



SUPPORTING MATERIAL FOR THE TEACHING FORMAT "INNOVATION AND TECHNOLOGY FOR SUSTAINABLE FUTURE"

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Module Description

Field of Education: Engineering (Industrial Engineering and Management)

Level of studies: Master

Innovation and Technology for Sustainable future

Type	Frequency	Semester
Standalone	Every academic year	Spring semester
Length	Examination Format(s) (+ weighting of grades if multiple)	Group Size
7 weeks	30% individual assignments and seminar participation, 70% group project and movie presentation	Approx. 20 ppl
ECTS-Credits	Hours per week	Workload (presence hours and self-study hours)
3 cr	4 hours per week	Presence: 26 h Self-study: 52 h Total: 78 h
Language	Responsible of Module	Lecturer(s)
English	Professor	1) Lecturer (competences: technology, sustainability, innovation management, systems and design competency) 2) Acting/drama coach (competences: theater-based teaching) 3) Industry expert (competences: real-life business expertise)

Requirements	Preliminary knowledge on sustainability and innovation management is recommended
Learning Objectives <ul style="list-style-type: none"> • Cognitive* • Socio-emotional (including social skills as well as self-reflection skills, values, attitudes & motivation)* • Behavioral (action competencies)* 	Cognitive (<i>"comprises knowledge and thinking skills"</i> *; <i>problem and solution based knowledge</i>) <ul style="list-style-type: none"> • Explain key environmental, social and economic challenges that are occurring in the world • Identify challenges and potential of science and engineering-driven solutions for sustainability problems • Analyse the systemic nature of (sustainable) innovation development and implementation in society • Evaluate different pathways towards a mission-oriented future • Co-create clear and inspiring fact-based development visions for the future
	Socio-emotional (<i>"includes social skills that enable learners to collaborate, negotiate and communicate as well as self-reflection skills, values, attitudes and motivations that enable learners to develop themselves"</i>) <ul style="list-style-type: none"> • Create collaborative understanding and action through reflecting, respecting and learning from one's own perspectives and the perspectives of others • Build uncertainty tolerance by turning the unknown into different versions of the future
	Behavioral (<i>"describes action competencies"</i> *) <ul style="list-style-type: none"> • Create visions of a more sustainable future and communicate them to others • Students learn to build evidence and take part in the sustainability discourse through scientific argumentation, class discussions and debates, written reports, and presentations.

<p>Content (Which are the main topics covered in the course?)</p>	<p>The course is focused on understanding the complexities of sustainable technological development and implementation in business and society. Main contents include:</p> <ul style="list-style-type: none"> • Disruptive technologies • Grand challenges and Sustainable Development Goals (SDGs) • Design, management, impact assessment, implementation and envisioned development trajectories of innovations in the context of sustainability
<p>Which SDGs does the course address?</p>	<p><i>Note! Emphasis on specific SDGs depends on the course project topic of each student group.</i></p> <ul style="list-style-type: none"> • SDG 1 No Poverty End poverty in all its forms everywhere • SDG 2 Zero Hunger End hunger, achieve food security and improved nutrition and promote sustainable agriculture. • SDG 3 Good Health and Well-being Ensure healthy lives and promote well-being for all at all ages • SDG 4 Quality Education Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all • SDG 5 Gender Equality Achieve gender equality and empower all women and girls • SDG 6 Clean Water and Sanitation Ensure availability and sustainable management of water and sanitation for all • SDG 7 Affordable and Clean Energy Ensure access to affordable, reliable, sustainable and clean energy for all • SDG 8 Decent Work and Economic Growth Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all • SDG 9 Industry, Innovation and Infrastructure Build infrastructure, promote inclusive and sustainable industrialization and foster innovation • SDG 10 Reduced Inequalities Reduce inequality within and among countries • SDG 11 Sustainable Cities and Communities Make cities and human settlements inclusive, safe, resilient and sustainable • SDG 12 Responsible Consumption and Production Ensure sustainable consumption and production patterns • SDG 13 Climate Action Take urgent action to combat climate change and its impacts • SDG 14 Life below Water Conserve and sustainably use the oceans, seas and marine resources for sustainable development • SDG 15 Life on Land Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss • SDG 16 Peace, Justice and Strong Institutions Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels • SDG 17 Partnerships for the Goals Strengthen the implementation and revitalize the global partnership for sustainable development
<p>Brief Course Structure/Outline</p>	<p>Week 1</p> <ul style="list-style-type: none"> • Session 1 (2 h): <ul style="list-style-type: none"> ○ Introduction to the course and methods used. ○ Introduction to short film making. • Session 2 (2 h) Introduction to key concepts: SDGs, disruptive technologies and futures thinking. • Homework: <ul style="list-style-type: none"> ○ Getting acquainted with the course contents and schedule. ○ Reading through the requirements for the main course project. ○ Making groups for the main course project. ○ Self-reflection journal post (+15min) <p>Week 2</p> <ul style="list-style-type: none"> • Session 3 (2 h) <ul style="list-style-type: none"> ○ Workshop: short film making (project development). ○ Sustainable innovation and design: Responsible innovation and design thinking



	<ul style="list-style-type: none"> • Session 4 (2 h) Seminar: Stakeholder roleplay. • Homework: <ul style="list-style-type: none"> ○ Choosing a topic and researching background information (specific SDG, technology, and context). ○ Self-reflection journal post (+15min) <p>Week 3</p> <ul style="list-style-type: none"> • Session 5 (2 h): <ul style="list-style-type: none"> ○ Workshop: short film making (pre-production). ○ Sustainability impact awareness, assessment and tools – examples from the ICT industry. • Session 6 (2 h): Seminar: Real-life company case of a sustainability problem and the means to solve it • Homework: <ul style="list-style-type: none"> ○ Working on the main course project: written report (part 1) and short film (project development). ○ Self-reflection journal post (+15min) <p>Week 4</p> <ul style="list-style-type: none"> • Session 7 (2 h) <ul style="list-style-type: none"> ○ Workshop: short film making (production) ○ Sustainable systems and transitions: Sustainability transitions and Socio-technical systems and the multi-level perspective ○ Visioning pathways with foresight and backcasting methods • Homework: <ul style="list-style-type: none"> ○ Working on the main course project: written report (part 2) and short film (pre-production) ○ Self-reflection journal post (+15min) <p>Week 5</p> <ul style="list-style-type: none"> • Session 9 (2 h) <ul style="list-style-type: none"> ○ Workshop: short film making (post-production) ○ Ethics of technological innovation and sustainable development. • Session 10 (2 h) Individual assignment: collective story writing. Case example: artificial intelligence (AI) • Homework: <ul style="list-style-type: none"> ○ Working on the main course project: written report (part 3) and short film (production). ○ Self-reflection journal post (+15min) <p>Week 6</p> <ul style="list-style-type: none"> • Session 11 (2 h) Seminar: Futures thinking in practice – examples from the consulting industry. • Session 12 (2 h) No activities for this week. Students will work on the main course project. • Homework: <ul style="list-style-type: none"> ○ Working on the main course project: short film (post-production) ○ Self-reflection journal post (+15min) <p>Week 7</p> <ul style="list-style-type: none"> • Session 13 (4 h) Visions for the future: students will present their short films followed by a joint discussion in class about each topic and the overall role of technology and innovation in sustainable development. • Homework: <ul style="list-style-type: none"> ○ Peer evaluation of short films. ○ Group members evaluate each others' performance within the group throughout the main course project. ○ Self-reflection journal post (+30min)
<p>Pedagogical approaches (<i>"guiding principles of designing learning processes"</i>*) e.g.:</p> <ul style="list-style-type: none"> • Lecture-based learning • Experiential learning (experience via projects, internships, community work, field trips) • Collaborative learning 	<ul style="list-style-type: none"> • Active learning • Inter-/transdisciplinary learning • Collaborative learning



<ul style="list-style-type: none"> • Active learning (passive role of teacher) • Self-directed learning • Inter-/transdisciplinary learning • Creative learning • Other 	
<p>Teaching methods (<i>"specific methods in line with" teaching approaches*</i>) e.g.:</p> <ul style="list-style-type: none"> • Lecture • Group discussion • Debate • In-class role play • Virtual reality simulation • Case study • Service-learning project (for community) • Sustainability-related consulting project (e.g. for NGOs) • Sustainability-related research project • Self-reflection task/exercise • Interdisciplinary team teaching • Vision-building exercise (e.g. future workshop, scenario analysis, forecasting and backcasting) • Field trip • Outdoor, nature-related experience • Gamification (e.g. LEGO game) • Arts-based teaching and learning method (e.g. theatre, drawing exercise, music-based exercise) • Peer-teaching (e.g. student-led lecture) • Flipped classroom • Other 	<ul style="list-style-type: none"> • Lecture • Group discussion • In-class role play • Case study • Arts-based teaching and learning • Vision-building exercise • Self-reflection task/exercise • Interdisciplinary team teaching
<p>Teaching Characteristics (none, low, medium, high)</p>	
<ul style="list-style-type: none"> • Degree of student participation / activeness 	High
<ul style="list-style-type: none"> • Degree of student collaboration / group work 	High
<ul style="list-style-type: none"> • Degree of student emotional involvement 	Medium
<ul style="list-style-type: none"> • Degree of inter-/transdisciplinarity 	High
<ul style="list-style-type: none"> • Degree of student (self-) reflection 	High
<ul style="list-style-type: none"> • Degree of experience of real-life situations 	Medium
<ul style="list-style-type: none"> • Degree of nature-related experiences 	(None)
<ul style="list-style-type: none"> • Degree of stakeholder integration 	Medium
<ul style="list-style-type: none"> • Degree of integration between theory and practice 	Medium

How does the course foster the following (if applicable for each, otherwise put n/a):	
Systems Thinking Competency**	Sustainability is addressed throughout the course as a wicked problem embedded in complex systems and thus in need of systemic, as well as inter-/transdisciplinary approaches. Systemic interdependencies are specifically addressed on week 4 (sustainable systems and transitions). Students are expected to apply systems thinking in mapping and framing systems and major actors around their selected sustainable innovation in connection to a specific SDG in their main course project. The course combines knowledge from business, engineering, arts, design, sustainability sciences and social sciences to promote a holistic understanding of sustainability.
Anticipatory Competency**	Anticipatory competency is fostered in the course through futures approaches addressed on week 1 (futures thinking) and week 4 (forecasting and backcasting). Students are expected to apply anticipatory thinking in generating SDG guided scenarios for the future and innovation driven pathways to them in their main course project.
Normative Competency**	Sustainability is introduced throughout the course as a largely normative issue with attached goals on week 1 (SDGs), values on week 2 (sustainable innovation and design), and ethical standpoints on week 5 (ethics of technological innovation and sustainable development). Students are expected to reflect on these views in subsequent seminar activities (stakeholder roleplay) and individual assignments (collective story writing), as well as in their main course project in the form of an overview.
Strategic Competency**	n/a
Collaboration Competency**	Students apply collaborative competencies in respecting, reflecting and learning from the perspectives of others by working in a group to co-create a synthesizing vision of the future and communicate it to others in their main course project.
Critical Thinking Competency**	Critical thinking is fostered by addressing sustainability as a highly normative issue throughout the course, where sustainability problems and innovations as solutions are questioned and no definitive answers can be found. Students apply critical thinking in identifying major challenges and potential of innovation of their choosing in connection to a specific SDG in their main course project.
Self-Awareness Competency**	Students are expected to reflect on one's own constantly developing role as a change maker, individual, business expert, engineer, innovator, etc. in weekly self-reflection posts.
Integrated Problem Solving Competency**	Frameworks and tools to evaluate sustainable solutions are addressed throughout the course and case examples are utilized as a baseline for analysis and discussion in seminar assignments, and guest lecturers from industry are included to ensure the practical implementation and integrated understanding of the topics.
Literature & Resources	See below for course literature list.
<p>*UNESCO (2017). Education for Sustainable Development Goals. Learning Objectives. https://www.unesco.de/sites/default/files/2018-08/unesco_education_for_sustainable_development_goals.pdf</p> <p>** Rieckmann, M. (2018). Learning to transform the world: Key competencies in Education for Sustainable Development. Issues and Trends in Education for Sustainable Development, 39, 39–59.</p>	



Course Outline

Semester Outline		Session Focus	Homework to next Session
Week 1	Session 1 (2 h)	Introduction to the course and methods used. Introduction to short film making.	Getting acquainted with the course contents, schedule and teaching methods. Reading through the requirements for the main course project.
	Session 2 (2 h)	Introduction to key concepts: SDGs, disruptive technologies and futures thinking.	Making groups for the main course project.
	<i>Interim session (15min)</i>		<i>Self-reflection journal post</i>
Week 2	Session 3 (2 h)	Workshop: short film making (project development). Sustainable innovation and design: <ul style="list-style-type: none"> • Responsible innovation • Design thinking 	Choosing a topic and researching background information (specific SDG, technology, and context).
	Session 4 (2 h)	Seminar: Stakeholder roleplay.	
	<i>Interim session (15min)</i>		<i>Self-reflection journal post</i>
Week 3	Session 5 (2 h)	Workshop: short film making (pre-production). Sustainability impact awareness, assessment and tools – examples from the ICT industry.	Working on the main course project: written report (part 1) and short film (project development).
	Session 6 (2 h)	Seminar: Real-life company case of a sustainability problem and the means to solve it	
	<i>Interim session (15min)</i>		<i>Self-reflection journal post</i>
Week 4	Session 7 (2 h)	Workshop: short film making (production) Sustainable systems and transitions: <ul style="list-style-type: none"> • Sustainability transitions • Socio-technical systems and the multi-level perspective • Visioning pathways with foresight and backcasting methods 	Working on the main course project: written report (part 2) and short film (pre-production).
		<i>Interim session (15min)</i>	
Week 5	Session 9 (2 h)	Workshop: short film making (post-production)	Working on the main course project: written report (part 3) and short film (production).

		Ethics of technological innovation and sustainable development.	
	Session 10 (2 h)	Individual assignment: collective story writing*. <ul style="list-style-type: none">Case example: artificial intelligence (AI)	
	<i>Interim session (15min)</i>		<i>Self-reflection journal post</i>
Week 6	Session 11 (2 h)	Seminar: Futures thinking in practice – examples from the consulting industry.	Working on the main course project: short film (post-production).
	Session 12 (2 h)	No activities for this week. Students will work on the main course project.	
	Interim session (15min)		Self-reflection journal post
Week 7	Session 13 (4 h)	Visions for the future: students will present their short films followed by a joint discussion in class about each topic and the overall role of technology and innovation in sustainable development.	Peer evaluation of short films. Group members evaluate each others' performance within the group throughout the main course project.
	<i>Post session (30min)</i>		<i>Self-reflection journal post</i>

Description of Underlying Approaches, Methods and Applied Exercises¹

Underlying Teaching Approaches

Active learning
Active learning is used throughout the course to enable students to take charge of their own level of engagement and input in seminar assignments individual assignments, workshops, as well as in the organization of the main course assignment, while teachers act in the role of facilitators.
Lecture-based learning
Lecture-based learning is used to provide brief transfers of knowledge about main theories and concepts that will act as a baseline to further learning.
Collaborative learning
Collaborative learning is used to enable student interaction in small teams while working on common assignments in seminars and with the main course assignment.
Inter- and transdisciplinary learning

¹ Definitions for the mentioned teaching approaches and methods can be found here: Bustamante, S., Martinovic, M. & Shaman, K. (2022). Fundamental Insights about Teaching Formats in the Area of Sustainability and Responsibility. In S. Bustamante, E. Saltevo, M. Schmitz, & M. Martinovic, Shaping a Sustainable Future. Innovative Teaching Practices for Educating Responsible Leader (pp. 31-49). Nomos.



Inter- and transdisciplinary learning is used to gain a holistic view of the integrated issues of innovation and technology development in the context of sustainability by applying principles from multiple fields of study such as business, engineering, arts and design, sustainability sciences and social sciences and analysing their compounded effect throughout the course and especially with the main course assignment.

Applied Teaching Methods

Arts-based teaching and learning

Arts-based teaching and learning, and more specifically theater-based learning, is the dominant method used in this course. Theater-based method is used to develop wide and nuanced insights about the complexity of innovation and technology development in the context of sustainability through visioning, storytelling, roleplay and narrative development in course assignments, while also developing students` soft skills.

Theater-based learning is a method based on using theatrical performance in order to report conversation on chosen topics through some sort of dramatic art (e.g. comedic skit). According to Nissley (2002), theater-based teaching is used to explore future scenarios, develop insights, teach about “soft” topics (e.g. business ethics) and soft skills (communication, presentation, empathy, etc.).

Nissley, N. (2002). Arts-based learning in management education. Rethinking management education for the 21st century, 14(5), 27-61

Lecture

Lectures are used to provide brief transfers of knowledge about main theories and concepts that will act as a baseline to further learning in lectures.

Group discussions

Group discussions are used throughout the course to convey different perspectives, facilitate exchange of information and to solve problems collectively in seminar assignments and in the main course assignment.

In-class role play

In-class role play is used to enable the broadening of one’s perspective by assuming the role of another and used in seminar assignments and in the main course assignment.

Case studies

Case-studies are used to enable the examination of real-life sustainability problems, as well as situational analysis and solution building in seminar assignments.

Vision building exercises

Vision building is used to synthesize course main learnings and apply it to the creation of plausible future scenarios of sustainable innovation and technology development as the main course assignment.

Self-reflection tasks/exercises

Self-reflection is used to enable the processing of one’s own role in sustainability.

Interdisciplinary team teaching



Interdisciplinary team teaching is implemented by involving lecturers, teachers and experts in different disciplines: business, engineering, arts and design, sustainability sciences and social sciences.

Exercises used in the Course

Exercise:	Self-reflection journal post.
Used in which part / session of the course:	Weekly exercise
Main goal of the exercise:	To enable students to self-reflect on their changing perceptions and own role throughout the course as a change-maker for sustainability.
Best used with:	Individual assignment
<p>After each weekly session, students are tasked to write short individual self-reflection posts on the learning platform. In their posts, students are expected to answer to the following questions:</p> <ul style="list-style-type: none"> • “What is my moral obligation/responsibility and capability to act for or influence sustainable development?” • “How has the perception of my own role as a change-maker transformed this week?” 	
Exercise:	Stakeholder roleplay
Used in which part / session of the course:	In the second session of the course.
Main goal of the exercise:	The main goal of this exercise is to enable the students to expand their viewpoints by stepping into the role of another person through roleplay. The exercise is intended to increase emotional and knowledge-based understanding of the importance of including and mitigating all stakeholder perspectives in the development and implementation of responsible innovations.
Best used with:	9-20 participants; in groups of 3-4
<p>This exercise is carried out in groups and conducted early in the course for students to get acquainted with theatre-based methods used throughout the course. The students are given a range of technological innovations that are viewed as disruptive (e.g., platform economy, lab grown meat, biofuels, or robotics and automation). In relation to each innovation, some stakeholder roles which are expected to experience differing impacts on the further implementation of the innovation are determined. The groups will choose topics on which to focus, and within each group assign individual stakeholder roles. The students will continue to search information about the topic and the role of their individual stakeholder. The students will discuss the gathered information in the group to be able to prepare and compose fact-based, but imagination driven, identities and perspectives for each stakeholder. Finally, each group will proceed to present their topic in class in the form of a dialogue held by all the members of the group acting in the role of their individual stakeholder. Each stakeholder will deliver their own view of the topic and mirror this perspective in relation to other stakeholder views. Afterwards, the audience is tasked to</p>	



<p>identify the main controversies that exist in the stakeholder views in relation to the topic and to think collectively how they could possibly be mitigated.</p>	
<p>Exercise: Real life company case of a sustainability problem and the means to solve it</p>	
<p>Used in which part / session of the course: In the third session of the course</p>	
<p>Main goal of the exercise: To enable students to understand the holistic nature of sustainability impact assessments and the difficulties that relate to it in real life.</p>	
<p>Best used with: 9-20 participants; in groups of 3-4</p>	
<p>Students are given a real-life company case description depicting a sustainability problem and a company's technological solution to address this issue. In groups of 3-4, students are tasked to familiarize themselves with the case in groups and then critically identify using an impact assessment framework how that proposed solution succeeds in mitigating/eliminating the different impacts of the sustainability issue in question.</p>	
<p>Exercise: Collective Story Writing</p>	
<p>Used in which part / session of the course: In the fifth session of the course.</p>	
<p>Main goal of the exercise: To enable students to think about the fundamentally ambiguous nature of technological development and innovation in relation to sustainability.</p>	
<p>Best used with: 9-20 participants; in groups of 3-4</p>	
<p>What is the value of technological development and innovation? Is this value intrinsic or extrinsic, i.e., context dependent or not? If related to context, then the value of the innovation is dependent on its use for the general good or bad. But is the definition and distinction of good and bad relative or universal? Also, do good intentions matter if the outcome is ultimately bad? This thought process above illustrates a brief and simplified extract of the many ethical considerations related to assessing technological innovations in the context of sustainability. To invoke nuanced ethical contemplations, the students are instructed to engage in a digital version of an improvisation exercise by participating in collective story writing around a predetermined topic (e.g., artificial intelligence) in the learning platform. One by one, the students post on the platform and continue the story by introducing new characters, perspectives, thoughts, events, changes of scenery – whatever brings forth an illustrative example of an alternative ethical standpoint – and little by little a rich collective understanding on the matter is formulated.</p>	
<p>Exercise: Fact Based Future Fiction</p>	
<p>Used in which part / session of the course: Throughout the course (main course project).</p>	
<p>Main goal of the exercise: The main goal of this exercise is to enable the students to summarise and implement the main course learnings by comprising a holistic understanding of a specific sustainability problem and analysing a possible technological solution for it withstanding all related complexities, uncertainties, differences in perspectives and conflicts by</p>	



	processing it in a structured way and translating it into a form that can be convincingly conveyed to others.
Best used with:	9-20 participants; in groups of 4-5
<p>The students construct a topic for the project by selecting a sustainability issue from one of the 17 SDGs (UN, 2015) along with a disruptive future technology to explore their compounded impact in a specific context. An overview of disruptive future technologies by Diamandis and Kotler (2022), including quantum computing, artificial intelligence, robotics and automation, material science and nanotechnology, biotechnology, networks and sensors (IoT), augmented and virtual reality (immersive technologies), blockchain, and 3D printing, as a reference point is provided. To illustrate, a possible topic could be “enhancing peace and justice (SDG 16) through immersive technologies (augmented and virtual reality) in peace-tech (context)”.</p> <p>First, students are tasked to delve deeper into the SDG (what are the main issues behind the goal and their contributing factors) and the more specific context chosen (how do these issues manifest in the specific context). Second, they investigate how the chosen technology or technologies could be applied in this specific context to aid in solving the underlying problems and drive forward the SDG’s fulfilment. Third, they conduct a holistic impact assessment and an examination of the solution’s development trajectory. This will act as knowledge-based background research for the development of a storyline.</p> <p>Second, the key findings of the research will be formulated into an interesting storyline and produced into a short film with a duration of 15 minutes maximum. By building a storyline, the students are forced to include not only detached factual perspectives of technological and economic analysis, but also more personal and emotional perspectives in order to go beyond what is known, into what should and could be to build visions for the future. To help structure the film, the students are suggested to follow the typical five-step dramatic scheme (Pavis 1998):</p> <ol style="list-style-type: none"> 1. Introduction of the setting and the underlying problem: what is the sustainability problem? 2. Evolving action: what is the rising proposed solution? 3. Collision or climax: how does the proposed solution affect stakeholders, surrounding systems and structures, and does it create possible conflicts? 4. Last twist in the form of surprising events: is there a possibility of unintended consequences or other risks, ethical or cultural considerations? 5. Resolution: what the does the future look like? 	



Resource Overview

Literature	
Week 1	<ul style="list-style-type: none"> • United Nations (2015). Transforming our World: The 2030 Agenda for Sustainable Development. General Assembly Resolution A/RES/70/1. • Diamandis, P. H., & Kotler, S. (2020). The future is faster than you think: How converging technologies are transforming business, industries, and our lives. Simon & Schuster. • Vergragt & Quist (2011). Backcasting for Sustainability: Introduction to the special issue. <i>Technological Forecasting & Social Change</i> 78, 747-755.
Week 2	<ul style="list-style-type: none"> • Adams, R., Jeanrenaud, S., Bessant, J., Denyer, D. & Overy, P. (2015). Sustainability-oriented innovation: A Systematic Review. <i>International Journal of Management Reviews</i>, 00, 1–26. • Lubberink, R., Blok, V., Van Ophem, J. & Omta, O. (2017). Lessons for Responsible Innovation in the Business Context: A Systematic Literature Review of Responsible, Social and Sustainable Innovation Practices. <i>Sustainability</i>, 9, 721. • Owen, R., Macnaghten, P., & Stilgoe, J. (2012). Responsible research and innovation: From science in society to science for society, with society. <i>Science and public policy</i>, 39(6), 751–760. • Stilgoe, J. Owen, R. & Macnaghten, P. (2013). Developing a framework for responsible innovation. <i>Research Policy</i>, 42, 9, 1568–1580. • Buchanan, R. (1992) Wicked Problems in Design Thinking. <i>Design Issues</i>, 9 (2), 5–21. • Oxman, N. (2016). Age of Entanglement. <i>Journal of Design and Science</i>. https://doi.org/10.21428/7e0583ad 1
Week 3	<ul style="list-style-type: none"> • James, P, Magee, L., Scerri, A. & Steger, M. (2015) <i>Urban Sustainability in Theory and Practice: Circles of Sustainability</i>, Routledge, London, 2015. • Penzenstadler, B., Duboc, L., Akinli Kocak, S., Becker, C., Betz, S., Chitchyan, R., Easterbrook, S., Leifler, O., Porras, J., Seyff, N. & Venters, C. (2020, January). The SusAF Workshop - improving sustainability awareness to inform future business process and systems design (Version 2). Zenodo. • Podder, S., Burden, A., Singh, S. K., & Maruca, R. (2020). How green is your software? <i>Harvard Business Review</i>, Sept.
Week 4	<ul style="list-style-type: none"> • Bolton, R. & Hannon, M. (2016) Governing sustainability transitions through business model innovation: Towards a systems understanding. <i>Research Policy</i> 45, 9 (2016) 1731–1742. • Geels, F.W., (2004). From sectoral systems of innovation to socio-technical system: insights about dynamics and change from sociology and institutional theory. <i>Research Policy</i> 33 (6/7), 897–920. • Markard, J., Raven, R., & Truffer, B. (2012) Sustainability transitions: An emerging field of research and its prospects. <i>Research Policy</i>, 41, 955–967.

	<ul style="list-style-type: none"> Rotmans, J. & Loorbach, D. (2009) Complexity and Transition Management. <i>Journal of Industrial Ecology</i>, 13, 2, 185–1196.
Week 5	<ul style="list-style-type: none"> Van de Poel, I. R., & Royakkers, L. M. (2011). Ethics, technology, and engineering: An introduction. Wiley-Blackwell. Bostrom, N. (2002). Existential risks. <i>Journal of Evolution and technology</i>, 9(1), 1–31. Bryden, J., & Gezelius, S. S. (2017). Innovation as if people mattered: The ethics of innovation for sustainable development. <i>Innovation and development</i>, 7(1), 101–118. de Vries, B. J. (2019). Engaging with the Sustainable Development Goals by going beyond Modernity: An ethical evaluation within a worldview framework. <i>Global Sustainability</i>, 2. Stephan, U., Andries, P., & Daou, A. (2019) Goal Multiplicity and Innovation: How Social and Economic Goals Affect Open Innovation and Innovation Performance*. <i>J PROD INNOV MANAG</i> 2019;36(6):721–743
Week 6	<ul style="list-style-type: none"> Miller, R. (2018). Transforming the future: Anticipation in the 21st century. Taylor & Francis. United Nations Development Programme (2018) Foresight Manual. Empowered Futures for the 2030 Agenda. UNDP Global Centre for Public Service Excellence.
(Online) Tools / Videos used	
Sustainable systems and transitions	<ul style="list-style-type: none"> Multi-Level-Perspective by Frank Geels (2020) NEST webinar series, part 3. Video accessible at: https://www.youtube.com/watch?v=Tm6xVb-TXgk Introduction to Sustainability Transitions by Jochen Markard (2020) NEST webinar series, part 1. Video accessible at: https://www.youtube.com/watch?v=WM3YXeamooM
Ethics of sustainability and technology	<ul style="list-style-type: none"> Ethics in the age of technology by Juan Enriquez (2018) TEDxBerlin. Video accessible at: https://www.youtube.com/watch?v=iiAirfn-lBI
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