fulfil this aim we analysed four modules in the project where CBL is used, by use of theories on experience-based learning models in general and the literature on CBL in particular.

Our main findings were that (1) there are many definitions of CBL, and we have landed in that CBL is an experiential learning approach that starts out with wicked, open and sustainability related real-life challenges that students, in multidisciplinary teams, take on their own way and develop into innovative and creative solutions which are presented in open forums. (2) When working with CBL the teacher cannot act as traditional teacher only. Instead, three roles need to be incorporated, i.e., the teacher role, which is knowledge oriented. The role of the coach, which is oriented toward skills and the role of the organizer that is oriented towards the context in which the learning takes place - the challenges. Taken together, these three roles could be labelled as “Teamcher”. We define a teamcher as an individual that, either on its own or as a part of a team, arranges, leads, and supports CBL activities. Figure 28 displays the teamcher roles, their focus areas and how they overlap. Both the definition of CBL and Teamcher are published in Eldebo et al (2022).

According to our own experience of working with CBL, the Teamcher role is preferably shared by a multi-disciplinary team of educators. CBL is also a rather costly way of educating, hence cooperation with actors such as tech transfer offices, innovation facilities and the regional innovation system can benefit this work. This is especially as CBL has an ambition to contribute to the society – this also underlines the importance of regional triple helix collaboration.

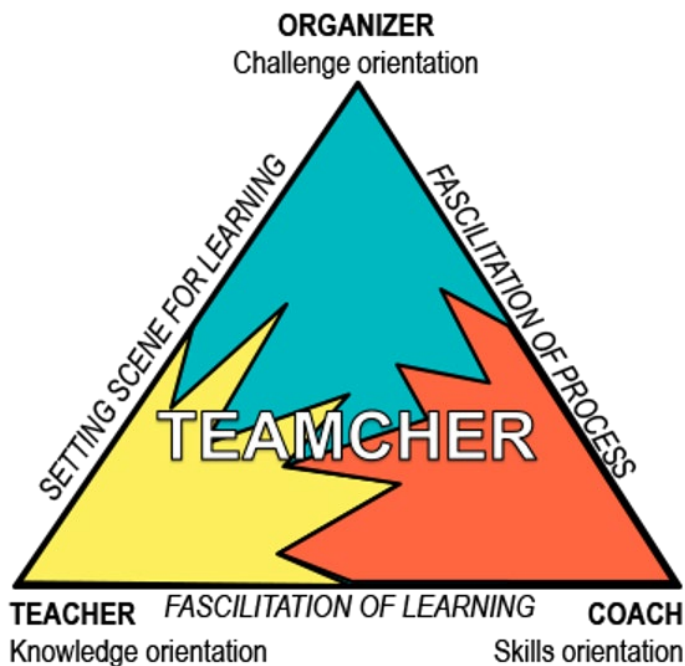


Figure 28. The roles of a Teamcher; an individual that, either on its own or as a part of a team, arranges, leads, and supports challenge-based learning activities (Eldebo et al 2022).

3.4 CHALLENGES FOR CHALLENGE PROVIDERS

We have developed all modules in the way of working with external parties, providing challenges for the students. Challenges can be of different types, e.g., mini, nano, standard and strategic, and can be defined as situations or calls for action. Students direct their innovative solutions to these challenges and thus both gain a larger purpose with their innovation projects, as well as contacts with a possible future work life.

Working with external challenge providers is common in CBL, and Challenge-based education. The teacher teams in the project have many years of experience with business partners and use their personal network to find and attract interested external parties. During the S4S project, we have shared our experiences in this work, and this cross-border and cross-cultural learnings have been of great use to us in improving our work. The knowledge developed in this area has been documented and resulted in a conference paper (Norrman et al., 2022; see <https://www.scaleup4sustainability.eu/>) which has been accepted by the 18th CDIO conference in Reykjavik in June 2022. We also launched the platform “Sustainable Venturing Challenges” (<https://platform.scaleup4sustainability.eu/>), to further inspire and guide others in this area.

The aim this article was to analyse the CBL-approach from the challenge provider perspective and provide knowledge on how to work with external parties in university education and events and to share our experiences and provide advice on working with CBL.

We based this paper on three pillars; literature studies, our own experience from teaching CBL in two modules, one at Linköping university and the other at Twente university and upon interviews with companies and organizations that have participated in the modules as challenge providers.

Regarding the literature studies we can conclude that although the literature is extensive regarding CBL in general, it is scarce when it comes to working with challenges and especially with external challenge providers, hence there have not been many theoretical contributions to draw upon. However, those



found are in line with our own experience. Through the analysis we have been able to create a list of learnings that hopefully can benefit organizers of CBL modules and events in their work with creating great challenges.

Among the factors that improves a challenge, the following can be mentioned: (1) wickedness and openness, (2) need for investigation, (3) able to take on in several ways, (4) supported by curious challenge providers with aligned expectations, (5) has a pedagogic purpose, (6) leads to an innovation process, and (7) leads to “a” solution, not “the” solution.

Taken together, the main rationale for businesses, participating as challenge providers, in education modules on green venturing adds new perspectives on solutions and opportunity to find channels into the university and to meet students.

3.5 A REFLECTION ON ASSESSMENT AND EVALUATION

Throughout the S4S-project we have had the ambition to measure the effectiveness of green venturing activities. By this we anticipate that implemented activities lead to improved skills and competences among all participants (not only students) and that this in turn lead to creation of new and upscaling of existing business ideas. To be able to measure such impacts of green venturing activities, we see a need of adapting evaluation methodologies to specific forms (curricular/ extracurricular, short term vs. long term) since the outcomes will differ. Students can for example have use of such skills and competences in their future career, and business partners might need more time to understand and see the needs and possibilities for the developed ideas. In both cases there is thus a time lag between the green venturing activity and the real impact. This is of course not reflected in the traditional evaluations normally performed after e.g., a module and something we could not achieve in the evaluations done in the S4S-project. The results from the surveys of students’ development of competences and attitudes before and after attending a specific module, indicate in those cases, that a good foundation for long term effects have been laid.

3.6 CONCLUSIONS AND FUTURE ACTIVITIES

Through the work in the S4S-project, knowledge and insights developed within S4S have been integrated in business cycle of S4S-partners core activities and thereby have contributed to the improvement of practice for all participating partners.

3.6.1 Main conclusions

Green venturing focuses on addressing sustainability challenges such as climate change, biodiversity loss, natural resource depletion which are by nature complex. The complexity of sustainability relates to the fact that these challenges cut across several sectors, cross time scales and are connected to several system aspects such as policy, knowledge, culture, and markets. Thus, VUCA (Volatility, Uncertainty, Complexity and Ambiguity; Bennett and Lemoine, 2014) is constitutive element for all involved in green venturing, not only for students but also for teaching personnel and business partners. Further, green venturing is complex and needs to be approached from a system perspective and continuing to work with narrow industry segments are not fruitful as the solutions lie in trans-industrial collaboration. By working across several industrial segments, the challenges, and solutions that students work with are more relevant for practise and for forwarding sustainability in that the risks of problem shifting are reduced and sustainability is addressed from a broad perspective including social, environmental, and economic aspects.



In the list below, we highlight key insights to address the complexity of sustainability challenges in green venturing and essentially to work with the volatility, uncertainty, complexity, and ambiguity of green venturing. The insights are sorted on (1) organisational and networking related aspects, (2) aspects related to teaching and students and (3) aspects related to industrial partners

Organisational and networking related aspects:

- Collaborative green venturing is resource intensive but also learning intensive by means that all that are involved gets a lot of both experience, knowledge, and skills at the same time.
- The creation of the network of S4S partners enforced the sustainability ecosystem of the business partners and the findings will be utilized in the development work regarding sustainability and circularity standards of the partners.
- Given the unstructured and complex character of wicked sustainable societal challenges, time-management is crucial in green venturing. This involves transparency of projected time spending and strict time management to be able to reach reasonable deliverables.
- Digitization and digitalization increase effectiveness when it comes to time and lowers emissions since it omits travelling. On the other hand, spontaneous face-to face communication as driver for creativity cannot be neglected. Hence it can be concluded that digitalization facilitates upscaling and transferability but can hamper creativity.
- Hybrid forms of green venturing activities (partly virtual, partly physical) adds complexity. Training and “learning-by-doing” is often more effective in a physical setting. Plain instruction workshops are easier to conduct hybrid or digitally.

Teaching and student related aspects:

- Training students to become entrepreneurial rather than studying entrepreneurial activities is about experiential learning approaches and requires real-world problems or as we say - challenges. Such challenges can both come from external actors such as business and public organisations, but also be based on students’ own ideas.
- Curricular activities are easier to fund and motivate students to participate in but requires more long-term planning to fit into administrative systems of higher education institutes.
- Extracurricular activities are easier to plan but they are both more difficult to finance and to get students to participate in.
- Teachers engaging in green venturing activities will take on other roles than then being a traditional teacher. Something we call Teamcher, which is a combination of teachers, coach and team developer and organizer.

Business partners related aspects:

- The quality of the partnership with the business partner (supplier of the challenges) is essential for long-term programs and a co-creating collaboration. Engagement of business partners is a vital element. The business engagement varies from co-creator to supplier of the challenging case.
- Business partners, and especially those engaged as challenge providers, can act as coaches of student teams especially by giving them insights in commercial conditions both regarding production and market aspects.
- Students have, through their participation in modules and events, supplied the business partners with new perspectives, fresh ideas, and business opportunities.
- Collaborative green venturing formats should be embedded in a wide portfolio of teaching formats.



In the work with S4S some success factors, worth to be highlighted, have emerged and these are that on a general level, successful implementation of green venturing activities boils down to flexible teachers, open-minded students and committed partners. To achieve this, factors such as the ones listed below are important:

- Broad networks and long relations between HEIs and the surrounding society. This is based on the need for extension and visibility of networks of teaching personnel engaged in green business venturing.
- A clear understanding of all parties' motivations and expectations. If possible, motivation interviews could / should be used to recruit and select participants.
- Clear guidance in form of instructions and playbooks has been identified as success factors in the S4S project.

Broad networks and long relations between HEIs and the surrounding society are especially important for teachers as challenge-based modules with external challenge providers require that the teachers can find business partners that are committed and willing to interact. A clear understanding of all parties' motivations and expectations is about alignment, which has been shown to be highly important in student business collaboration (cf. Norrman et al., 2022). Clear guidance and instructions underline the importance of using available methods, tools, and approaches for student business collaboration. In the S4S project we have summarised our learnings in case of play books for the modules involved in the projects, where the setups are shown in a way that can enable knowledge transfer and serve as inspiration to others. To further deal with this, a website <https://www.scaleup4sustainability.eu/> is created.

Despite the benefits of green venturing using student business collaboration, it is also important to be aware and reflect upon potential drawbacks and obstacles. From a teacher's perspective, running CBL activities is resource intensive. This resource intensity can be eased by a collaborative university that can help teachers, that lack of personal industry network and contacts, in their collaboration with the surrounding community of trade and industry. Another important aspect is that Rome was not built in one day – transforming modules to CBL and real-life problem solving is not created over a night but can be done bit by bit with a long-term plan. Regarding the student, CBL creates – as has been described above – a lot of uncertainty which can imply that students get frustrated and thereby loose engagement. This can be remedied by alignment of expectations, clear descriptions of the process and facilitation/coaching of the teams so that they become more secure. In the end this commonly is rewarded by increased self-confidence. Unfortunately, the incentives for teachers to engage in green venturing are limited or even non-existent, hence a matter for improvement ought to be to find ways of rewarding those that try.



3.6.2 Future activities

As discussed above it is challenging to assess the long-term outcome and impact of green venturing activities. It remains to find a feasible way to make such assessments, which could be a task for future projects in this area.

Digitalization opens for new forms of green venturing activities engaging multiple faculties and nationalities into such programs. This might increase the cross-fertilization of the program and the added value for students and businesses. This can include team building of virtual teams and inter-cultural collaborations; new digital tools / platforms to enable larger scale of green venturing activities.

Hybrid green venturing activities are challenging, and it is therefore interesting to explore the enablers and success factors and gain experience with hybrid student teams, in which the participants collaborate with each other partly online and partly physical.

Challenge-based learning as a concept, is still under development and needs more attention and development activities for example in identifying and developing relevant challenges.



4. References

- Ashton, M.C., and Lee, K. (2009). The HEXACO–60: A Short Measure of the Major Dimensions of Personality. *Journal of Personality Assessment*, 91(4), 340–345
- Barth, M., Godemann, J., Rieckman, M. & Stoltenberg, U. (2007) Developing key competences for sustainable development in higher education. *International Journal of Sustainability in Higher Education*, 8, 416-430.
- Bennett, N., & Lemoine, G. J. (2014). What a difference a word makes: Understanding threats to performance in a VUCA world. *Business Horizons*, 57(3), 311-317.
- Biberhofer, P., Lintner, C., Bernhardt, J. & Rieckmann, M. (2019) Facilitating work performance of sustainability-driven entrepreneurs through higher education: The relevance of competencies, values, worldviews and opportunities. *The International Journal of Entrepreneurship and Innovation*, 20(1), 21-38.
- Bocken, N. M., Short, S. W., Rana, P., & Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production*, 65, 42-56.
- Brandenburger, A.M. and Nalebuff, B.J. (1996). *Co-opetition. A revolutionary mindset that combines competition and co-operation. The Game Theory strategy that's changing the game of business.* New York, Doubleday-Bantam Publishing Group.
- Brennan, J., Broek, S., Durazzi, N., Kamphuis, B., Ranga, M. and Ryan, S. (2014) Study on innovation in higher education: final report. European Commission Directorate for Education and Training Study on Innovation in Higher Education, Publications Office of the European Union, Luxembourg. ISBN: 9789279350818.
- Brislin, R. W., and Horvath, A.-M. (1997). Multicultural training and education. In M. Segal, J. W. Berry, and P. Dasen (Eds.), *Handbook of cross-cultural psychology* (Vol. 3, 2nd ed., pp. 327–369). Needham Heights, MA: Allyn and Bacon
- Carman, J. G. (2010). The Accountability Movement: What’s Wrong With This Theory of Change? *Nonprofit Voluntary Sector Quarterly*, 39(2), 256–274.
- Carson, J.B., Tesluk, P.E., and Morrone, J.A. (2007). Shared leadership in teams: a investigation of antecedent conditions and performance. *Academy of Management Journal*, 50(5), 1217-1237.
- Chen, G., Gully, S.M., and Eden, D. (2001). Validation of a New General Self-Efficacy Scale. *Organizational Research Methods*, 4, 62-83.
- Dale, A. & Newman, L. (2005) Sustainable development, education and literacy. *International Journal of Sustainable Higher Education*, 6, 351-362.
- De Dreu, C., Evers, A., Beersma, B., Kluwer, E.S., and Nauta, A. (2001). A theory-based measure of conflict management strategies in the workplace. *Journal of Organizational Behavior*, 22, 645-668.
- Dyer, J., Gregersen, H., and Christensen, C.M. (2009a). *The innovator's DNA, mastering the five skills of disruptive innovators.* Harvard Business Review Press, Boston, Massachusetts.
- Dyer, J., Gregersen, H., and Christensen, C.M. (2009b). The innovator's DNA, five “discovery skills” separate true innovators from the rest of us. *Harvard Business Review*, Dec, 61-67.
- Edmondson, A. (1999). Psychological Safety and Learning Behavior in Work Teams. *Administrative Science Quarterly*, 44(2), Jun. 1999), 350-383.



- Eldebo, K., Lundvall, C., Norrman, C. A. and Larsson, M. (2022). How to make good teachers great in challenge-based learning. Presented at the 18th International CDIO Conference, Reykjavik, Iceland, June 13-15 2022.
- Fagerberg, J., Fosaas, M., & Sapprasert, K. (2012). Innovation: Exploring the knowledge base. *Research Policy*, 41(7), 1132-1153.
- Fichter, K., Geier, J. and Tiemann, I. (2016). Good practice collection – University support for sustainable entrepreneurship. Berlin, Helsinki, Linköping: SHIFT.
- Fichter, K., Hurrelmann, K., Seela, A., Hjelm, O., Larsson, M., Sundberg, C., Wisdom, K. & Stel, F. (2020). S4S Report on evaluating leading approaches and tools in collaborative green venturing (Work Package 2). Oldenburg, Linköping and Zuidlaren.
- Geissdoerfer, M., Pieroni, M. P., Pigosso, D. C. & Soufani, K. (2020). Circular business models: A review. *Journal of Cleaner Production*, 123741.
- Gibson, C.B., Cooper, C.D., and Conger, J.A. (2009). Do you see what we see? The complex effects of perceptual distance between leaders and teams. *Journal of Applied Psychology*, 94(1), 62-76.
- Hansen, E. G., Lüdeke-Freund, F. & Fichter, K. (2020). Circular Business Model Typology: Actor, Circular Strategy, and Service Level. Institute for Integrated Quality Design (IQD), Johannes Kepler University Linz (JKU).
- Heikkinen, J. & Isomöttönen, V. (2015). Learning mechanisms in multidisciplinary teamwork with real customers and open-ended problems. *European Journal of Engineering Education*, 40(6), 653670. doi:10.1080/03043797.2014.1001818
- Henry, M., Bauwens, T., Hekkert, M. & Kirchherr, J. (2020). A typology of circular start-ups: An Analysis of 128 circular business models. *Journal of Cleaner Production*, 245, 118528.
- Hoogeboom, M.A.M.G., & Wilderom, C.P.M. (2019). Advancing the Transformational-Transactional Model of Effective Leadership: Integrating two Classic Leadership Models with a Video-Based Method. *Journal of Leadership studies*, 13(2), 23-46
- Kanda, W., Geissdoerfer, M. & Hjelm, O. (2021). From circular business models to circular business ecosystems. *Business Strategy and the Environment*, 30(6), 2814-2829.
- Keskin, D., Diehl, J. C., Molenaar, N. (2013) Innovation process of new ventures driven by sustainability, *Journal of Cleaner Production*, 45, 50-60.
- Kingston, G. (2007), *Innovation: The Five Disciplines for Creating What Customers Want* by Curtis R. Carlson and William W. Wilmot. *Journal of Product Innovation Management*, 24: 502-503
- Kuckertz, A., Berger, E. S. & Gaudig, A. (2019). Responding to the greatest challenges? Value creation in ecological startups. *Journal of Cleaner Production*, 230, 1138-1147.
- Lans, T., Blok, V. & Wesselink, R. (2014) Learning apart and together: towards an integrated competence framework for sustainable entrepreneurship in higher education. *Journal of Cleaner Production* 62, 37-47.
- Larsson, M. (2020) Benchmark of modules combining sustainability and innovation/entrepreneurship in Swedish universities. Downloadable at <https://www.scaleup4sustainability.eu/>
- Liñán, F., Rodríguez-Cohard, J.C. & Rueda-Cantucho, J.M. (2011). Factors affecting entrepreneurial intention levels: a role for education. *International Entrepreneurship Management Journal*, 7, 195–218.
- Maresch, D., Harms, R., Kailer N. and Wimmer- McGee, J.E., Peterson, M., Mueller, S.L., and Sequia, J.M. (2009). Entrepreneurial Self-Efficacy: Refining the Measure. *Entrepreneurship Theory and Practice*, 33(4), 965 – 988.



- Mindt, L. & Rieckmann, M. (2017) Developing competencies for sustainability-driven entrepreneurship in higher education: a literature review of teaching and learning methods. *Teoría de la educación* 29(1), 129-159.
- Muehlfeld, K., Van Doorn, J., and Van Witteloostuijn, A. (2011). The Effects of Personality Composition and Decision-Making Processes on Change Preferences of Self-Managing Teams. *Managerial and Decision Economics*, 32, 333-353.
- Norrman, C., & Hjelm, O. (2017). CDIO-based entrepreneurship courses as drivers of innovation in industrial segments. In 13th International CDIO Conference, University of Calgary, Calgary, Canada, June 18-22, 2017 (pp. 288-297). University of Calgary.
- Norrman C., A., Lundvall, C., Eldebo, K., Boiertz, S. and Stel, F. G. (2022). Making good challenges great – engaging external parties in CBL activities. Presented at the 18th International CDIO Conference, Reykjavik, Iceland, June 13-15, 2022.
- O'Mahony, T.K., Vye, N.J., Bransford, J.D., Sanders, E.A., Stevens, R., Stephens, R.D., Richey, M.C., Lin, K.Y., Soleiman, M.K. (2012). A Comparison of Lecture-Based and Challenge-Based Learning in a Workplace Setting: Course Designs, Patterns of Interactivity, and Learning Outcomes. *Journal of the Learning Sciences*, 21(1), 182-206.
- Oskam, I. (2020). Shaping Sustainable business models, stakeholder collaboration for sustainable value creation. PhD thesis, VU University Amsterdam, NL.
- Parviainen, P., Tihinen, M., Kääriäinen, J., & Teppola, S. (2017). Tackling the digitalization challenge: how to benefit from digitalization in practice. *International journal of information systems and project management*, 5(1), 63-77.
- Pettersen, R. C., (2008). *Kvalitetslärande i högre utbildning – Introduktion till problem- och praktikbaserad didaktik*. Lund: Studentlitteratur.
- Ploum, L., Blok, V., Lans, T. and Omta, O. (2018). Toward a Validated Competence Framework for Sustainable Entrepreneurship. *Organisation & Environment* 31(2), 113-132.
- Rosique-Blasco, M., Madrid Guijarro, A., and Garcia-Perez-de-Lema, D., (2016). Entrepreneurial skills and socio-cultural factors. An empirical analysis in secondary education students. *Education & Training*, 58 (7-8), 815-831.
- Schumpeter, J. A. (1934). *The theory of economic development*. Cambridge, Mass: Harvard University Press.
- Thomas, D.C., Elron, R., Stahl, G., Ekelund, B.Z., Ravlin, E.C., Cerdin, J.L., Poelmans, S., Brislin, R., Pekerti, A., Aycan, Z., Maznevski, M., Au, K. and Lazarova, M.B. (2008). Cultural intelligence: domain and assessment. *Inter-national Journal of Cross Cultural Management*, 8, pp. 123–143.
- Volkman, C., Fichter, K., Klofsten, M., & Audretsch, D. B. (2021). Sustainable entrepreneurial ecosystems: an emerging field of research. *Small Business Economics*, 56(3), 1047-1055.
- Wagner, M., Schaltegger, S., Hansen, E. G., & Fichter, K. (2021). University-linked programmes for sustainable entrepreneurship and regional development: how and with what impact? *Small Business Economics*, 56(3), 1141-1158.
- Wiek, A., Withycombe, L. & Redman, C. L. (2011). Key competencies in sustainability: a reference framework for academic program development. *Sustainability Science* 6(2), 203-218.
- Wong, C-S, and Law, K.S. (2002). The effects of leader and follower Emotional Intelligence on performance and attitude: an exploratory study. *The Leadership Quarterly* 13(3), 243–274.



Zhou, J., and George, J.M. (2001). When job dissatisfaction leads to creativity: encouraging the expression of voice. *Academy of Management Journal*, 44(4), 682-692.



5. Appendices

This section contains supplementary material to section 1.5.3 “Tool for evaluation of students Sustainable Entrepreneurship Competencies as well as material related to several of the developed approaches described in chapter 2.

5.1 SUPPLEMENTARY MATERIAL TO SECTION 1.5.3 “TOOL FOR EVALUATION OF STUDENTS SUSTAINABLE ENTREPRENEURSHIP COMPETENCIES

Table 1: Competencies for sustainable entrepreneurship including their performance criteria assessed in the evaluation (Based on Ploum et al., 2018)

Competence	Performance criterions
Diversity competence	<ul style="list-style-type: none"> ▪ I am able to bring together economic, social and environmental conflicts of interest. ▪ I use the experiences, activities and values of various relevant stakeholders in addressing sustainability issues. ▪ I am able to actively involve stakeholders and experts from other disciplines in addressing sustainability issues. ▪ I am able to explain the importance of involving local stakeholders (e.g. in recruitment) for a company.
Foresighted thinking competence	<ul style="list-style-type: none"> ▪ I am able to identify risks and opportunities inherent in present and future developments. ▪ In analysing and evaluating scenario’s for action, I take the impact on the short as well as the long term into consideration. ▪ In analysing and evaluating scenario’s for action, I take both the impact on the local and the global scale into consideration. ▪ I am able to integrate social, environmental and economic issues into future plans of a company.
Systems thinking competence	<ul style="list-style-type: none"> ▪ I am able to identify key aspects of production chains and agricultural eco-systems. ▪ I am able to identify the key operations of a company that have a negative impact on the environment or society. ▪ I am able to analyse strengths and weaknesses of production chains and propose improvements to reduce the negative effects on the environment or society. ▪ I am able to construct and consider different directions for sustainability in the future.
Normative competence	<ul style="list-style-type: none"> ▪ I am willing to take initiative to make improvements in my own practice based on norms, values, targets and principles of sustainability.



	<ul style="list-style-type: none"> ▪ I know what is seen as ‘good sustainable practice’ in my field of study. ▪ I am able to apply norms, values, targets and principles of sustainability to my own practice. ▪ I know how to explain the decisions a company has made concerning sustainability.
<p>Interpersonal competence</p>	<ul style="list-style-type: none"> ▪ I am patient and sensitive to someone who “lets off steam” in complex issues. ▪ In a personal conflict, I am able to take the others’ perspective and really understand his or her point of view. ▪ I am able to feel to what extent stakeholders are willing to cooperate in a project.
<p>Strategic action competence</p>	<ul style="list-style-type: none"> ▪ When it comes to achieving particular goals in relation to sustainability, I know whom to involve. ▪ If I want to reach goals in relation to sustainability, I know which steps should be taken to be successful. ▪ I am able to use a strategic way of working in sustainability related projects (designing, testing, implementing, evaluating). ▪ I am able to monitor the sustainability performance of a company. ▪ I challenge not sustainable ways of working in a company. ▪ I am very good at identifying opportunities for sustainable development. ▪ I know how social, environmental or societal challenges can be turned into opportunities for an organization/company. ▪ I am able to motivate higher management in a company to invest in sustainability.



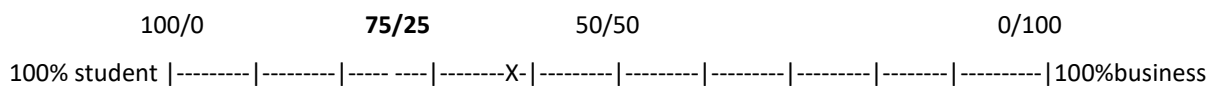
5.2 FACT SHEET AND SYLLABUS OF MODULE "ECO-VENTURING"

Title of module:	Eco-Venturing/ since 2021 Sustainable Venturing
Initiating university:	University of Oldenburg
Start year:	2009
End year / ongoing:	Ongoing
No. of modules held:	13
Duration (weeks):	1 semester (24 weeks)
ECTS:	6
Module objective(s):	<p>The main target of the "Eco-Venturing" module is to develop entrepreneurial skills for the development and implementation of environmental innovations and sustainable business ideas. These include:</p> <ul style="list-style-type: none"> ▪ the ability to identify new solution needs in the context of sustainable development and the sustainable development goals set by the United Nations, ▪ Knowledge and skills for the entrepreneurial development and implementation of innovative solutions, ▪ Knowledge and skills for systematically combining economical, ecological, and societal objectives and ▪ the ability to strategically develop business areas and markets for sustainable business solutions. <p>The entrepreneurial development and implementation of environmental innovations can relate both to the establishment of new companies (start-ups) and organisations and to the development of new solutions and business ideas within the framework of established companies and organisations (corporate venturing).</p>
Phases and activities:	<ul style="list-style-type: none"> ▪ Before module starts (April to September): Scouting and selection of sustainable and innovative venturing ideas, defining appropriate challenges with business partners, match expectations of business partners with teaching needs and students' capacities ▪ October Information session for interested students, presenting the framework of the module ▪ October Kick-off: Pitch of Business Partners and their challenges, forming student teams, knowledge-input (methods and tools of ideation) ▪ Bi-weekly teaching sessions: Teaching input as asked by student teams (e.g. data collection, idea assessment, Sustainable Business Model Development, Sustainability Assessment, Value Chain Analysis, Stakeholder Mapping) ▪ Independent work within project groups and coaching by teaching team: Project clarification, understanding of business requirements, working according to the project plan



	<ul style="list-style-type: none"> ▪ December: Intermediate presentation: students present draft business model and first results ▪ Independent work within student teams and coaching by teaching team: Working according to the project plan ▪ February. Final presentation for business partner and class ▪ March: Writing of final project report
No. of business projects so far:	61
No. of business partners so far:	55
No. of students so far:	205

Balance involvement between Business / Student:



Student involvement per module

(Characteristics of students typically included in the module)

No. of students:	15-20
Level of students:	Bachelor level; Master level ; PhD level
Background students:	Technical; Managerial ; Environmental; Mostly: Sustainability Economics and Management
No. of universities/ professorships involved:	2
Number of Faculties involved:	1

Business involvement per module

(Characteristics of business partners typically included in the module)

No. of companies/ venture teams/ start-up teams:	4 to 6 / 2019 and 2020: 1
Age of business partners:	Pre-seed (1-3 months): x Seed (4-12 months): x Start-up (1 year): x 1 st Stage (1-3 years): x 2 nd Stage (4-6 years): x 3 rd Stage or later (>6 years): x
Size of companies FTE (no. of companies):	Single entrepreneur: 10 Venture team (<5 employees): 21



	<p>Micro enterprise (5-10 employees): 10</p> <p>Small (10-25 employees): 5</p> <p>Medium (25-250 employees): 5</p> <p>Large (>250 employees): 4</p>
Size of companies sales (no. of companies):	None: (25) Small (<1 mln €): (17) Medium (1-10€): 9 Large (>10€): 4
Typical Branches (no. of companies):	Industry; Services; Government; Not for profit

Sustainability items covered

People issues (social):	Yes, but no core
Planet issues (sustainable):	Yes
Profit issues (business):	Yes
keywords of sustainable subjects covered (max 10):	Renewable energies, energy efficiency, circular economy, sustainable mobility, renewable materials, green IT, clean clothing, cleantech, emission reduction and control, sustainability in supply chains, green packaging

Personal assessment (qualitative)

Which activities and methods have been effective:	<ul style="list-style-type: none"> ▪ Project guidelines for students and project guidelines for business partners (new) ▪ Clear expectation management ▪ Using miro-boards for collaboration within project teams ▪ Sustainable Business Canvas for analyzing initial situation as well as business model development ▪ joint kick-off meetings with business partners, ▪ coaching student teams
Which improvements could be made:	<ul style="list-style-type: none"> ▪ Establish criteria for a “Good Challenge” ▪ Building a network of alumni (business partner) and evaluate the impact in the medium-term and long-term
Main outcomes of the module	<ul style="list-style-type: none"> • Students enjoy hands-on start-up experience and real world learning with business partners. • They get sensitized for the option to start new venture and what it feels to be an entrepreneur • They learn how develop business ideas with the aim and consideration of sustainability • Students develop their sustainable entrepreneurship competencies • Some students join the venture after the module • We accelerate promising green venture ideas and help to be sufficiently critical about innovative ideas that don't meet a need. • The module attracts start-ups and ventures of the region.


Module Syllabus⁶

<i>Lectures (in chronological order)</i>	<i>Content</i>	<i>Student activities (gates to pass through)</i>	<i>Supporting material/documents needed</i>
Preparation			
3 month before kick-off	Acquisition of business partners, defining challenges and discussing agenda with business partners		Module leaflet Checklist for Business partners Checklist for students (both containing module requirements, schedule, hints for project management)
Introduction (week 1-3)			
Info session	Introduce module content and requirements to students → Enrollment of engaged students, minimize drop-out rate of students		Presentation slides
Kick-off/ Lecture I	Presentation of business partner(s) and challenges; Introduction: Sustainable Venturing Tool: KWL-Chart, Sustainable Business Canvas (SBC)	Group formation, clear and common understanding of challenges (problem) and of the chosen business partner, Analyzing the current business model of the business partner (using SBC)	Playbook Presentation slides Non-disclosure agreements Sustainable Entrepreneurship Questionnaire Online-Tool/template Sustainable Business Canvas (www.start-green.net/tools) Miro: KWL-Chart, SBC template, template project plan Feedback-questions (online: mentimeter.com)
Sustainable Business Model Development (week 4-17)			
Lecture II (week 4)	Input: Idea Generation Input: Data Collection Tools: Brainwriting with 6-3-5 method, Lego Serious Play (if ideation phase is given more time)	Develop ideas to solve the challenge, chose the most promising idea, documentation of the process on miro Project Management: Elaborate a project plan, Discuss project plan with lecturers (content of project plan is basis of module assessment)	Playbook Presentation slides Interview guidelines Miro: brainwriting template Query for tool demand
Lecture III (week 6)	Input: Idea Assessment Input: Tools and Methods for Business Model Development*	Visit Business Partner (if possible; could also scheduled earlier)	Playbook Presentation slides

⁶ Each lecture in this syllabus is planned with 4 hours.



	(depending on students' needs, each challenge and therefore the applicable tools is unique) Examples: Design Thinking, Innovation radar, Lead-User-Method, Value Chain Analysis, Supply Chain Analysis, Stakeholder Mapping, Value Mapping	Finalizing project plan Implementation of project plan	feedback-questions (online: mentimeter.com)
Lecture IV (week 8)	Input: Sustainability Assessment Tools: DIN SPEC – Sustainability Assessment of Start-ups If applicable: reports/input from business partners	Assessing the suggested solution regarding the possible impact on sustainability	Playbook Presentation slides Interim feedback questions for Business Partners satisfaction
Lecture V (week 10)	Mid-term presentation	Presentation of current stage of project implementation, peer-feedback and feedback from teaching team, discussion of the approach and methodological questions	
	Coaching: each project team is coached by one mentor (from university) and a representative from the business partner (as sparing partner).	Discussing current stage of project and possible difficulties, individual support as needed	
Presentation (week 18-week 24)			
Lecture VI/ Final presentation (week 18)	Presentation of project results in front of class and business partners	Group pitch and discussion, feedback from business partners, peers and teaching team (Assessment I)	Template presentation structure Assesment criteria/ evaluation template Sustainable Entrepreneurship Questionnaire
End of module (week 24)		Submitting project report (Assessment II)	Evaluation template
Follow-up			
	Evaluation of module (implementation and results), sustainable entrepreneurship questionnaire, feedback business partners		

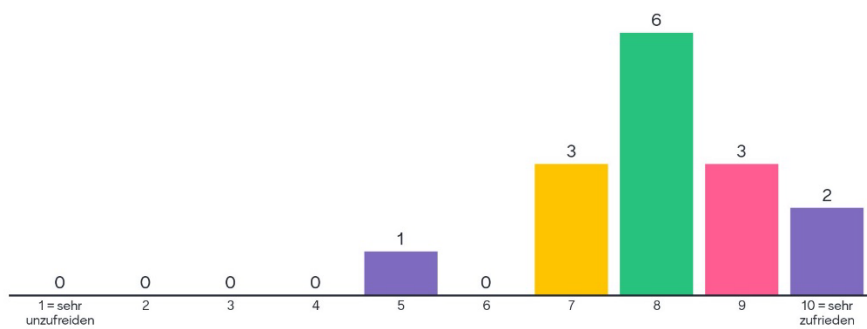


5.3 EVALUATION REVISED MODULE ECO-VENTURING (UOL)

5.3.1 Non-formal module evaluation at the end of the module (Example: Winter term 2020/21)

Question: **How satisfied are you with the module?** (Scale 1 (= very unsatisfied) to 10 (=very satisfied))
 Tool: mentimeter.com

Wie zufrieden sind Sie mit der Lehrveranstaltung Eco-Venturing?



Question: **What have been your personal high lights, had been your most important insights or was most fun for you?** (Multiple answers possible)

Tool: mentimeter.com

Was waren Ihre persönlichen Highlights, brachte die größten Erkenntniss oder hat am meisten Spaß gemacht?

Direkte Ansprechpartner bei CEWE zu haben war ein absoluter Mehrwert	Es hat viel Spaß gemacht neue Methoden zu verwenden und viel Freiraum für Kreativität zu haben.	Ich finde die online Zusammenarbeit im Team und mit dem Cheez Team sehr spannend, um kennenzulernen wie Teamwork auch online funktioniert. Außerdem freue ich mich neue wissenschaftliche Methoden und Kreativmethoden kennenzulernen zu können.
Zusammenarbeit mit einem Unternehmen (Auch wenn es hier immer wieder Probleme gab)Die Challenge an sich war sehr spannend!	Die Kombination von der Theorie mit der Praxis. Allgemein die Gewinnung von deutlich mehr Kenntnis zum ganzen Themengebiet der Nachhaltigkeit.Das Treffen vor Ort war sehr angenehm. Allgemein war die Zusammenarbeit mit CEWE äußerst angenehm.	Die Kreativtechniken
Produktenwicklung kann ich mir als Berufsperspektive vorstellen. (beste Erkenntnis)	Arbeit in der Gruppe, Abwechslungsreichtum, recht hohe Erwartungen als Ansporn	Super Zusammenarbeit mit Cewe und tolle Betreuung auch vom Lehrenden-Team! Highlight war natürlich auch das direkte Gespräch/die Kooperation mit einem Start Up, weil dadurch doch alles sehr konkret und handfest wurde -)



Answers (Examples):

- “Having direct contacts at CEWE was an absolute added value”
- “It was a lot of fun to use new methods and have a lot of freedom for creativity.”



- “I found the online collaboration in the team and with the Cheerz team very exciting to get to know how teamwork also works online. I am also looking forward to getting to know new scientific methods and creative methods.”
- “I can imagine product development as a career perspective (best insight)”
- “Great cooperation with CEWE and great support from the teaching team! The highlight was of course the direct discussion/cooperation with a start-up, because it made everything very concrete and tangible:-)”

Question: **What do you suggest to improve Eco-Venturing?**

(Multiple answers possible)

Welche Verbesserungsvorschläge haben Sie für Eco-Venturing?

Keine Verbesserungsvorschläge.

-Potentiale der Challenges abschätzen und Umsetzbarkeit berücksichtigen (Zeit, Umfang)-Zu kurze Präsentationszeit in Relation zu geforderten Inhalten

keine

Bei Präsentationen sollte die Präsentationsrechte selber gezogen werden können, damit jeder durch seine eigenen Folien klicken kann! Bessere Betreuung in Bezug auf Konflikte mit CEWE!

Mehr inhaltlicher Input/kürzere Ausarbeitung (10 Seiten pro Person scheinen mir noch utopisch)

Anfangs teilweise ein etwas holpriger Start bzw. wäre etwas mehr Einarbeitungszeit bis zur Zwischpräsentation super.

Ich fand die Veranstaltung insgesamt wirklich sehr gelungen!

Strukturen der Lehrveranstaltung haben teils wenig Freiraum zugelassen (Arbeitsrhythmus in der Gruppe teils schwer an diese anzupassen)

- Methoden etwas eher behandeln



Answers (Examples)

- “Assess the potential of the challenges and consider feasibility (time, scope) - Presentation time too short in relation to the required content”
- “Better support with regard to conflicts with CEWE!”
- “Better coordination with the practice supervisors (partly did not know what the projects were about), clearer project plan (e.g. first interviews were surprising, not very efficient), more similar topics/requirements”

5.3.2 Self-Assessment of Student’s Competences in Sustainable Entrepreneurship: general information

On the following pages we provide a module evaluation in summary of three runs. All the students had answered the questionnaire at the beginning of the module. At the end of the module, we missed out the second answer from some of them.

Term	Study module	No of participants	return 1. questionnaire	return 2. questionnaire
WS 2019	Eco-Venturing	12	12	8
WS 2020	Eco-Venturing	17	17	15
WS 2021	Sustainable Venturing*	22	22	19
Total		51	51	42



* Title of module was changed

Figure 1 and Figure 2 show the distribution of participating students concerning study program and gender. Figure 3 gives an impression about the motivation to choose the module. The statement highlighted the most was the attractiveness of collaborating with business partners, followed with the expected practical relevance of learning content. Entrepreneurial experiences and entrepreneurial motivations of the participating students had been different. Nearly half of the students state, that they have somehow entrepreneurial experience (e.g. entrepreneurial-related activities at school), 40% of the students have friends and 40% family members that started or owns a business. Interest in entrepreneurial activities is comparatively restrained. The most likely interest is in acquiring or inheriting a company and turn it into a high growth company (Figure 5).

Study program of students

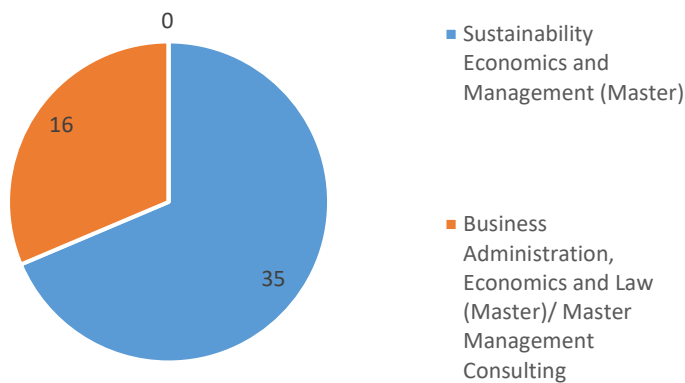


Figure 1: Number of students in the module by study program.

Gender

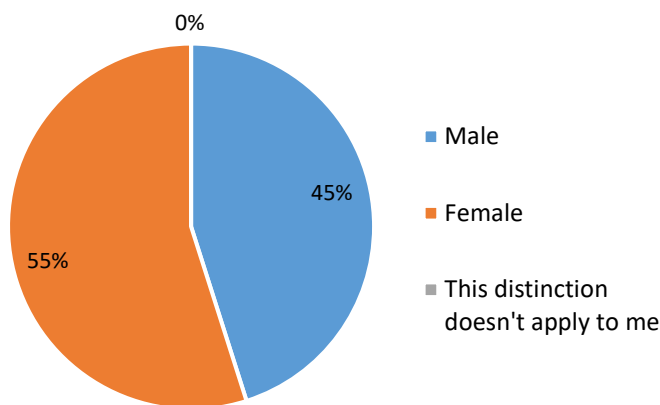


Figure 2: Gender of students



Motivation for participation in the course

- 5 - I fully agree
- 4 - I agree
- 3 - I somehow agree
- 2 - I don't agree
- 1 - I don't agree at all

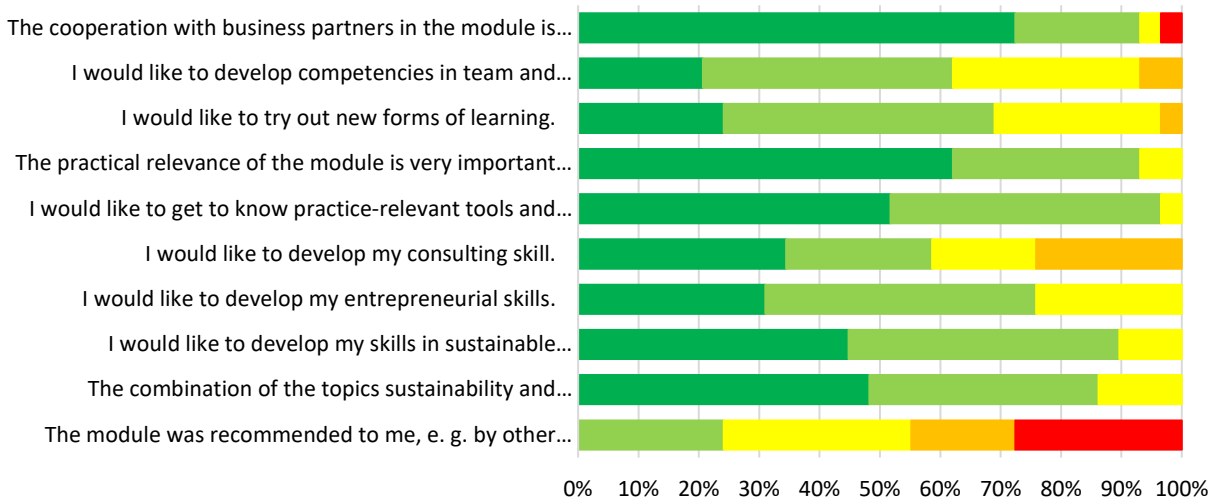


Figure 3: Motivation for participation in Eco-Venturing module 2019 and 2020 (n=29)

Experiences

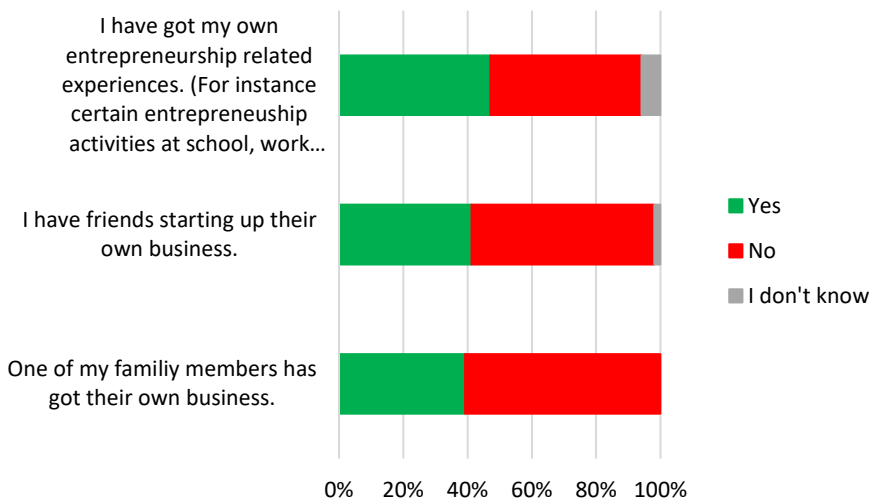


Figure 4: Entrepreneurial experiences (participants in Eco-Venturing 2019, 2020, 2021, n=51)



Interest for entrepreneurial activities in the next coming 5-10 years

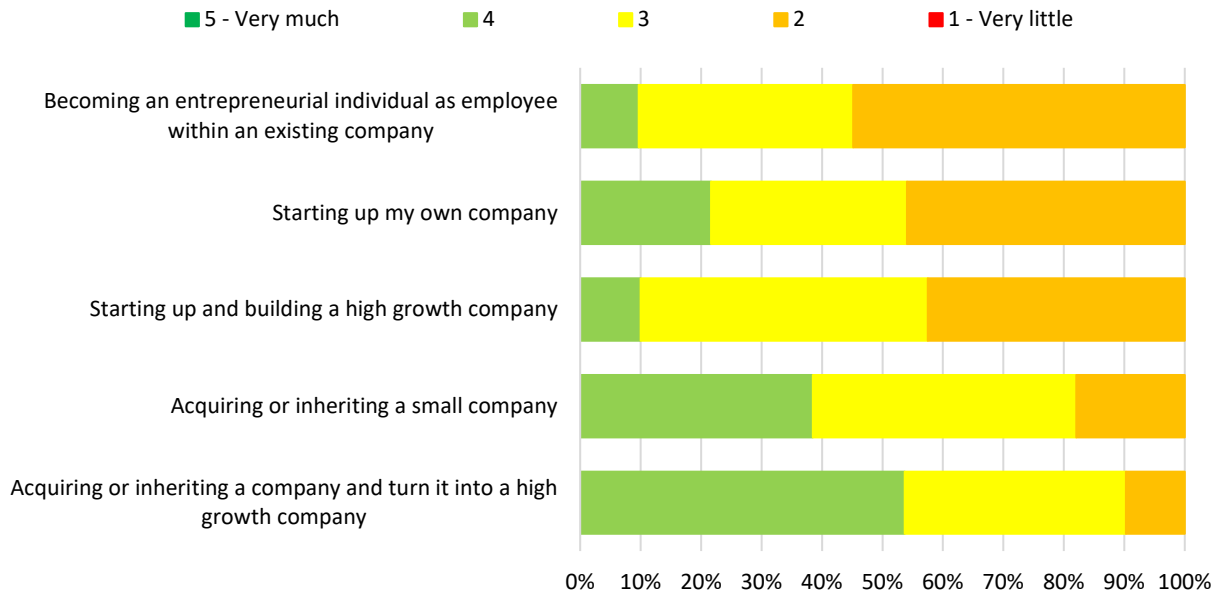


Figure 5: Interest for entrepreneurial activities in the next coming 5-10 years (participants in Eco-Venturing module 2019, 2020, 2021, question at the beginning of the module, n= 51)



5.3.3 Self-Assessment of Sustainable Entrepreneurship Competencies: Evaluation over all modules Eco-Venturing 2019, 2020, 2021

Summary: A change in the individual assessment of the extent of sustainable entrepreneurship competences can be observed in all areas examined, though to different extend.

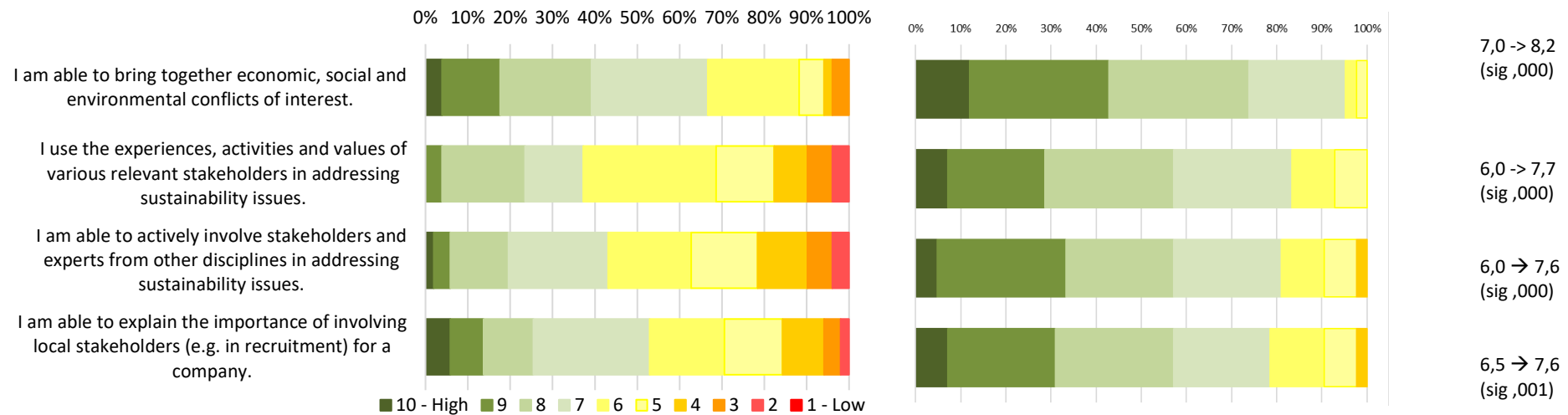
Diversity Competence

At the beginning of the module, most of the students assessed themselves as “moderate” competent when it comes to addressing stakeholders and involve their demands, interests and experiences. As most of the students’ projects contained some kind of stakeholder analysis, self-assessment had changed after the module.

Before the module (n=51)

After the module (n=42)

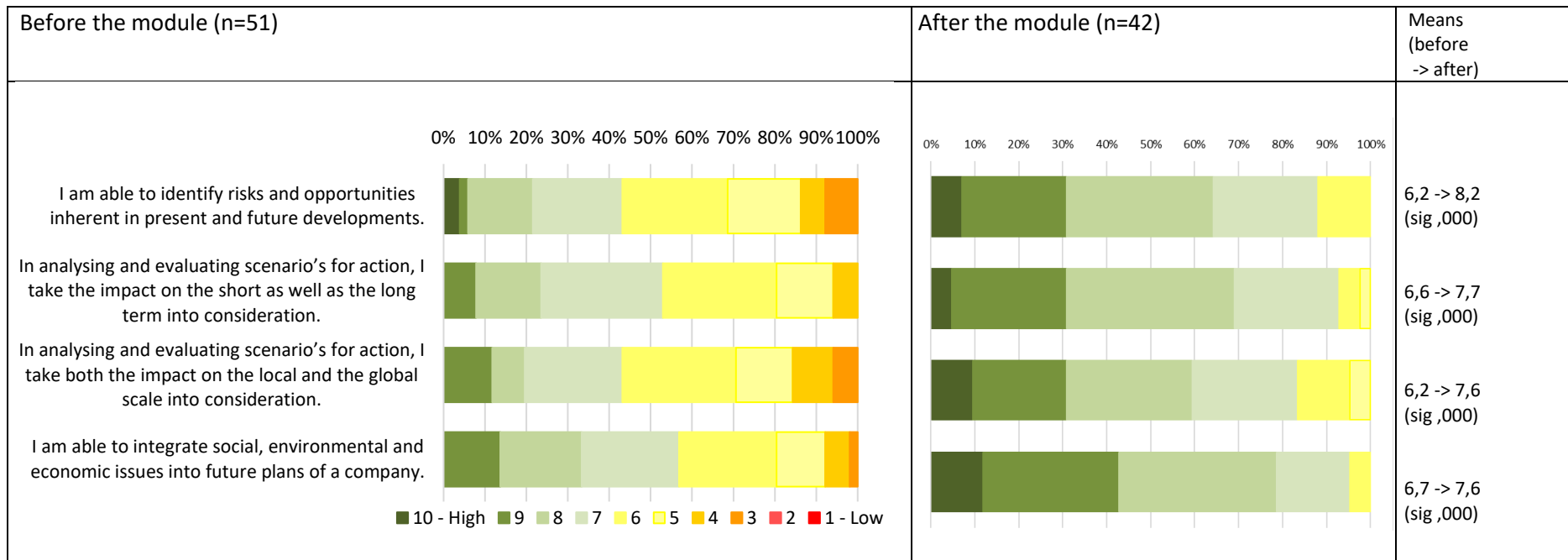
Means
(before
-> after)





Foresighted Thinking Competence

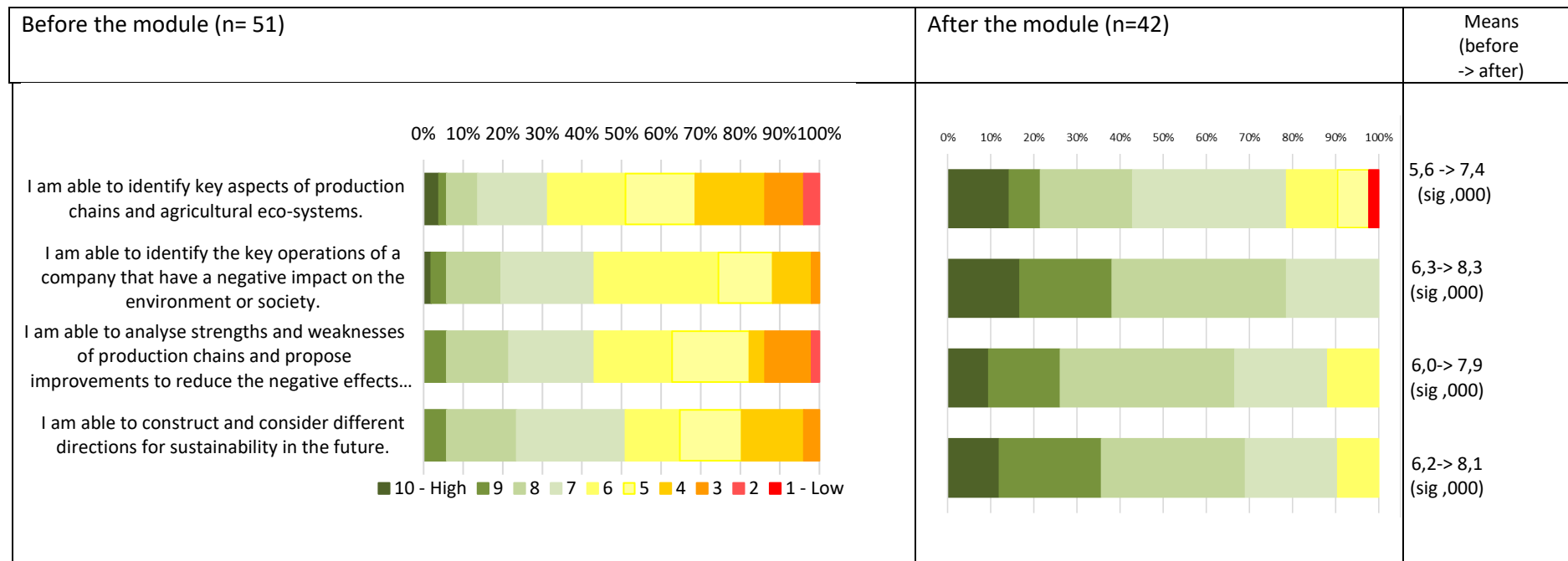
Also, the changes in Foresighted Thinking Competence have been significant. Students enter the module with a self-assessment rating themselves mostly with 5 to 7 on a scale from 1 (very low) to 10 (very high). At the end of the module no one assessed it's abilities as low (minor 5), most students rated themselves with 6 to 9.





System Thinking Competence

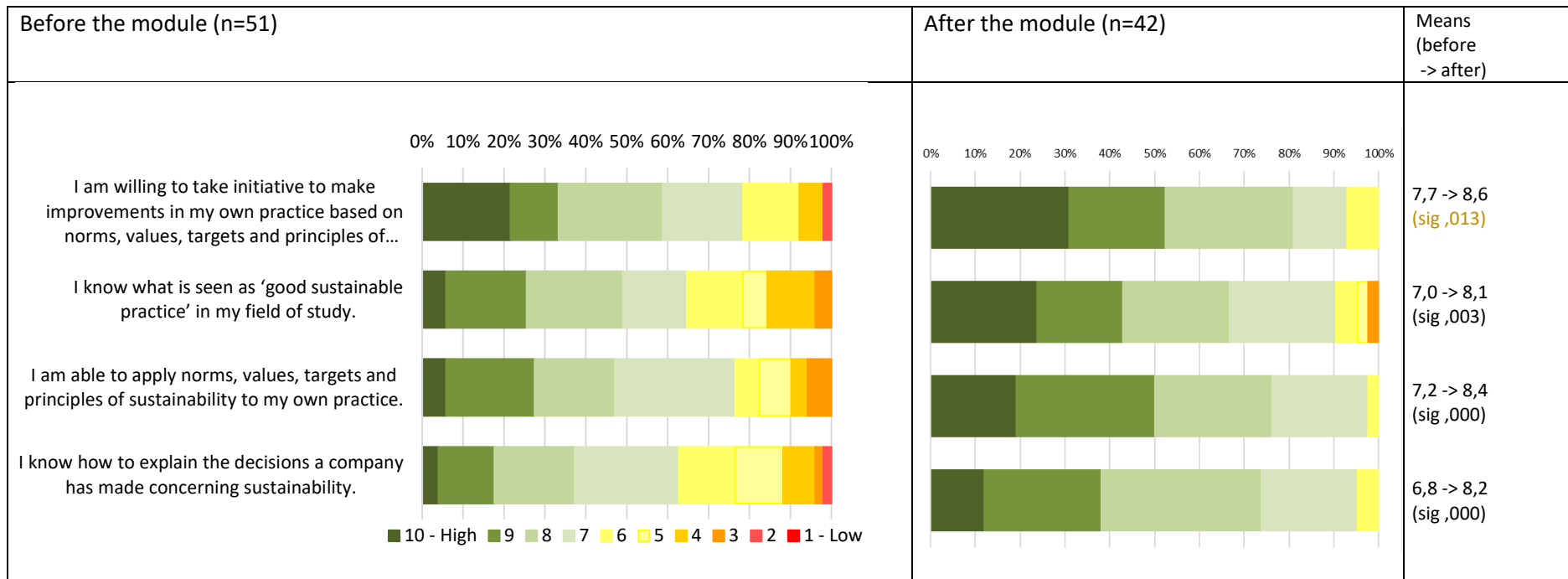
In the area of System Thinking Competence some of the biggest changes are to be observed. Less than half of the students assess themselves better than 6 on the 1 to 10 scale, after the module this number increased impressively.





Normative Competence

In the area of Normative Competence the only item is to detect, where no significant changes has been observed. It is assumed that students with a strong sense of values for sustainability attend the module. These values continue to be consolidated through their studies, but the differences in development are rather small in the module of the semester.





Interpersonal Competence

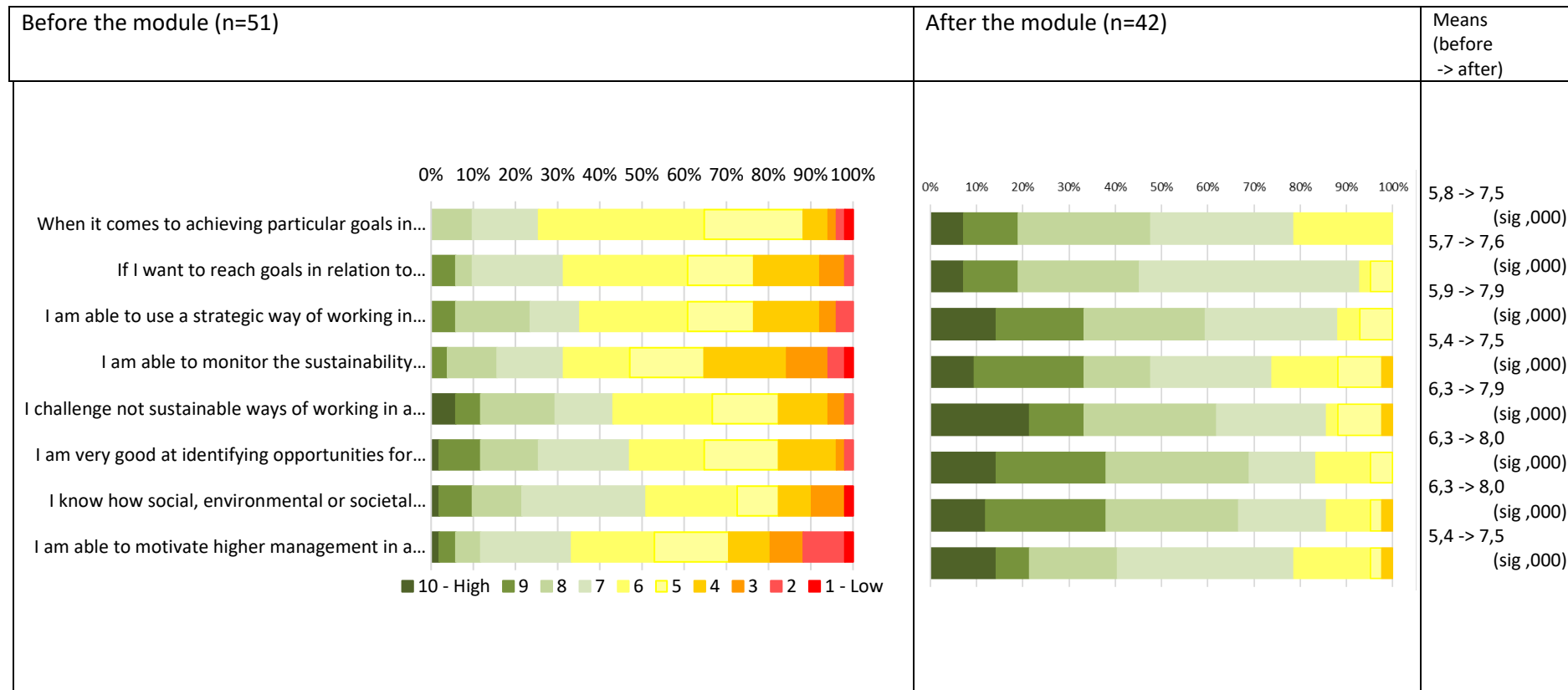
Significant changes in Interpersonal Competence are to be seen here as well. A presumption is, that the collaboration with business partners with “real” cases contributes to that.

Before the module (n=51)	After the module (n=42)	Means (before -> after)
<p style="text-align: center;">0% 10% 20% 30% 40% 50% 60% 70% 80% 90%100%</p> <p>I am patient and sensitive to someone who “lets off steam” in complex issues.</p> <p>In a personal conflict, I am able to take the others’ perspective and really understand his or her point of view.</p> <p>I am able to feel to what extent stakeholders are willing to cooperate in a project.</p> <p style="text-align: center;">■ 10 - High ■ 9 ■ 8 ■ 7 ■ 6 ■ 5 ■ 4 ■ 3 ■ 2 ■ 1 - Low</p>	<p style="text-align: center;">0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%</p>	<p>6,6 -> 7,5 (sig ,009)</p> <p>7,3 -> 8,1 (sig ,013)</p> <p>6,7 -> 7,9 (sig ,001)</p>



Strategic Action Competence

Students tended to rate themselves lowest here and show a significant development. In average they assess themselves almost two point better at the end than at the beginning of the module.





5.4 FACT SHEET AND PLAYBOOK OF MODULE “FUJIFILM FUTURE CHALLENGE”

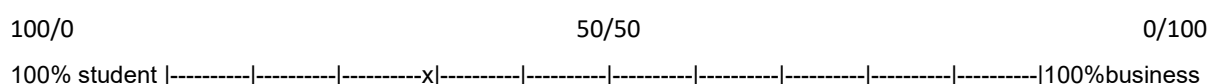
5.4.1 Fact sheet for “Fujifilm Future Challenge”

Module in general

Title of module:	Fujifilm Future Challenge
Initiating university:	Avans University of Applied Sciences
Start year:	2016
End year / ongoing:	ongoing
No. of modules held:	5 programs
Duration (weeks):	10
ECTS:	5
Module objective(s):	Generate new sustainable businesses for Fujifilm
Phases and activities (in keywords only):	<ol style="list-style-type: none"> 1. Ideation 2. Validation of business models
No. of business projects so far:	47 new business ideas
No. of business partners so far:	1 (29 staff)
No. of students so far:	222

Balance involvement between Business / Student:

(Mark with a X on the scale below)



Student involvement per module

(Characteristics of students typically included in the module)

No. of students:	222
Level of students:	Bachelor level: 193 Master level: 29 PhD level: 0
Background students:	Technical: 12 Managerial: 205 Environmental: 5 Other: 8



No. of universities/ professorships involved:	6
Number of Faculties involved:	8

Business involvement per module

(Characteristics of business partners typically included in the module)

No. of companies/ venture teams/ start-up teams:	47 new business models
Age of business partners:	3rd Stage or later (>6 years)
Size of companies FTE (no. of companies):	Large (>250 employees)
Size of companies sales (no. of companies):	Large (>10€)
Typical Branches (no. of companies):	Industry: 1 Services: Government: Not for profit:

Sustainability items covered

People issues (social):	Yes
Planet issues (sustainable):	Yes
Profit issues (business):	Yes
Keywords of sustainable subjects covered (max 10):	Improving health, Waste reduction, reduced raw materials, climate change,

Personal assessment (qualitative)

Which activities and methods have been effective:	<ol style="list-style-type: none"> 1. Design thinking exercise 2. Creativity in practice: out-of the box solutions for sustainable challenges 3. Student/business Collaboration
Which improvements could be made:	<ol style="list-style-type: none"> 1. Reducing drop-out ratio of student teams; 2. improving innovativeness of ideas; 3. Adding more quantitative in-depth aspects 4. Digital format 5. New tools
Main outcomes of the module:	<ol style="list-style-type: none"> 1. New 'fresh' business ideas for Fujifilm 2. Improved corporate image of Fujifilm 3. Exercise in developing and validating new business models



5.4.2 Playbook for “Fujifilm Future Challenge”

Course design

The course is based on a ‘experiential’ learning and co-creation with a high-tech company. Students are expected to acquire knowledge through learning-by-doing by executing a complete innovation process from the “fuzzy front end” of ideation to meeting real customers in a customer development process.

The course is designed as a mix of different types of learning activities:

- *three plenary sessions* in which useful tools and techniques are explained and practiced.
- *team activities*, in which teams take the initiative to develop their solutions to sustainable problems in team meetings
- *weekly coaching sessions*, in which teams reflect upon their progress and team process.

The FFC requires a high level of student-driven entrepreneurial initiative. University staff members are mainly act as coaches aimed at increasing the problem-solving capacity of the student teams.

Participants of the FFC are expected to:

- active participate in the plenary sessions and the team meetings
- prepare an infographic of the value proposition of their main idea
- develop an initial business model of their main idea
- test and pivot this idea at real customers, resulting in a validated business model
- produce a sales pitch video of their validated business model
- prepare and present their validated business model to an expert jury
- reflect weekly on their progress and team process using a progress monitor
- assess the innovativeness and feasibility of all ideas.
- Participate in research about drivers of new venture creation

More information about the aims, process steps, and deliverables FFC program can be found via:

<https://youtu.be/LylyhZaw1Y>



Time	Activities	Responsibilities	Materials
Preparation			
Start 3 Months Prior to the Challenge	Decision on playbook (incl. participating universities, Locations, on-line tool-set etc) GO/NO GO Fujifilm challenge Decision on dates Decision on play book and documents Decision on program details	All stakeholders	Promo material Teaser and factsheet
Start 1 Month Prior to the Challenge	Publish promotion leaflet: communication to participants Selection of participants Recruitment of coaches Participants per university known Send list of participants to organizer	All participating universities	List of participants and coaches
2 weeks Prior to the Challenge	Train coaches Form student teams, assign coaches, Send invite and preparation instructions to students Example of trailer: https://youtu.be/ZwQneNzEF9c	Organizer	Teams + Coaches lists Training material coaches, Introductory material for students on challenge and tools
Days Prior to the Challenge	Collect team-deliverables (one-minute team presentation video-clip) Finalize program kick-off session	Organizer	Slides
Entire program (10 weeks)			
1 hr/week	Team meetings with coaches (10	coach	Via Zoom
1-2 hr/wk	Team meetings of students – own initiative	teams	Via Zoom
Orientation phase (1 week before kick-off)			
1 hr/week	Team building exercise concerning intercultural collaboration, team dynamics and clarification of the program. Examples of team presentations can be found via: https://youtu.be/msXqRnpwz2Q https://youtu.be/nUxLaCCRMUM	coach	Slides and video: Team building: https://youtu.be/qU_fpiQo_c0 Clarification: https://youtu.be/LylyhZaw1IY
Kick-off session (3hr)			
1 hour	Introduction of program Introduction of Fujifilm	Organizer	Slides and videos Problem phase: https://youtu.b



	Introduction of creativity tools Explanation collaboration and creativity exercises		e/Xt9uRdnvFWA Solution phase: https://youtu.be/W_2Chmp6F0c Enabling technologies: https://youtu.be/8hDpVYqJ5HE
1.5 hour	Student teams collaborate and work on diverging creativity exercises	All	In breakout sessions
0.5 hour	Explanation assignment for the (+/- 4) weeks to come and deliverables (preliminary value proposition and un-validated business model)	Organizer	Slides
Mid-term session (3hr)			
Days Prior	Collect team-deliverables (preliminary value proposition and un-validated business model) Finalize program mid-term session	Organizer	Slides and video: https://youtu.be/iMzAubYEMx4
1 hour	Introduction of customer validation tools Explanation collaboration and validation exercises	Organizer	Slides
1.5 hour	Student teams collaborate and work on validation exercises	All	In breakout sessions
0.5 hour	Explanation assignment for the (+/- 4) weeks to come and deliverables (final value proposition and validated business model)	Organizer	Slides
End-game / Finals Session (3hr)			
1 Month Prior	Recruitment of jury members	Organizer	Jury members list
Days Prior	Collect team-deliverables (final value proposition and validated business model) Finalize program end-game session Distribute relevant materials to jury-members for preparation	Organizer	Slides
0.5 hour	Explain proceedings of the day	Organizer	Slides
2.0 hour	Student teams present, Q&A by jury-members Example of sales pitch: https://youtu.be/AMemhnO4Nyo	All	Plenary
0.5 hour	Jury conveys and decides on winner Award ceremony: participants assess each other (of research purposes only)	Organizer	Slides
Evaluation			



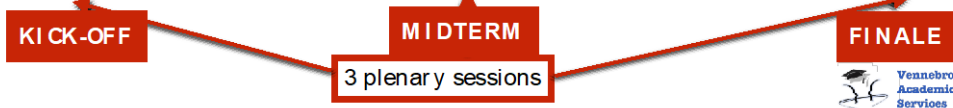
Shortly After the End-game	Send out evaluation to students, coaches, challenge provider	Organizer	Surveys
1 Month after the End-game	Prepare evaluation reports Evaluate with coaches Evaluate with challenge provider and decide on future improvements and enhancements	Organizer	Surveys Evaluation reports Decision on future improvements and enhancements

The aims, activities, and deliverables of the FFC are summarized in the slide below:

6 PHASES



Phase:	1. Orientation	2. Problem	3. Solution	4. Validation	5. Feasibility	6. Pitch
Focus:	Team - intro program & company	creativity 1: idea idealism - divergence	creativity 2: idea realism - convergence	Customer realism	Business realism	Communication
Aim:	energized team, clarity of who-does-what-when-how	exploration of expanded playing field of problems : unusual ideas after shifting perspectives, analogies	pain/gain, VP, combine, integrate, select solutions	customer feedback, pivot	quantitative, financial, more added value to Fujifilm	Convincing case
Output:	video of team (1')	many possible ideas	value proposition video (2'); checklist Initial BM	adapted ideas / BMs	validated BM	business video (3'), pitch (5')
Duration:	<2 wk	<2 wk	<2 wk	<3 wk	<1 wk	1 wk



Tools offered

In the FFC-program, we offer the following tools, usually consisting of a video tutorial and a template:

- Digital brainstorm and collaboration tool: Solution Explorer (<https://youtu.be/fVRb7BThSik>);
- Orientation phase: team dynamics and culture map;
- Problem Phase: 5Why, Brainstorming and divergent thinking, trend analysis, Osborne, Scamper, switching perspectives (9-windows);



- Solution phase: Problem-Minus-Overcome (PMO), Value Equation method, Customer journey, mind mapping, business modelling, how to make a Value proposition statement and business model canvas
- Validation phase: pivoting assumptions, how to develop and conduct questionnaires, online surveys and interviews, Mock up, Mom test, Digital prototypes, Business Model navigator;
- Feasibility phase: activities and partnerships, cost and benefits, ecosystem analysis, building a business case, revenue strategy and revenue model, scalability, stakeholder analysis;
- Pitching phase: storyboard, storytelling, pitching and interacting with public.

Progress monitor

Via internet, participants and their coaches fill in a progress monitoring tool that consists of sliders (between 0-100%) and 2 open questions. During the course of the program, coaches discuss the outcome of the progress monitor with each other in order to tailorize and finetune their coaching.

Our team shows COMMITMENT to achieving its goals.	
Our team WORKS EFFICIENTLY. We divide up our tasks.	
Our team is QUALITY oriented. We make changes to improve our team.	
Our team is LEARNING from experiences.	
Our team is CREATIVE. We generate newest-of-the-box ideas.	
Our team works according to AGREEMENTS with clear tasks and deadlines.	
Our team has put ADVICE from the COACH into practice.	
The INTERACTION between our team and the COACH is positive.	
Our team made PROGRESS on achieving its end goal since the last coaching session.	

- **What was your team’s most important learning during the past week?**
Please motivate your answer (in keywords only).
- **What was your team’s biggest challenge during the past week?**
Please motivate your answer (in keywords only).



Student involvement per module

(Characteristics of students typically included in the module)

No. of students:	15 to 60
Level of students:	Bachelor level ... ; Master level ...X.; PhD level
Background students:	Technical X.... ; Managerial X...; Environmental X...; Other
No. of universities/ professorships involved:	2 professors (divisions)
Number of Faculties involved:	1

Business involvement per module

(Characteristics of business partners typically included in the module)

No. of companies/ venture teams/ start-up teams:	1 Pre-seed, venture team, no sales, industry (energy) 3 student start-ups (active students in the module). One pre-seed and one 1 st Stage. Both were venture teams. Sales were none for the pre-seed and small for the 1 st Stage. One in industry (agriculture) one in services (environmental management).
Age of business partners:	Not applicable
Size of companies FTE (no. of companies):	Not applicable
Size of companies sales (no. of companies):	Not applicable
Typical Branches (no. of companies):	Not applicable

Sustainability items covered

People issues (social):	Yes/no Partly but not core.
Planet issues (sustainable):	Yes Core
Profit issues (business):	Yes Core
Keywords of sustainable subjects covered (max 10):	Energy, sustainable consumption, recycling, energy and environmental management (tools, digitalization), waste as a resource, waste prevention, circular solutions,



Personal assessment (qualitative)

<p>Which activities and methods have been effective:</p> <ul style="list-style-type: none"> ▪ Student focused workshops backed up with lectures. ▪ Digitalization of some lectures and module management. ▪ Inspirational and creativity workshops. ▪ Final presentation as an exhibition. 	<p>Which improvements could be made:</p> <ul style="list-style-type: none"> ▪ Adjust to more diverse group of students with different engineering backgrounds. ▪ Increasing the focus on <u>environmentally</u> driven business development to differentiate from similar modules. ▪ Improve feedback on drafts of student reports. ▪ Perhaps take one step back regarding flipped classroom pedagogics. ▪ Opening for more external projects (now mainly based on student ideas).
<p>Main outcomes of the module</p>	<p>Approximately 40 business plans.</p> <p>Three student start-ups developing their own ideas in the module.</p> <p>One university start-up helped in drafting their first business plan.</p>



5.5.2 Playbook of module “Environmentally driven business development”

On learning activities and student activities

The module is based on a combination of ‘academic’ and ‘experiential’ learning. Students are expected to gain knowledge both from theoretical (i.e reading literature, listening to lectures, discussing with other students, writing academic essays) and also acquire knowledge through learning-by-doing (i.e. by actually doing what they are supposed to learn how to do). For example, reading about how to do a market analysis is usually not enough to acquire the ability to *perform* such an analysis.

The module is designed as a mix of different types of learning activities:

- *Lectures* in which teachers give an overview of relevant concepts, theoretical frameworks, or analyses.
- *Workshops*, in which you practice using the frameworks and tools of business development learned in the Lectures, building the base for the Group Project.
- *A group project*, in which you learn by experiencing an idea qualification and business planning process in order both to get a better understanding of the process as such and to improve your abilities to manage it in practice.

Since Environmentally Driven Business Development is an advance module, it requires a high level of student-driven activity to function properly. Student activity and “drive” is also important from the point of view of the module topic itself: Entrepreneurship research clearly emphasizes the importance of individual driving force for successful entrepreneurial processes. In line with this, the teacher team should expect students to be an active participant in the module and take responsibility for their own learning process.

Students are expected to...

- actively search for the information needed
- prepare for lectures and seminars
- take active part in lectures and workings, contributing to an open and stimulating discussion climate in the module
- follow up on lectures and seminars; and
- take active part in the group project.

Module Syllabus and Construction

The module consists of parallel tracks of lectures and seminars. Together with student activities this builds the final group project.

<i>Lectures (in chronological order)</i>	<i>Corresponding workshops</i>	<i>Student activities (gates to pass through)</i>
Introduction		
Formal introduction to the module and its learning goals.		Group formation.
Innovation and Entrepreneurship	Workshop on the Challenges provided for Group Projects	



A theoretical background to the subject.	Together with the teacher team, the Challenge Providers hold an inspirational seminar to spark ideas on business opportunities for the Group Projects.	Idea generation.
The Business Idea	Workshop on Ideation	
A run-through on the process of idea development and the NABC model from a theoretical perspective.	Students formulate NABCs on their ideas to compare them for selection.	Selection of idea for the Group Project.
The Sustainable Business Model	Workshop Shitty Prototyping	
This module is built on the framework of the Business Model Canvas, see below. This lecture gives both the theories behind sustainable business modelling and a walk-through of the 3P BMC.	The teams build a fast prototype of their idea in 90 minutes. Both a team-related workshop as well as making the idea more concrete.	
Lecture on IP and IPR		
Theory and practice in IP and IPR by one of our partners, a law firm specializing in innovation.		Contacting potential customers for the idea.
Market analysis for sustainable, innovative ideas	Workshop Market analysis	
With a perspective on innovations for sustainability, this lecture gives the theories behind market analysis.	Using well recognizable tools like Kottler's 4P and the STP model students set a first thought on their market approach, together with things learned from their interviews.	
Business Intelligence with a sustainability focus	Workshop Business Intelligence	
A theoretical walk-through of the importance of business and niche analysis with a special focus on innovations for sustainability.	Students work with the Porters 5 forces model and the PESTEL model to analyze how their niche affects their idea.	Contacting external experts in the field.
The Sustainable Business Model 2	Value Creation Forum	
A more in-depth lecture on sustainable business models and business model innovation.	As a half-way gate all teams gather in a Value Creation Forum (from SRI) to give each other feedback and ideas. Also great to create cross-collaboration between groups.	Giving feedback on other groups ideas and presentations.
Resources	Workshop on Resource management	
A lecture on resource management and resource theory, focusing on new teams and how to get access to resources. Also, a run-through of the innovation support system and startup financing.	All teams make their own circular value chain and discuss their resource management throughout the chain.	



Analysis and Finances	Workshop on Analysis	
A lecture on the foundations of business analysis and the SWOT tool. Tying together all the parts of the module for the finalization of their group project	Workshop on SWOT, connecting learnings from all parts of the prior workshops and ending in both a risk analysis and an action plan.	Pitch training - students work on their pitch from materials supplied.
Responsible Innovation	Workshop on Responsible Innovation	
A theoretical background to the subject of ethics and innovation.	Workshopping on the framework presented in the lecture.	(Writing feedback on other groups projects)
	Final presentation	
	Set as an "idea fair", students pitch their ideas to one another (and to guests), and vote on the ideas with most potential, best presentation and best pitch.	(Submission of finalized group project)

The business report build in this module is centred on the BMC, connecting workshops and theories to this model to build an understanding of the whole business opportunity.

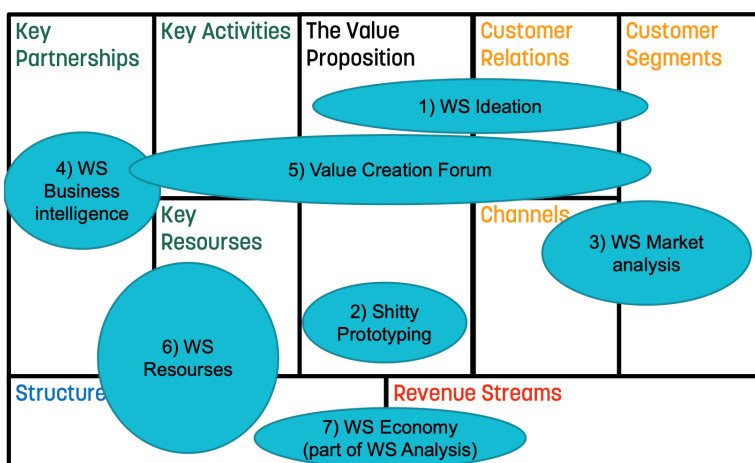
In addition to these two tools are used to understand the world outside the future company: Porter’s Five Forces and the PESTEL model.

Models used to build the BMC

Key Partnerships <ul style="list-style-type: none"> Value chain Networks Strategic partnerships Bransch analysis, focusing on suppliers and competition 	Key Activities <ul style="list-style-type: none"> Value Chain Activities in 4P 	The Value Proposition <ul style="list-style-type: none"> NABC Market analysis: STP, 4P product, price, customers surveys URS - User analysis 	Customer Relations <ul style="list-style-type: none"> STP, 4P - promotion, 7 steps of sales 	Customer Segments <ul style="list-style-type: none"> NABC STP AIDA Needs Buying patterns Byuning processes
Key Resources <ul style="list-style-type: none"> Resource theories Resource mapping SWOT 			Channels <ul style="list-style-type: none"> 4P - place B2B, B2C, B2P Technology-push/ market pull 	
Structure of costs <ul style="list-style-type: none"> Budget and business numbers Value Chain, activity and resource analysis, quality / quantity 		Revenue Streams <ul style="list-style-type: none"> Budgets and business numbers Market analysis 4P - price 		

The workshops set to relation of the BMC:

BMC and workshops





5.6 EVALUATION OF THE REVISED MODULE ENVIRONMENTALLY DRIVEN BUSINESS DEVELOPMENT (LIU) – STUDENT SELF-ASSESSMENTS OF SUSTAINABLE ENTREPRENEURSHIP COMPETENCIES

Below you find detailed results of the student self-assessments of sustainable entrepreneurship competencies performed during the module Environmentally Driven Business Development in 2021. Results are presented for the 26 students (corresponding to almost 50% of the students in the module) who responded to the survey both in the beginning and the end of the module. Statistical evaluation of the results is presented in the end of this section in Table 1.

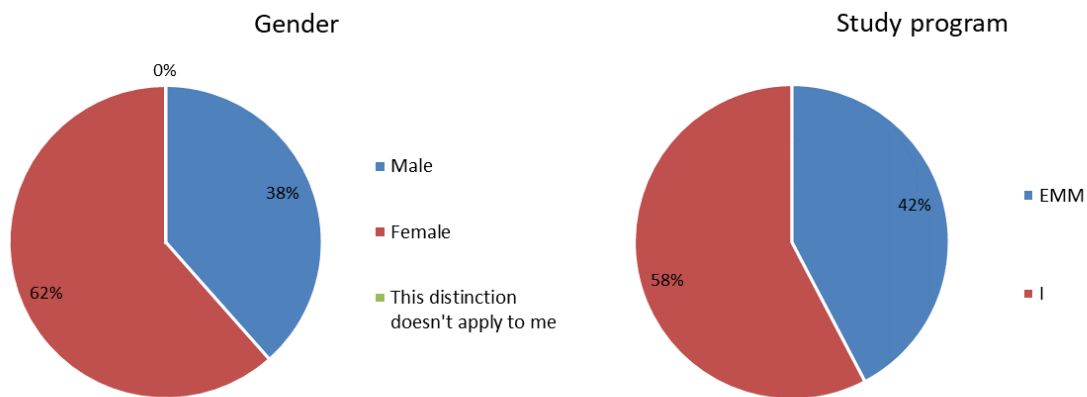


Figure 1: Background information on the participating students in terms of gender and study program (n=26). EMM: Energy - Environment - Management Engineering, I: Industrial Economics Engineering.

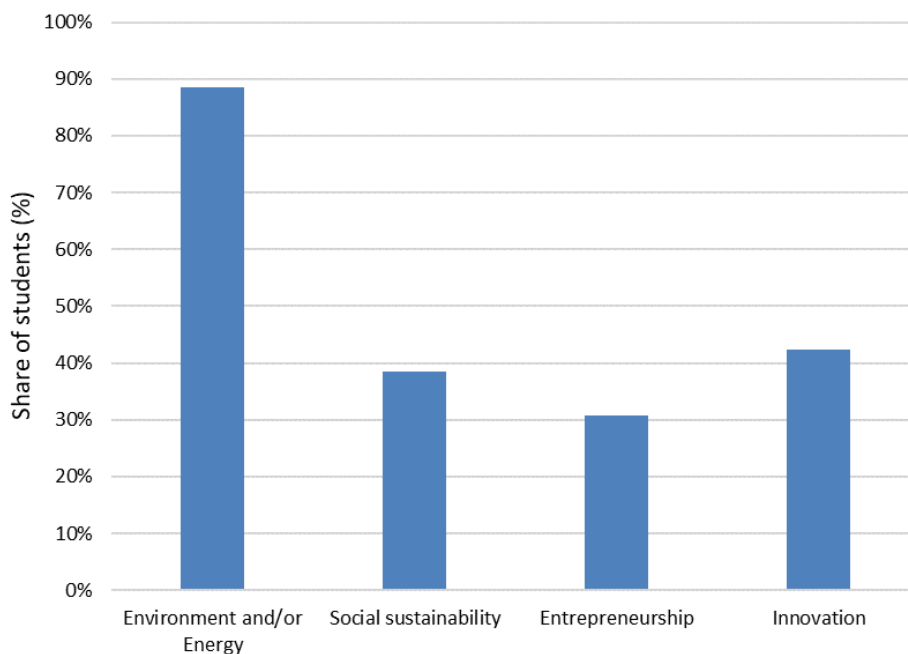


Figure 2: Background information on the participating students in terms of earlier experiences of modules within the fields: Energy - Environment - Management Engineering, Social sustainability, Entrepreneurship, and Innovation (n=26).

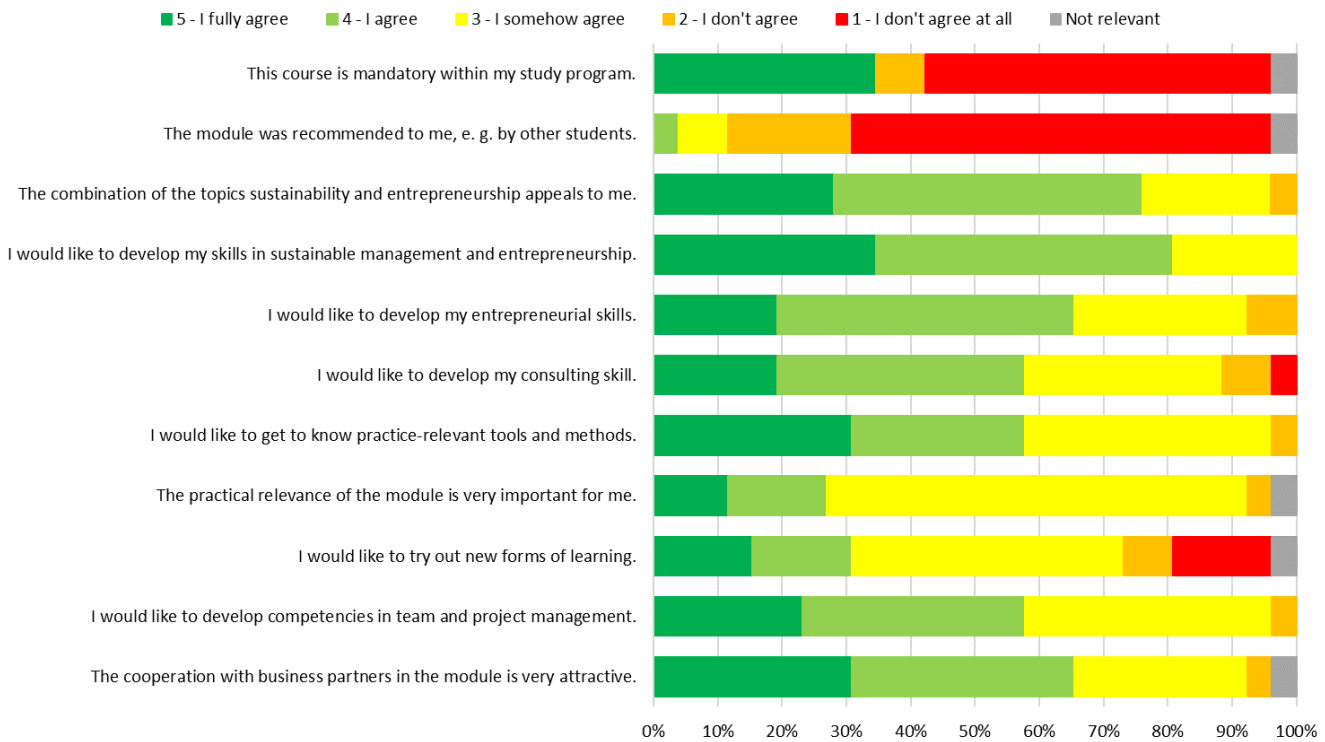


Figure 3: Background information on the participating students in terms of motivation for participation in the module (n=26).

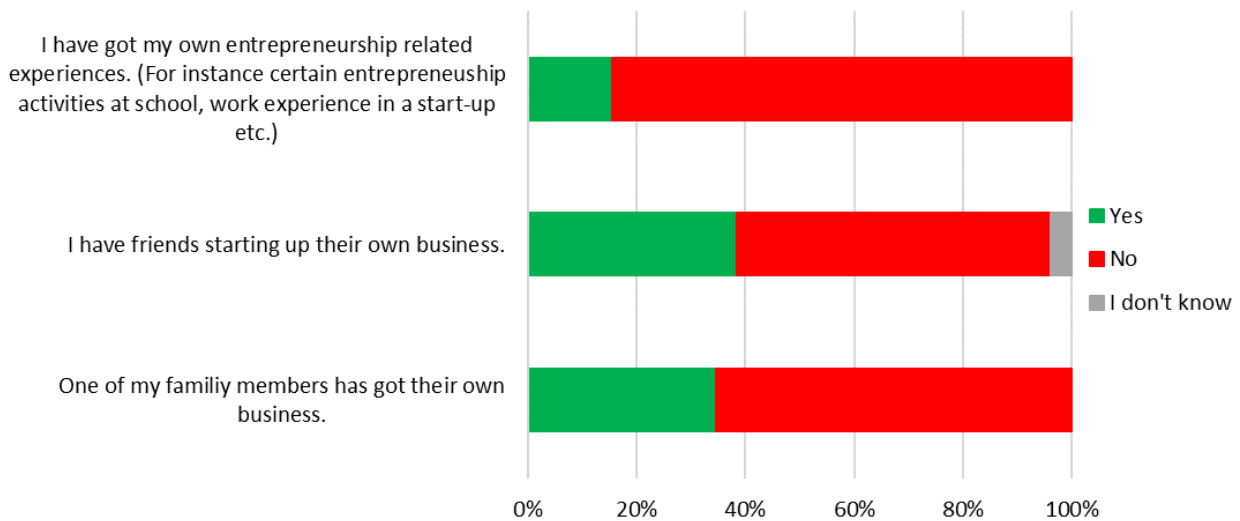


Figure 4: Background information on the participating students in terms of earlier experiences of entrepreneurship (n=26).

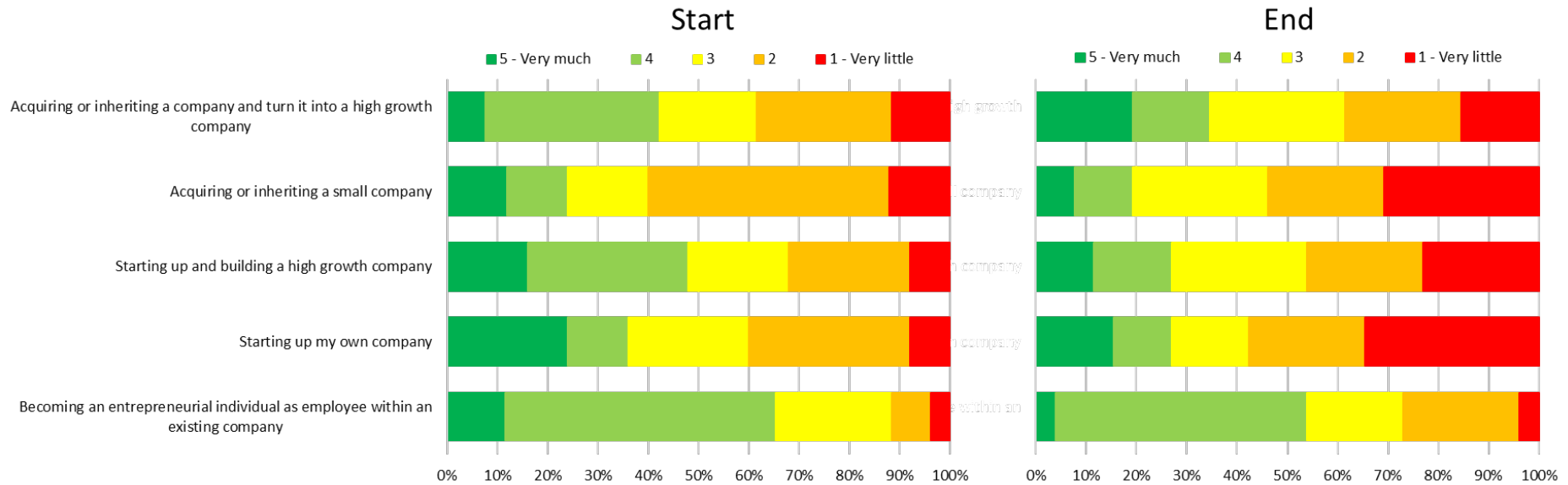


Figure 5: Background information on the participating students in terms of entrepreneurial intentions (n=26). Which type of entrepreneurial activities are you interested in the next 5 to 10 years? Graph to the left is at the start of the module and to the right at the end. Green means that students have a high interest and red a low interest. The indicated decrease in interest for future entrepreneurial activities was not statistically significant (comparing means at 95% confidence level).

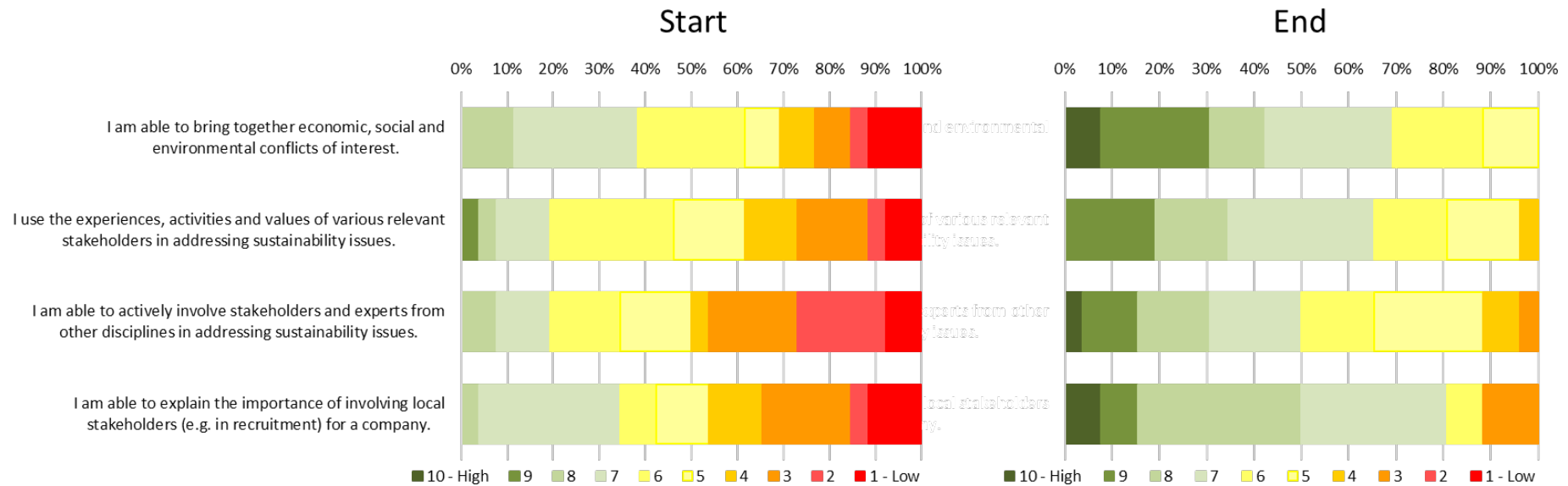


Figure 6: **Diversity competence** (n=26) – Results of student self-assessments for Environmentally Driven Business Development 2021. Graph to the left is at the start of the module and to the right at the end. Green means that students assess their competence as high and red as low. Based on these assessments the average student increased its competence regarding all criterias during the module (see details in Table 1).

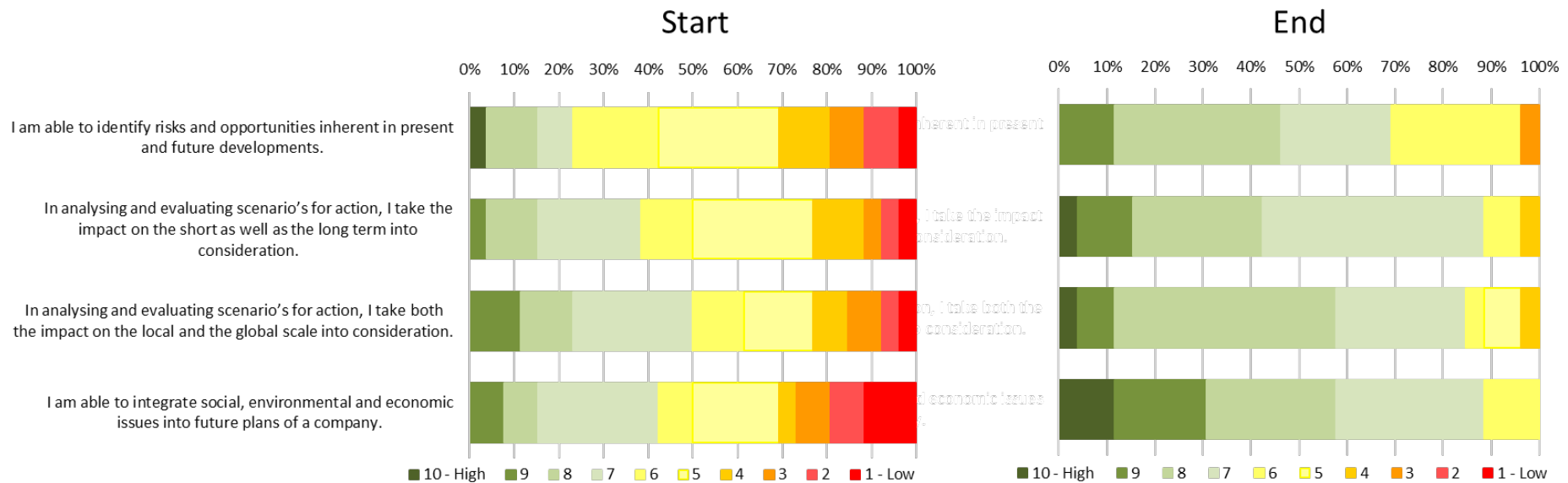


Figure 7: **Foresighted thinking competence** (n=26) – Results of student self-assessments for Environmentally Driven Business Development 2021. Graph to the left is at the start of the module and to the right at the end. Green means that students assess their competence as high and red as low. Based on these assessments the average student increased its competence regarding all criterias during the module (see details in Table 1).

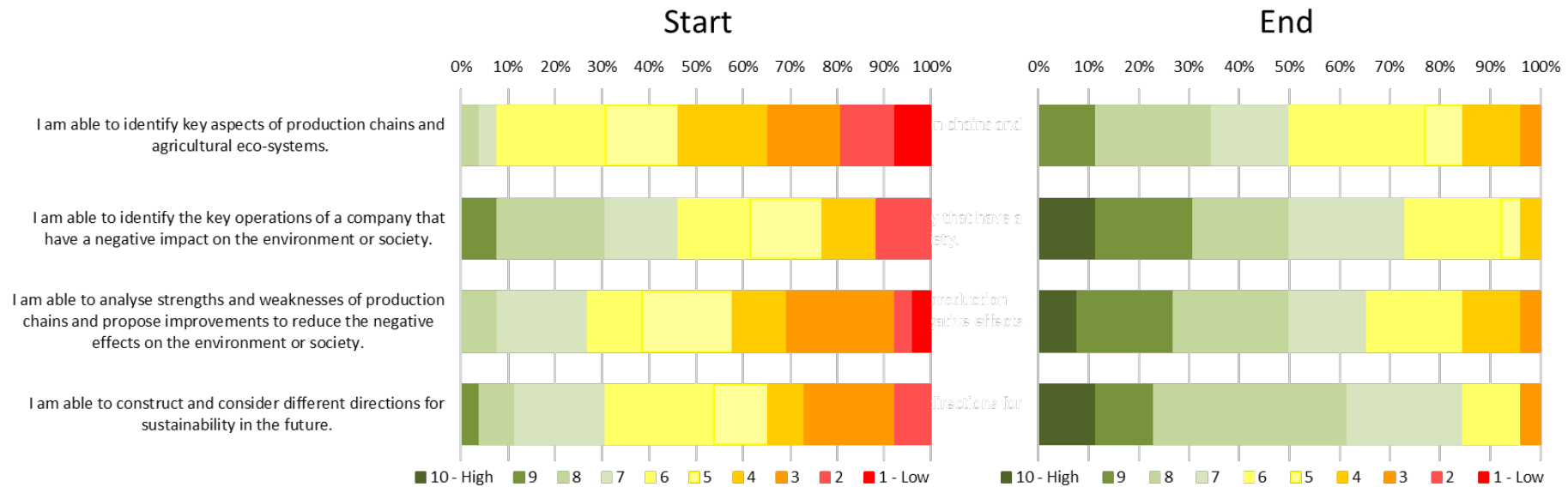


Figure 8: **Systems thinking competence** (n=26) – Results of student self-assessments for Environmentally Driven Business Development 2021. Graph to the left is at the start of the module and to the right at the end. Green means that students assess their competence as high and red as low. Based on these assessments the average student increased its competence regarding all criterias during the module (see details in Table 1).

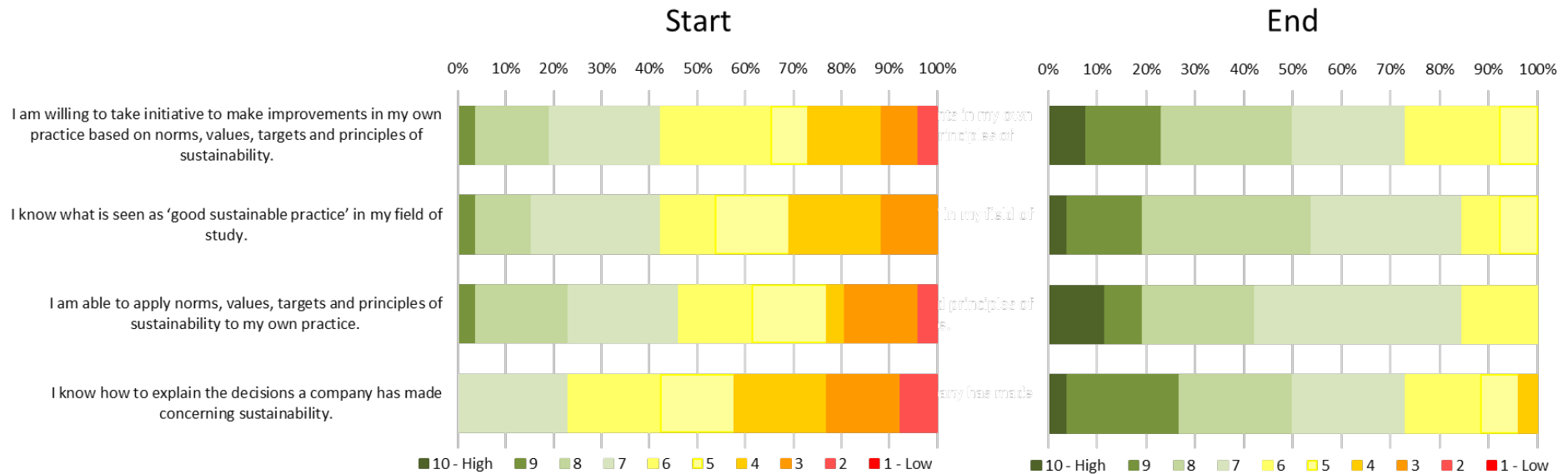


Figure 9: **Normative competence** (n=26) – Results of student self-assessments for Environmentally Driven Business Development 2021. Graph to the left is at the start of the module and to the right at the end. Green means that students assess their competence as high and red as low. Based on these assessments the average student increased its competence regarding all criterias during the module (see details in Table 1).

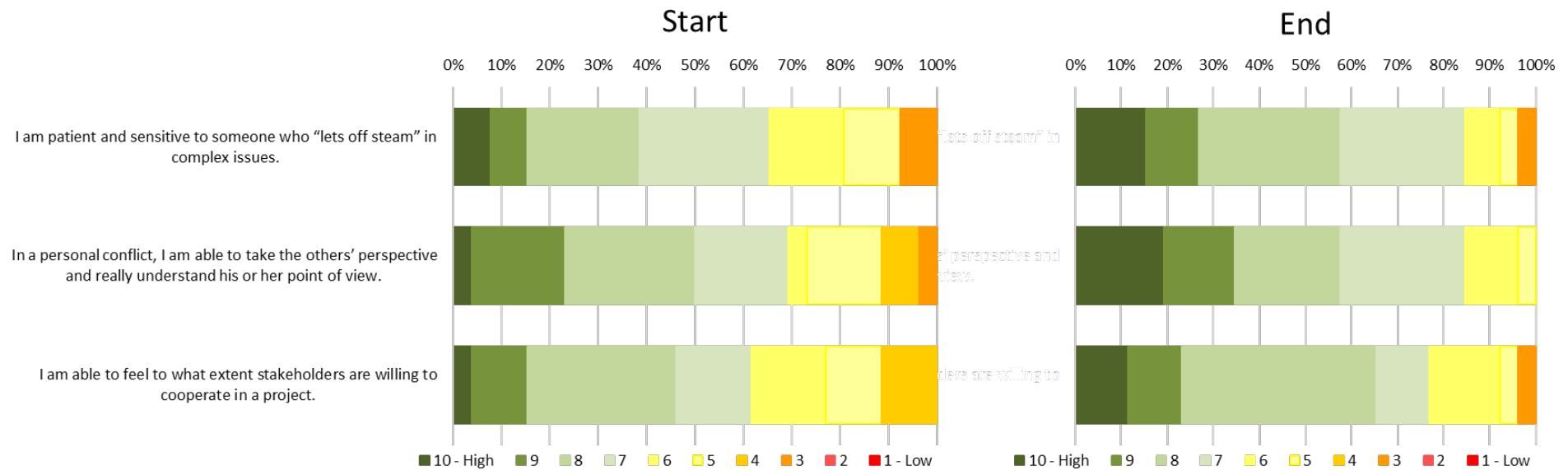


Figure 10: **Interpersonal competence** (n=26) – Results of student self-assessments for Environmentally Driven Business Development 2021. Graph to the left is at the start of the module and to the right at the end. Green means that students assess their competence as high and red as low. Based on these assessments the average student slightly increased its competence regarding all criterias during the module, however not statistically significant (see details in Table 1).

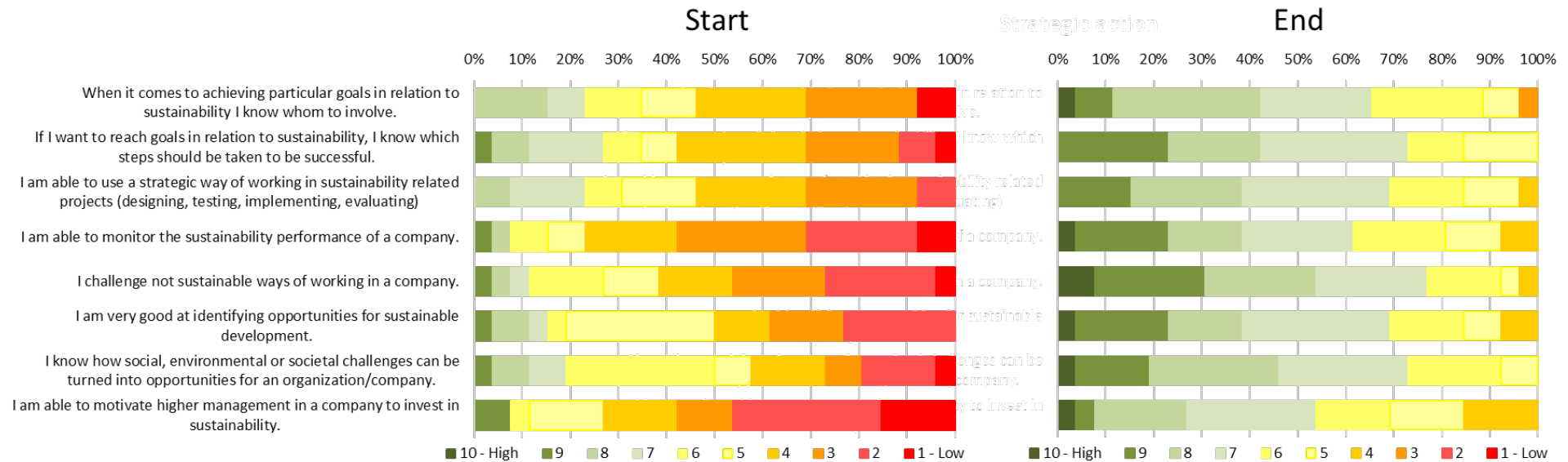


Figure 11: **Strategic action competence** (n=26) – Results of student self-assessment for Environmentally Driven Business Development 2021. Graph to the left is at the start of the module and to the right at the end. Green means that students assess their competence as high and red as low. Based on these assessments the average student increased its competence regarding all criterias during the module (see details in Table 1).



Table 1a: Results of student self-assessments for Environmentally Driven Business Development 2021. The results are presented with mean values (standard deviation) for each criterion assessed in the beginning and at the end of the module (n=26). Each criteria/competence is assessed on a scale of 1-10 (low to high competence).

Competence	Criteria	START Mean (SD)	END Mean (SD)	Significant change? ⁷
Diversity	I am able to bring together economic, social and environmental conflicts of interest.	5.3 (2.2)	7.4 (1.5)	Yes! (p<0.001)
	I use the experiences, activities and values of various relevant stakeholders in addressing sustainability issues.	4.9 (2.0)	7.0 (1.5)	Yes! (p<0.001)
	I am able to actively involve stakeholders and experts from other disciplines in addressing sustainability issues.	4.3 (2.2)	6.5 (1.8)	Yes! (p<0.001)
	I am able to explain the importance of involving local stakeholders (e.g. in recruitment) for a company.	4.7 (2.2)	7.2 (1.8)	Yes! (p<0.001)
Foresighted thinking	I am able to identify risks and opportunities inherent in present and future developments.	5.2 (2.1)	7.2 (1.3)	Yes! (p<0.001)
	In analysing and evaluating scenario's for action, I take the impact on the short as well as the long term into consideration.	5.6 (1.9)	7.4 (1.2)	Yes! (p<0.001)
	In analysing and evaluating scenario's for action, I take both the impact on the local and the global scale into consideration.	6.0 (2.2)	7.4 (1.3)	Yes! (p=0.005)
	I am able to integrate social, environmental and economic issues into future plans of a company.	5.3 (2.2)	7.9 (1.2)	Yes! (p<0.001)
Systems thinking	I am able to identify key aspects of production chains and agricultural eco-systems.	4.3 (1.8)	6.5 (1.7)	Yes! (p<0.001)
	I am able to identify the key operations of a company that have a negative impact on the environment or society.	6.0 (2.1)	7.5 (1.6)	Yes! (p=0.004)
	I am able to analyse strengths and weaknesses of production chains and propose improvements to reduce the negative effects on the environment or society.	4.9 (1.9)	7.2 (1.9)	Yes! (p<0.001)
	I am able to construct and consider different directions for sustainability in the future.	5.3 (2.0)	7.7 (1.5)	Yes! (p<0.001)

⁷ Statistical evaluation performed in SPSS: Lavene's Test for Equality of Variances followed by t-test for Equality of Means (95 % Confidence Interval).



Table 1b: Results of student self-assessments for Environmentally Driven Business Development 2021. The results are presented with mean values (standard deviation) for each criterion assessed in the beginning and at the end of the module (n=26). Each criteria/competence is assessed on a scale of 1-10 (low to high competence).

Competence	Criteria	START Mean (SD)	END Mean (SD)	Significant change? ⁸
Normative	I am willing to take initiative to make improvements in my own practice based on norms, values, targets and principles of sustainability.	5.9 (1.8)	7.5 (1.4)	Yes! (p=0.001)
	I know what is seen as 'good sustainable practice' in my field of study.	5.7 (1.8)	7.5 (1.2)	Yes! (p<0.001)
	I am able to apply norms, values, targets and principles of sustainability to my own practice.	5.9 (1.9)	7.6 (1.2)	Yes! (p=0.001)
	I know how to explain the decisions a company has made concerning sustainability.	4.9 (1.6)	7.4 (1.5)	Yes! (p<0.001)
Interpersonal	I am patient and sensitive to someone who "lets off steam" in complex issues.	6.9 (1.8)	7.7 (1.6)	No! (p=0.110)
	In a personal conflict, I am able to take the others' perspective and really understand his or her point of view.	7.0 (1.9)	7.9 (1.4)	No! (p=0.061)
	I am able to feel to what extent stakeholders are willing to cooperate in a project.	6.9 (1.7)	7.6 (1.6)	No! (p=0.136)
Strategic action	When it comes to achieving particular goals in relation to sustainability I know whom to involve.	4.7 (2.1)	7.0 (1.5)	Yes! (p<0.001)
	If I want to reach goals in relation to sustainability, I know which steps should be taken to be successful.	4.7 (2.1)	7.2 (1.4)	Yes! (p<0.001)
	I am able to use a strategic way of working in sustainability related projects (designing, testing, implementing, evaluating)	4.7 (1.8)	7.0 (1.4)	Yes! (p<0.001)
	I am able to monitor the sustainability performance of a company.	3.6 (2.0)	7.0 (1.6)	Yes! (p<0.001)
	I challenge not sustainable ways of working in a company.	4.1 (2.1)	7.6 (1.5)	Yes! (p<0.001)
	I am very good at identifying opportunities for sustainable development.	4.4 (2.0)	7.1 (1.6)	Yes! (p<0.001)
	I know how social, environmental or societal challenges can be turned into opportunities for an organization/company.	4.9 (2.1)	7.4 (1.3)	Yes! (p<0.001)
	I am able to motivate higher management in a company to invest in sustainability.	3.4 (2.2)	6.5 (1.6)	Yes! (p<0.001)

⁸ Statistical evaluation performed in SPSS: Lavene's Test for Equality of Variances followed by t-test for Equality of Means (95 % Confidence Interval).



5.7 FACT SHEET AND PLAYBOOK OF MODULE “INGENIOUS”

5.7.1 Fact sheet of module “InGenious”

Module in general

Title of module:	799g52 InGenious - Cross-disciplinary project
Initiating university:	Linköping university
Start year:	2016 (under the label InGenious)
End year / ongoing:	ongoing
No. of modules held:	About 12
Duration (weeks):	One semester; about 20 weeks
ECTS:	8
Module objective(s):	<p>After completed module the student should be able to:</p> <ul style="list-style-type: none"> ▪ conduct a cross-disciplinary project as part of a team ▪ formulate research questions independently and contribute with relevant knowledge and skills in the work process ▪ discuss and communicate solutions to external parties such as clients and other stakeholders both orally and in writing ▪ reflect on group processes and group dynamics in collaboration with other professions ▪ reflect on the work process and team dynamics from different perspectives such as business, sustainability and an ethical perspective
Phases and activities (in keywords only):	Challenge based learning, three phases: (1) Engage, (2) Investigate, (3) Act
No. of business projects so far:	58
No. of business partners so far:	50
No. of students so far:	250

Balance involvement between Business / Student:

(Mark with a X on the scale below) About 1 business per 5 students

100/0 50/50 0/100
 100 % student |-----|-----X-----|-----|-----|-----|-----|-----|-----| 100 % business



Student involvement per module

(Characteristics of students typically included in the module)

No. of students:	Average 21 students per module, however ranging from 10-44
Level of students (mark with X):	Bachelor level: x (almost a prerequisite, hence few) Master level: x (most common) PhD level: x (very rare, but have happened)
Background students:	Technical: 50% Managerial: about 10% of the technical students Environmental: about 5% of the technical students Other: 45% philosophical, 5% medical faculty and others (including lifelong learners)
No. of universities/ professorships involved:	1
Number of Faculties involved:	4

Business involvement per module

(Characteristics of business partners typically included in the module)

No. of companies/ venture teams/ start-up teams:	58
Age of business partners:	Pre-seed (1-3 months): Seed (4-12 months): Start-up (1 year): Very few, but some 1 st Stage (1-3 years): some, but rather few 2 nd Stage (4-6 years): some 3 rd Stage or later (>6 years): most common
Size of companies FTE (no. of companies):	Single entrepreneur: very few Venture team (<5 employees): very few Micro enterprise (5-10 employees): some Small (10-25 employees): rather common Medium (25-250 employees): rather few Large (>250 employees): very few
Size of companies sales (no. of companies):	None: - Small (<1 mln €): some Medium (1-10€): rather common Large (>10€): rather few



Typical Branches (no. of companies):	Industry: most common Services: rather few Government: about 5-10 Not for profit: 1
--------------------------------------	--

Sustainability items covered

People issues (social):	Yes
Planet issues (sustainable):	Yes
Profit issues (business):	Yes
keywords of sustainable subjects covered (max 10):	Responsible innovation, UN SDGs, core focus on SDG 11

Personal assessment (qualitative)

Which activities and methods have been effective:	Most of those in the current module (see paly book) those not working have been sorted away
Which improvements could be made:	Reflections and self-estimations of initial values and learning Assessment matrixes needs to be improved regarding formative judgement of skills.
Main outcomes of the module:	Knowledge and skills to master the VUCA world – students with self-confidence. Better team workers, and awareness of ethical issues. See playbook!

5.7.2 Playbook of module “InGenious - cross-disciplinary project”

Module content

During the module, the students work in teams that are expected to independently develop a cross-disciplinary project that meets a challenge posed by an external challenge provider (usually a company or an organisation).

The work is interdisciplinary, and the framework of the challenges leaves room for interpretation, this requires that the students are active, inquisitive and show initiative. The challenges that the student develops solutions to are an important part of the module as well as a big part of the learning experience. Both oral and written communication is an important part of the module, both in the teams and between the teams and their challenge providers. One part of this communication is through organized presentations where the teams pitch to an auditorium of varying sizes. The pitches follow an inclining learning curve where the participants get opportunity to develop their pitches successively in a safe environment leading up to a final pitch where the project is presented in front of a larger audience.



Teaching and working methods

This module is given in cooperation between Linköping University and InGenious East Sweden. The module is organized in case of lectures, workshops, self-reliant interdisciplinary group work and a written individual reflection. The students are expected to conduct self-studies, both individually and in the team.

In the below list the different types of learning activities are explained:

- **Lectures** where teachers give an overview of relevant concepts, theoretical frameworks, or analyses.
- **Workshops and events**, students apply the frameworks and tools of business development learned from the Lectures in practical use. The workshops form the basis for the group project.
- **Group project**, in which students learn by experiencing an idea qualification and business planning process in order to both get a better understanding of the process as such and to improve their abilities in practice. The group project also includes group dynamics work in case of a lecture and a group contract, which are revised during the module. The group process are supported by the teachers/facilitators.
- **Individual reflection**, where students individually reflect upon the aim of the module, the module goals and to what extent they are judged to have been reached and upon the activities and specific learnings that they, on an individual level, have made.

Notes about some of the activities that have been listed above

The workshops and events are essential in the InGenious module and therefore we want to take a closer look at some of them.



Shitty prototyping is a “serious play” which means that although it is a “play” it is very consciously designed. During this seminar, which follows a strict program (warm-up, planning, construction, pitch



preparation, pitches) and takes about 2 hours, the students build their solutions by use of garbage and crafts material. Fantasy and creativity are encouraged and among the benefits of the seminar, the following could be mentioned:

- The idea becomes visual, and a united picture is created
- The idea often develops in new directions or even change radically through the seminar
- The seminar also works to strengthen the group and detect what group members are good at. The students also learn about group dynamics and individual skills such as handling deadlines and stress.
- It fosters entrepreneurship, knowledge on production, shows upon obstacles such as limited resources etc.

Value Creation Forum

- Practice pitching
- Give and get feedback from different perspectives
- Improve

h.u. LEARNINGS UNIVERSITET

The slide features a black background with white text. On the right side, there is a small inset photograph showing a group of people in a seminar room. A person is standing at the front, presenting to an audience seated at tables. A screen is visible in the background of the photo.

The **Value Creation Forum (VCF)** is an event where the groups pitch their ideas and receive and give feedback from different perspectives. Practically students are assigned to make a no slide 1 minute pitch and all members should be able to pitch.

The VCF feedback methodology is developed by Stanford Research Institute, and we have elaborated on it to fit a class situation. After a group have launched a pitch, they receive/leave feedback. There are four feedback roles: green hat = keep and develop this! Red hat = improve or add this! Yellow hat = stakeholder perspective, blue glasses = the customer perspective.

The students are encouraged to try to be helpful and constructive so that the comments really contribute to the development work of the group they comment on. Those receiving feedback should avoid discussion and just say “thanks!”

Through this seminar the students can improve both the content of the pitch and how it is leveraged. The teachers moderate the seminar.



The graduation event is the final presentation in the module. It is done in public with invited guests. Under normal circumstances it is run on site as shown by the picture. However, due to Covid 19 it has also been held online. During this seminar the Challenge providers are present and so also representatives from the support system.



The individual reflection is rather comprehensive (3-4 pages) and aims at reflecting over what the students have learned. They are issued to departure from the aim of the module and upon all the module goals and reflect on their goal attainment. They are also issued to reflect upon the activities undertaken in the module, i.e. upon what you have learned throughout the module. They are recommended to



focus upon their own learning, their personal development and their own findings. They are encouraged to reflect in terms of GROW - that is GOAL (your initial goals), Current REALITY (what happened) OPTIONS/OBSTACLES (that appeared) and WILL (your will forward - i.e. what you can learn from the experience). It is also made clear that the reflection is not a module evaluation – but instead a reflection upon their own observations and a self-assessment upon their achievement of the module goals.

Examination and grades

The module is graded in three grades, F (fail), P (pass) and PWD (pass with distinction). F means that the student has failed to reach the requirements of the degree "passed" - the student's knowledge are at a pre-structural or unistructural level which means that the student might be able to identify relevant aspects and follow simple procedures but cannot combine this into more complex patterns. The student may also fail to perform serial skills. There might also be some of the compulsory parts of the module that have been missed. P means pass and at this degree the student can explain and use concepts and theories, identify the most critical aspects, answer questions and reflect on literature and models on the subject. The answers given are based on objective and logical reasoning, and the knowledge have reached a multi-structural level where several relevant aspects can be combined, listed and described. PWD means that the student can demonstrate understanding of the subject and have a critical approach. The student can argue, apply, criticize and explain different aspects. Analysis and answers are profound and highly qualified by literature and other sources. The knowledge is relational by means that it could be integrated into a structure, and it could even be extended abstract, which means that the student is able to generalize to a new domain.

To pass, all mandatory parts and assignments (6 in total, whereof 5 is groupwise) must have reached the level of pass. To receive a PWD on the entire module a PWD on the group work report is required. Furthermore, PWD of two out of three of the following are required; Project plan, individual reflection and pitch.

On learning activities and student activities

The cornerstones of the module is the cross disciplinary work, the focus on sustainability, the idea development process and communication. Challenge-based learning (CBL) is used as the main pedagogical approach. The module as such is student centered by means that it puts the learning goals in focus. The challenges give the context in which the learning takes place. The pedagogics, the teachers (teamchrs), and the module web platform supports the learning.

Some notes on how CBL is applied in the InGenious module

Firstly, one of the main reasons why we have applied CBL is the recognition of a changing world with an increasing amount of VUCA (volatility, uncertainty, complexity, and ambiguity) which the students need to be equipped to deal with. This somewhat new circumstance implies, to quote Einstein, that “we cannot solve our problems with the same thinking we used when we created them”. Hence, we need to think and act in new ways and to do so, CBL is a working method.

We define CBL as an experiential learning approach that starts out with wicked, open and sustainability related real-life challenges (supplied by external stakeholders) that students, in multidisciplinary teams, take on their own way and develop into innovative and creative solutions which are presented in open forum (Eldebo et al 2022). CBL is an inductive method (Prince & Felder, 2006) that starts with observations to be interpreted, questions to be answered and problems to be solved. It is also a student-centered method, as the knowledge is created by the students instead of transferred from the teacher. CBL also includes active and collaborative learning.

As the InGenious module is part of ECIU we have applied the ECIU-way of CBL which implies that the work is done in three main phases; the engage phase, the investigate phase and the act phase. In the



engage phase the students get the challenge from the challenge provider and then make their own take of the challenge. ECIU describes this as going from a “big idea” which is, by the group of students, narrowed down into a specific challenge. Another way of describing this is, that the take of the challenge is made from the prerequisites of the group and its members' view or understanding of the essential problem and in what way the group wants to solve this problem. In the investigate-phase it is about digging up as much information about the challenge, its context, its stakeholders and its construction as possible. In particular, the feedback from stakeholders is important. From this analysis the group can continue into the act phase in which the solution is created, described, packaged, and publicly presented. The ECIU way of CBL is hence to be described as an open innovation process.

As mentioned above, CBL helps the students acquire skills to deal with the VUCA-world¹⁰. Such skills are in popular named as 21-century skills and includes e.g. critical thinking, communication skills, creativity, problem solving, perseverance, collaboration, information literacy, technology skills and digital literacy. Basically, all of these skills can be trained within the InGenious module.

The module could also be said to use a blended learning approach by means that it is set up in a way that mixes lectures, workshops, groupwork, individual work and least but not last reflection. The latter is essential as it is the reflection that makes the students aware of what knowledge and skills that are acquired and how this could be utilized in the future.

Below a couple of students are quoted (quotes are taken from their final individual reflections) to illustrate what have been described above:

- “I really enjoyed this way of learning and the freedom that we got. We by ourselves in a way decided how the module was going to be and what to make out of it. The other aspect that I liked was the way or learning both with and from people from other disciplinaries and backgrounds.”
- “In conclusion participating in the module was an unique experience, like in many other project modules you were free to teach yourself and study what you thought was necessary but the fact that you worked on a project outside of your comfort zone, together with people with different skills added another level.”

As mentioned above sustainability is an important aspect of the course. The students are required to relate their solutions to a selection of the UN goals for sustainable development (SDGs). Besides this they also work with what is referred to as “responsible innovation”. In this work they, by use of a couple of scientific frameworks, regard the ethical aspects of their idea development.

The teacher role in CBL is by ECIU named as “teamcher”. During the S4S-project we have been digging deeper into this question since the literature on CBL is rather scarce when it comes to teaching CBL modules. In this work (Eldebo et al, 2022) we have developed a model that defines the term “teamcher” and describes what roles are required in a CBL organizing team (see figure in chapter 3).

According to our findings, there are three main roles: Firstly, the teacher-role which is oriented toward the facilitation of the development of knowledge. Secondly, the role of the coach, which is more oriented toward facilitating the development of skills. Thirdly, the role of the organizer, which is oriented toward the challenges and the work with finding challenge providers and formulating challenges that could play the role of open big ideas that the students can make their own take on.



Module Syllabus and Construction

The module has a blended learning approach which is in detail described above. Here follows a chronological order of the module syllabus and student activities:

<i>Lectures</i>	<i>Corresponding workshops / group work activities</i>	<i>Student activities (gates to pass through)</i>
Introduction "Kick Off"		First meeting with project members and challenge providers
Video lecture on Group dynamics	Group work on creation of group contract	Assignment: Group contract
Video lecture NABC	Workshop Shitty Prototyping	The teams build a fast prototype of their idea in 90 minutes. Both a team-related workshop as well as making the idea more concrete.
Video lecture on project management "Project pancake"	<i>Facilitation and review of the NABC model.</i>	Assignment: Project plan
The Art of pitching lecture	Lecture and workshop on one occasion	Students are interactive during the lecture/seminar
	1-minute pitch (no slide)	Students get input from others who are pitching and give feedback to module mates. Pitch training with each student.
	Pitch training (3 minutes) Value Creation Forum (VCF)	All teams gather in a VCF to give each other feedback and ideas. Also, great to create cross-collaboration between groups.
Video lecture on Responsible Innovation (RI)	Responsible innovation seminar after the lecture. Presentations, discussion, and opportunity to develop or rewrite their analysis	Assignment: An analysis of responsible innovation chapter (before the seminar) Workshop material on RI and UN SDGs
	3-minutes-pitch Groupwork to prepare pitch	With students and their challenge provider. External parties such as incubators and Science Parks are invited to give feedback.
Video lecture on Group dynamics (revisited)	Groupwork to revise group contract	Assignment: Group dynamic reflection.
	Pitch training (5 minutes)	
	Graduation Event (5-minutes pitch)	Student pitches their solution for a bigger audience consisting of challenge providers, stakeholders, incubators, Science Parks and other invited persons from the innovation support system ESBR - East Sweden Business Region. A jury appoints the "Best pitch" (includes content and way of presenting the solution).
	Group work with project	Assignment of a project report
	Individual work throughout the module. Students are encouraged to create a diary.	Assignment: Individual reflection



5.8 FACT SHEET AND PLAYBOOK OF NEW MODULE “DIGITAL TRANSFORMATION: STRATEGIES AND SUSTAINABILITY”

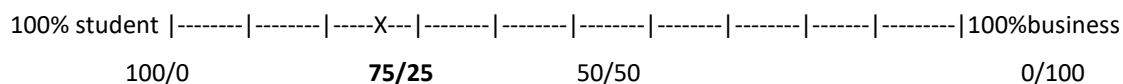
5.8.1 Fact sheet for Digital Transformation: Strategies and Sustainability

Title of module:	Digital Transformation: Strategies and Sustainability
Initiating university:	University of Oldenburg
Start year:	2019/20
End year / ongoing:	ongoing
No. of modules held:	2
Duration (weeks):	1 semester (24 weeks)
ECTS:	6
Module objective(s):	<p>Students are familiarized with the basics and application areas of digitalization as well as the economic, social, and ecological implications. In collaboration with a business partner, students develop digital business ideas and models under the guidance of experienced coaches, taking into account economic, ecological and social/ethical criteria.</p> <p>Students should:</p> <ul style="list-style-type: none"> ▪ know basic definitions, trends, and application areas of digitalization ▪ be able to assess the economic effects of digitalization ▪ understand corporate strategies and business models in the context of digital transformation ▪ know how companies should design processes and structures to promote digitalization in organizations ▪ have an overview of social, legal and ethical aspects of digitalization ▪ assess the environmental impact of digitalization ▪ evaluate digital products, services and business models using ethical and sustainable guidelines ▪ independently develop proposals for the integration of ethical, social, and ecological criteria in digitalization projects and processes
Phases and activities (in keywords only):	<p>Lectures and company case studies:</p> <ul style="list-style-type: none"> ▪ Lectures to discuss key concepts and frameworks related to digital transformation ▪ Company case studies to raise and discuss important issues in the context of digital transformation <p>Practical projects:</p> <ul style="list-style-type: none"> ▪ Development of digital solutions/prototypes for selected problems in collaboration with a business partner ▪ Writing a term paper that summarizes the process of the practical projects and draws general implications for the consideration of social and ecological criteria in the context of digitalization
No. of business projects so far:	10



No. of business partners so far:	2
No. of students so far:	98

Balance involvement between Business / Student



Student involvement per module

(Characteristics of students typically included in the module)

No. of students:	max. 60		
Level of students:	Bachelor level <input type="checkbox"/>	Master level <input checked="" type="checkbox"/>	PhD level <input type="checkbox"/>
Background students:	Technical <input type="checkbox"/>	Managerial <input checked="" type="checkbox"/>	Environmental <input type="checkbox"/>
	Sustainability Economics Management <input checked="" type="checkbox"/>		
No. of universities/ professorships involved:	1		
Number of Faculties involved:	1		

Business involvement per module

(Characteristics of business partners typically included in the module)

No. of companies/ venture teams/ start-up teams:	2	
Age of business partners:	Pre-seed (1-3 months):	<input type="checkbox"/>
	Seed (4-12 months):	<input type="checkbox"/>
	Start-up (1 year):	<input type="checkbox"/>
	1 st Stage (1-3 years):	<input checked="" type="checkbox"/>
	2 nd Stage (4-6 years):	<input type="checkbox"/>
	3 rd Stage or later (>6 years):	<input checked="" type="checkbox"/>
Size of companies FTE (no. of companies):	Single entrepreneur:	
	Venture team (<5 employees):	1
	Micro enterprise (5-10 employees):	
	Small (10-25 employees):	
	Medium (25-250 employees):	
	Large (>250 employees):	1



Size of companies' sales (no. of companies):	None Small (<1mIn €): Medium (1-10€): Large (>10€):	1 1
Typical Branches (no. of companies):	Industry Services Government Not for profit	<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Sustainability items covered

People issues (social):	Yes/ no (covered as a side aspect)
Planet issues (sustainable):	Yes
Profit issues (business):	Yes
keywords of sustainable subjects covered (max 10):	Ecological aspects of digitalization, renewable energies, energy efficiency, circular economy, sustainable mobility, renewable materials, green IT, sustainable infrastructure, emission reduction and control

Personal assessment (qualitative)

Which activities and methods have been effective: <ul style="list-style-type: none"> Design thinking process with EWE design thinking coaches digital tools like "miro"(whiteboard for visual collaboration) and "adobe XD" (UI/UX design solution for website and mobile app creation) guidelines and criteria for pitches and term papers online collaboration with business partners and students 	Which improvements could be made: <ul style="list-style-type: none"> In times of the corona-pandemic the digital implementation of the module was very successful. In the long term, offline events should also be integrated into the module. The personnel capacities are very high for the business partner. It should be checked whether the maximum number of participants could be reduced, or the team size could be changed. The difference between the project presentation and the scientific term paper could be clarified for the students in the future.
Main outcomes of the module:	<ul style="list-style-type: none"> Students gain experience in a design thinking process in collaboration with a business partner. Students learn how digital business ideas are developed Students learn how sustainability criteria can be integrated into an ideation and business modelling process. Students and companies get to know each other Business partner gets a new perspective on its innovation process



5.9 PLAYBOOK AND FACT SHEET OF CLIMATE CHALLENGE AS PART OF THE MODULE “INNOVATION MANAGEMENT”

5.9.1 Playbook for Climate Challenge Seminar

Online format: Clime Challenge Seminar

Time	Activities	Responsibilities	Materials
Preparation			
Prior to the module	Company’s Climate Challenges are identified: initial situation/problem, status of implementation, concrete tasks and expectation.	Lecturers and company	Draft version of slides or factsheet
Prior to the module	Introductory slides for the seminar presentation during the kick-off event of the innovation management module: <ul style="list-style-type: none"> ▪ Basic idea of climate neutralization ▪ Presentation of the topics and challenges ▪ Presentation of the seminar schedule 	Lecturers	Slides
Last lecture: Introduction to the climate challenge seminar			
Approx. 20 minutes	Presentation of the basic idea of corporate climate neutrality	Lecturers	Slides
Approx. 20 minutes	<ul style="list-style-type: none"> ▪ Presentation of the climate challenges: one or two slides per challenge: initial situation/problem, status of implementation, concrete task and expectation, Fact sheets will be sent to the students after the lecture ▪ Introduction to the team building process and the selection of climate challenges ▪ Introduction to the climate challenge seminar 	Lecturers	Slides
Kick-off: climate challenge seminar			
Prior to the seminar	<ul style="list-style-type: none"> ▪ Information on the company’s climate challenges is elaborated. Either as a factsheet or on PowerPoint slides. ▪ Company mentors for the climate challenges are determined ▪ Contact details and form of contact have been defined: The student teams arrange individual interview appointments with the company mentors during the seminar. ▪ Slides for the kick-off of the seminar are prepared. ▪ Form and scope of the company’s participation during the seminar is clarified. ▪ Use of video conference software has been clarified with the company and the students. 	Lecturers and company	Final version of factsheet or slides for the climate challenge Slides



Approx. 45 minutes	<ul style="list-style-type: none"> Welcome Form of examination - quality and evaluation criteria for the presentation and the Climate-Challenge-Solution-Paper Presentation/assignment of teams, topics Schedule of individual coaching appointments with the student teams 	Lecturer	Slides
Approx. 15minutes	Break		
Approx. 60 minutes	<p>Break-Out-Session: One Break-Out-Room for each student team</p> <p>Topic for each student team</p> <ul style="list-style-type: none"> Round of introductions Exchange on the specific climate challenge Development of a common understanding Development of questions for the business partner and derivation of next steps Determination of the project management form <p>Lecturers and company staff visit the Break-Out-rooms to answer questions</p>	Lecturers and company	
Approx. 30 minutes	<ul style="list-style-type: none"> Time for questions "Homework" for the next week. Students get familiar with the topic 	Company and lecturers	
Second climate challenge seminar			
Approx. 45 minutes	<ul style="list-style-type: none"> What is important for good teamwork and project management? Which topics should be discussed in principle with the company mentors? For example, in the context of an expert interview. What is the purpose of the coaching appointments for? When do the appointments take place? How to use online collaboration tools like Miro 	Lecturers	Slides
Approx. 15minutes	Break		
Approx. 60 minutes	<ul style="list-style-type: none"> Student teams start with the guideline-based project management in break-out-rooms Support of lecturers if needed 	Lecturers	
Approx. 45 minutes	<ul style="list-style-type: none"> Student teams present their current progress. Feedback by lecturers and students 	Students and lecturers	
Student teams work on the challenges and arrange coaching appointments with the lecturers			
30 minutes per team	<ul style="list-style-type: none"> Students provide lecturers with individual questions prior to the coaching appointment 	Student teams and lecturers	



	<ul style="list-style-type: none"> Give hints for the final presentation: Who is presenting? Conduct final rehearsal, keep to time frame, elaborate central message 		
Presentation of the climate challenge solutions			
Prior the presentations	<ul style="list-style-type: none"> Clarification of the participation of company mentors and senior management Company mentors should participate in the respective presentation of their student team. Clarification of scheduling conflicts Clarification company presentation Student teams send the slides to the lecturers in advance 	Lecturers and company staff	Slides
Approx. 15 minutes	<ul style="list-style-type: none"> Welcome of company and students by lecturers Outlook on the event Short introduction by lecturers 	Lecturers	Slides
Approx. 15 minutes	<ul style="list-style-type: none"> Welcome by company management Framing the importance of becoming climate neutral, relevance of the students' work. 	Company	
Approx. 30 minutes per challenge In case of an online format, spread the presentation over two days	<ul style="list-style-type: none"> 15 minutes presentation + 15 minutes discussion Challenge 1 Strengthening climate awareness among company employees (company site) Challenge 2 Strengthening climate awareness among company employees (mobility) Challenge 3 Innovative logistics solutions for the company Challenge 4 Promotion of sustainability innovations by the company Challenge 5 Regional company's climate compensation project Challenge 6 Digitalization processes at company's customer service Challenge 7 Intelligent energy management for a new PV system of the company 	Students and lecturers and company staff	Slides
Approx. 15 minutes	Closing remarks and next steps	Lecturers and company	
	Submission of the Climate-challenge-solution-paper	Student teams	



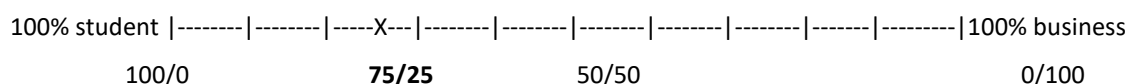
5.9.2 Fact sheet for Climate Challenge Seminar

Title of module:	Climate Challenge as part of the module "Innovation Management"
Initiating university:	University of Oldenburg
Start year:	2020/21
End year / ongoing:	ongoing
No. of modules held:	1
Duration (weeks):	1 semester (24 weeks)
ECTS:	6
Module objective(s):	<p>The innovation management module is designed as an introduction to innovation management and provides a basic understanding of the possibilities and limitations of managing innovation processes.</p> <p>Students should:</p> <ul style="list-style-type: none"> ▪ be able to define the terms "innovation" and "innovation management", ▪ be able to name different types of innovations and be familiar with criteria for the level of innovativeness, ▪ be able to explain the factors affecting innovation management, ▪ understand the importance of an "innovation system" for successful innovation management, ▪ know types of conflicts in the context of innovation management, ▪ be able to identify possible triggers for innovation projects, ▪ know push and pull factors of innovation processes, ▪ be able to describe what is meant by "path dependencies", ▪ be able to explain what is meant by "open innovation", ▪ know the characteristics of an innovation-friendly organization ▪ be able to distinguish between different forms of collaboration in the field of innovation ▪ be able to explain what is meant by an innovation community, ▪ be able to explain the special features of managing innovation processes, ▪ be able to distinguish between the phases of the innovation process and explain the main objectives, ▪ be able to develop proposals for idea generation ▪ know methods for evaluating and selecting innovation ideas, and ▪ know the specifics of innovation marketing.
Phases and activities (in keywords only):	<p>Lectures</p> <ul style="list-style-type: none"> ▪ Lectures to discuss key concepts and frameworks related to innovation management ▪ Introduction: Climate neutrality of companies <p>Climate Challenge Seminar</p>



	<ul style="list-style-type: none"> Challenges identified in the "Green Business Idea Jam" (See section 2.3.1) are integrated into the seminar. The ideation process is followed up by different student teams. Student teams develop innovation ideas for BÜFA's climate-neutrality strategy Writing a term paper (Climate-Challenge-Solution-Paper) that summarizes the process of the practical projects and derives general conclusions for the implementation by BÜFA
No. of business projects so far:	7
No. of business partners so far:	1 (number of business personnel involved 10)
No. of students so far:	35

Balance involvement between Business / Student



Student involvement per module

(Characteristics of students typically included in the module)

No. of students:	max. 35		
Level of students:	Bachelor level <input type="checkbox"/>	Master level <input checked="" type="checkbox"/>	PhD level <input type="checkbox"/>
Background students:	Technical <input type="checkbox"/>	Managerial <input checked="" type="checkbox"/>	Environmental <input type="checkbox"/>
	Sustainability Economics Management <input checked="" type="checkbox"/>		
No. of universities/ professorships involved:	1		
Number of Faculties involved:	1		



Business involvement per module

(Characteristics of business partners typically included in the module)

No. of companies/ venture teams/ start-up teams:	1			
Age of business partners:	Pre-seed (1-3 months):	<input type="checkbox"/>		
	Seed (4-12 months):	<input type="checkbox"/>		
	Start-up (1 year):	<input type="checkbox"/>		
	1 st Stage (1-3 years):	<input type="checkbox"/>		
	2 nd Stage (4-6 years):	<input type="checkbox"/>		
	3 rd Stage or later (>6 years):	<input checked="" type="checkbox"/>		
Size of companies FTE (no. of companies):	Single entrepreneur:			
	Venture team (<5 employees):			
	Micro enterprise (5-10 employees):			
	Small (10-25 employees):			
	Medium (25-250 employees):			
	Large (>250 employees):	1		
Size of companies sales (no. of companies):	None			
	Small (<1mln €):			
	Medium (1-10€):			
	Large (>10€):	1		
Typical Branches (no. of companies):	Industry	Services	Government	Not for profit
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sustainability items covered

People issues (social):	Yes/no (Covered as a side aspect)
Planet issues (sustainable):	Yes
Profit issues (business):	Yes
keywords of sustainable subjects covered (max 10):	Carbon neutrality, renewable energies, energy efficiency, sustainable innovation eco system, sustainable mobility, renewable materials, green IT, compensation, emission reduction and control



5.10 PLATBOOK PF GREEN BUSINESS IDEA JAM

Green Business Idea Jam: Online kick-off

Time	Activities	Responsibilities	Materials
Preparation			
Prior to the event	<ul style="list-style-type: none"> ▪ If necessary, recruitment of students ▪ If necessary, screening of applications and selection of students ▪ Clarification online presentation by company team: content and scope ▪ Clarification and preparation: video conferencing software ▪ Preparation of company slide deck ▪ Preparation of introductory slides to present the objectives and the process of the Green Business Idea Jam 	<ul style="list-style-type: none"> ▪ Lecturers ▪ Lecturers and company ▪ Lecturers ▪ Company ▪ Lecturers 	<ul style="list-style-type: none"> ▪ Green business idea Jam advertising ▪ If necessary, selection criteria ▪ Slides ▪ Preparation of virtual meeting room
8-4 days prior to the event	<ul style="list-style-type: none"> ▪ Sending invitations to students incl. information on use of video conferencing software, 	<ul style="list-style-type: none"> ▪ Lecturers 	<ul style="list-style-type: none"> ▪ Mail
8 – 4 days prior to the event	<ul style="list-style-type: none"> ▪ Finalizing the challenge topics for the Green Business Idea Jam with the company 	<ul style="list-style-type: none"> ▪ Lecturers and company 	<ul style="list-style-type: none"> ▪ Slides
One day before the event	<ul style="list-style-type: none"> ▪ Testing video conferencing software with company ▪ Already uploading slides if necessary 	<ul style="list-style-type: none"> ▪ Lecturers and company 	<ul style="list-style-type: none"> ▪ Video conferencing platform
Online kick-off			
10 minutes before the kick-off	<ul style="list-style-type: none"> ▪ Participants dial into the online event ▪ Cameras activated ▪ Microphone switched off 	<ul style="list-style-type: none"> ▪ Lecturers 	<ul style="list-style-type: none"> ▪ Video conferencing platform
15 minutes	<ul style="list-style-type: none"> ▪ Welcoming the participants ▪ Introduction of the corporate team and the team of lecturers ▪ Presentation of the context of the Green Business Idea Jam incl. associated objectives for company and students 	<ul style="list-style-type: none"> ▪ Lecturers 	<ul style="list-style-type: none"> ▪ Slides
15 minutes	<ul style="list-style-type: none"> ▪ Introduction of the company and its past activities to achieve carbon neutrality and their expectations for the Green Business Idea Jam. Presentation of key topics on climate neutrality. 	<ul style="list-style-type: none"> ▪ Company ▪ Students ▪ Lecturers 	<ul style="list-style-type: none"> ▪ Slides



	<ul style="list-style-type: none">▪ Students can ask questions in the chat or just turn on the mic and start talking		
15 minutes	<ul style="list-style-type: none">▪ Presentation of the Green Business Idea Jam schedule, clarification of expectations▪ Students can ask questions in the chat or just turn on the mic and start talking	<ul style="list-style-type: none">▪ Lecturers	<ul style="list-style-type: none">▪ Slides with “agenda”
5 minutes	<ul style="list-style-type: none">▪ Clarification of formalities, access to venue/registration process, how to get there, hygiene rules, image rights, confidentiality, “bring your own device” for the use of “Miro” during the Green Business Idea Jam▪ Questions?	<ul style="list-style-type: none">▪ Lecturers	<ul style="list-style-type: none">▪ Slides with formalities▪ If necessary, template for image rights
10 minutes	<ul style="list-style-type: none">▪ Open questions?▪ Motivational closing	<ul style="list-style-type: none">▪ Lecturers and company	<ul style="list-style-type: none">▪ Sending Miro link, template for image rights and factsheets to the students



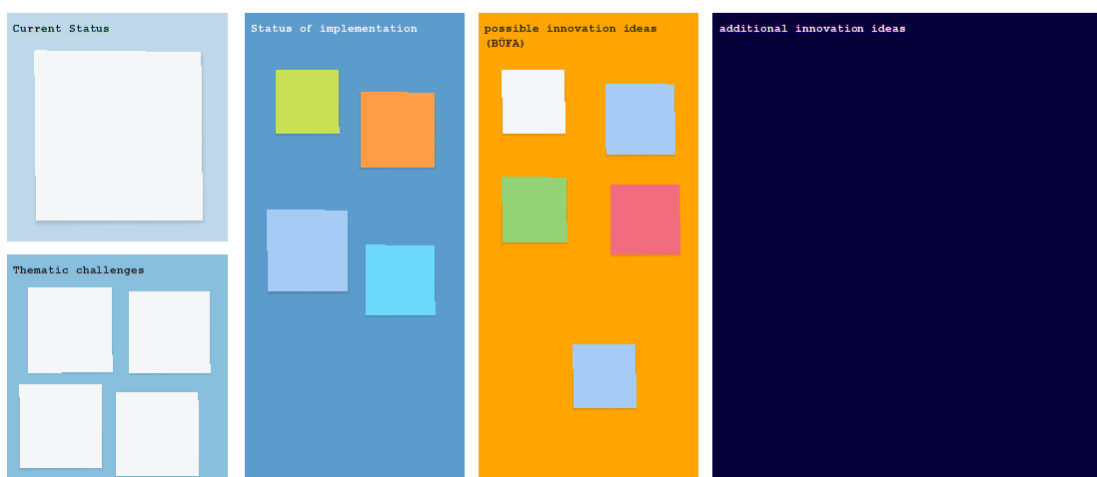
Green Business Idea Jam: Face-to-face event

Time	Activities	Responsibilities	Materials
Preparation			
Prior to the event	<ul style="list-style-type: none"> ▪ Clarification of the use of tools: analogue with cards and brown paper or digital with Miro? ▪ Clarification: venue preparation: seating for the teams, equipment for the presentation, internet access for students, beamer, catering? 	<ul style="list-style-type: none"> ▪ All 	<ul style="list-style-type: none"> ▪ Prepared "Miro-templates" or workshop materials (pens, cards, brown paper, movable walls)
Prior to the event	<ul style="list-style-type: none"> ▪ Preparation of factsheets on company's key challenges ▪ Identification of company coaches for the challenges ▪ Coordination of factsheets' structure with university ▪ Identification of moderators for the topic tables ▪ Briefing of moderators for topic tables either in Miro or for "classic" documentation of discussion ▪ Preparation of workshop slides (agenda, ideation process etc.) 	<ul style="list-style-type: none"> ▪ Company ▪ Lecturers 	<ul style="list-style-type: none"> ▪ Factsheets ▪ Slides ▪ Miro account or workshop materials ▪ Preparation of name badges
1-2 days prior to the event	<ul style="list-style-type: none"> ▪ Final coordination: Venue preparation - allocation of tables for the group work, materials, catering, etc. 	<ul style="list-style-type: none"> ▪ Lecturers and company 	
Green Business Idea Jam			
approx. 30 minutes before the start of the Workshop	<ul style="list-style-type: none"> ▪ Arrival lecturers and company staff ▪ Arrival of the participants, if necessary, taking seats under observance of the hygiene rules ▪ Filling in the list of participants 		<ul style="list-style-type: none"> ▪ List of participants
Start of the workshop 15 minutes	<ul style="list-style-type: none"> ▪ Welcome by the company and university team ▪ Presentation of the objectives and the process of the Green Business Idea Jam by lecturer 	<ul style="list-style-type: none"> ▪ Company and lecturers 	<ul style="list-style-type: none"> ▪ Slides, beamer, notebook
15 minutes	<ul style="list-style-type: none"> ▪ Short introduction of participants: Background (module of study, semester, relation to the company), motivation to participate, expectations of the workshop 	<ul style="list-style-type: none"> ▪ All 	<ul style="list-style-type: none"> ▪ Each person introduces him/herself (e.g. in 30 sec.)
15 minutes	<ul style="list-style-type: none"> ▪ Company coaches briefly present key topics for each challenge (based on the factsheets) 	<ul style="list-style-type: none"> ▪ company coaches 	<ul style="list-style-type: none"> ▪ Without slides?



15 minutes	<ul style="list-style-type: none"> Group assignment Introduction to the procedure of the first working group phase 	<ul style="list-style-type: none"> Lecturers 	<ul style="list-style-type: none"> E.g. 3 x group of 5 (1- 2 persons from company, 3 - 4 students)
90 minutes	<ul style="list-style-type: none"> Working group phase: Brainstorming Host ensures that all team members have access to Miro interface Host asks company coaches to present status of planning and introduces the company's first ideas Clarification of company's proposed ideas, if necessary joint specification in the team Host adapts ideas and transfers new ones into Miro Brainstorming of additional ideas, first noting them down individually Thereafter verbal presentation of 1 idea per person etc., host transfers ideas to Miro Hosts ensure clear understanding of proposed ideas within each group Host ensures presentation of ideas by student or company staff in plenary. Host asks participants to locally save Miro frame with initial situation and ideas as a PDF 	<ul style="list-style-type: none"> All 	<ul style="list-style-type: none"> Miro

Topic



30 minutes	<p>Flashlight</p> <ul style="list-style-type: none"> Lecturers explain "flashlight" Flashlight from each group: One person per group presents new ideas using Miro (transfer to projection screen so that everyone can see ideas) 	<ul style="list-style-type: none"> One person per group 	<ul style="list-style-type: none"> 10 min. per team Miro and Beamer
------------	---	--	---



	<ul style="list-style-type: none"> Advice and comments by lecturers and company competence team 		
60 minutes	Lunch break	<ul style="list-style-type: none"> All 	<ul style="list-style-type: none"> Lunch
90 minutes	<p>Working group phase: clustering ideas</p> <ul style="list-style-type: none"> Host explains work phase Existing and new ideas are clustered where useful and possible Joint evaluation of ideas in two steps: Step 1 type of contribution to climate neutrality, step 2 amount of contribution Individual voting: Each person scores the ideas regarding their GHG savings potential and climate neutrality using 5 points which can be cumulated in Miro Host must start and end voting in Miro (Voting Area, setting number of points per person) <p>Climate potential</p> <p>Working group phase Innovation radar</p> <ul style="list-style-type: none"> The 2 or 3 ideas with the greatest climate potential are evaluated with a radar (6 criteria) Host explains evaluation criteria and clarifies questions of understanding Group discussion: For each assessment dimension convincing arguments are noted in the Miro template, assessment is made by using the points in Miro The result: 2 to 3 innovation radars Hosts pay attention to implementation Clarifying presentation of innovation radars in the plenum 	<ul style="list-style-type: none"> All 	

	<p>Innovation Radar</p> <p> <ul style="list-style-type: none"> • (5) very high • (4) high • (3) medium • (2) low • (1) not clear </p>		
30 minutes	<ul style="list-style-type: none"> ▪ Break 	<ul style="list-style-type: none"> ▪ All 	<ul style="list-style-type: none"> ▪ Preparation of presentation in Miro
60 minutes	<ul style="list-style-type: none"> ▪ Presentation of the three core ideas per team in plenary with Miro + time for questions ▪ University team moderates presentation and discussion 	<ul style="list-style-type: none"> ▪ One person per team 	<ul style="list-style-type: none"> ▪ Miro
30 minutes	<ul style="list-style-type: none"> ▪ Evaluation of the ideas by company team (e.g., 30 min. internal discussion): 1. Which of the ideas developed would the company like to pursue further? 2. Which ones have special priority? ▪ Evaluation of ideas by students (e.g., online survey): Which of the proposed ideas has the greatest impact on the realization of the company's climate neutrality! 	<ul style="list-style-type: none"> ▪ All 	<ul style="list-style-type: none"> ▪ Query student evaluation e. g. with menti,
30 minutes	<ul style="list-style-type: none"> ▪ Presentation of the company's choice ▪ Presentation of the menti survey result of the students by lecturers ▪ Outlook and next steps, 	<ul style="list-style-type: none"> ▪ Lecturers and company 	
	<ul style="list-style-type: none"> ▪ End of event 	<ul style="list-style-type: none"> ▪ All 	



Borderstep Institute for
Innovation and Sustainability