



Guidelines for group projects

31st March

MSE-433 Towards
Sustainable Materials

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Spring 2025

Objectives and approach

The group project comprises 5 milestones

#	When	What
1	March 3, 2025	Form groups of 5-6 students, with mixed backgrounds and propose a topic based on a company and a product
2	March 10, 2025	Signatures
3	April 7, 2025	Mid-term review
4	May 19, 2025	Presentation in front of the class
5	June 9, 2025	Send the report in the form of a scientific manuscript to YL and MDW

The course grading is on 100 pts, based on 4 assessments:

1. debate (10 pts)
2. **report* (50 pts)**
3. **presentation* (20 pts)**
4. 1hr written exam (multiple choice questions, 20 pts)

(*) The presentation and report are graded using marking rubrics (see detailed guidelines on the course moodle page)

- April 7, 2025
- Not graded but very important!
- All group members must be present and all must present!
- Each group will present its progress with a short (5-6 slides) presentation, which must include:
 - Objective of the project
 - Role of individual group members
 - Definition of circular product
 - Circular business model canvas
 - Material Circularity Indicator (MCI) calculation
 - Initial Life Cycle Assessment and life cycle costing calculations
 - Future work plan

Mid-term review: MXH-135

- Make an appointment in google sheets (EPFL email address only)
- 20 minutes per group in MXH-135 (LPAC)
- April 7, 2025, not graded but very important!
- All group members must be present and all must present!

MSE-433 Midterm feedback

Room INR219 is free to work on the group project

Room MXH135 (at LPAC) is for the group midterm feedback

Mid-term review

April 7, 2025

Not graded but very important!

Please select one timeslot for per group (~20mins)

Group	Topic	Time
7		13:15
8		13:40
9		14:05
10		14:30
11		14:55
12		15:20
13		15:45
14		16:10
15		16:35

All group members must be present and all must present!
Each group will present its progress with a short (5-6 slides) presentation, which must
Objective of the project
Role of individual group members
Definition of circular product
Circular business model canvas
Material Circularity Indicator (MCI) calculation
Initial Life Cycle Assessment and life cycle costing calculations

Group project report

- The project report should be concise and scientifically sound!
- A good report should be easy and interesting to read.
- Aim to write your report as a publication: imaging you are preparing a journal paper manuscript for the journal “Nature Sustainability” Nature Sustainability
- 10 pages excluding: references and annexes

The image shows two journal article covers side-by-side. The top article is from 'nature sustainability' (Volume 4, Issue 4, April 2022) with the title 'Advancing life cycle sustainability of textiles through technological innovations' by Linhe Zhang et al. The bottom article is from 'Frontiers in Sustainability' (Volume 2, Article 1207162, April 2024) with the title 'How does embracing an outdoor lifestyle and sense of responsibility impact plastic reduction efforts?' by Oliver Ruedan and Isabell Richter.

nature sustainability

Review Article

<https://doi.org/10.1038/s43247-023-07004-5>

Received: 6 May 2022 | Accepted: 10 October 2022 | Published online: 22 December 2022

Advancing life cycle sustainability of textiles through technological innovations

Linhe Zhang^{1,2}, Man Yat Leung^{1,2}, Svetlana Borikina^{3,4}, Xiaomin Yu^{1,2}, ...

Frontiers in Sustainability

Original Research

Published: 20 April 2024 | DOI: 10.3389/funsus.2024.1207162

How does embracing an outdoor lifestyle and sense of responsibility impact plastic reduction efforts?

Oliver Ruedan and Isabell Richter^{1*}

¹Norwegian University of Science and Technology (NTNU), Trondheim, Norway

Introduction Plastic pollution in coastal regions poses severe environmental challenges. This research aims to examine the impact of an individual's outdoor lifestyle and their perceptions of responsibility for litter management—specifically the roles of government, businesses, non-governmental organizations (NGOs), Cornwall council, and volunteers—on their engagement in activities aimed at reducing plastic pollution.

Methods The study surveyed 972 individuals in Cornwall, UK, to gather data on their perceptions and behaviors related to plastic reduction initiatives. The survey employed binomial logistic regression tests to analyze the relationship between respondents' views on responsibility for litter management and their participation in ten different plastic-reducing activities.

Results The analysis revealed that individuals' perceptions of who should be responsible for managing litter significantly influence their likelihood of participating in plastic reduction activities. Notably, respondents who viewed

Required ANNEXES

- Circular business model canvas
- Supply chain systems map template
- Stakeholders table
- SMART initiatives table

Group project report

The report is graded over 6 categories (50 pts total) using a marking rubric (information in the following):

- Q1. Define circular product (5 pts)
- Q2. Best carbon footprint materials (5 pts)
- Q3. Circular supply chain (5 pts)
- Q4. Impact assessment (20 pts)
- Q5. Cost model of product (5 pts)
- Q6. Initiatives (10 pts)

Marking rubric and grading

- The marking rubric aids transparency and also provides suggestions as how to approach the various topics and maximize your grade!
- 6 rubrics = 6 categories as listed in previous slide
- The grade is the same for all students in the group.

- **Define circular product (5 pts)**

- Value proposition versus incumbent,
- Circular business model canvas
- CAD model of design to give the BOM and mass, **extra 2 pts**
- FEA model showing the design and materials meet the main load case(s), **extra 2 pts**

1	i) define your product and its value proposition and ii) choose a company making this product and explain your choice. Describe the industrial sector, list main companies / competitors.	(1 pt.)
2	Compare and contrast current sustainability / decarbonization strategies of sector.	(1 pt.)
3	Propose a competitive <u>product</u> enabled by an emerging material/technology/supply chain offering a circular and lower impact approach	(1 pt.)
4	For your competitive product, present a simple design to give the bill of materials (BOM), masses, manufacturing processes [this will be used throughout the case study] (extra 2 pts. for optional CAD model, extra 2pts. for FEA model)	(1 pt.) (+4pts)
5	Complete the circular business model canvas	(1 pt.)

Question	Satisfactory	Excellent	Exemplary
1)	Good description of product, VP, supply chain, and competitors (0.6pts)	Clear and nuanced product, VP, supply chain, and competitor description with referenced sources (0.8pts)	Company specific product VP and supply chain described versus competitors with referenced sources and flow diagrams (1pts)
2)	Sustainability and decarbonization strategies of sector summarized. (0.6pts)	Sustainability and decarbonization strategies of sector summarized in table. (0.8pts)	Sustainability and decarbonization strategies of sector summarized in comparative ranking chart. (1pts)
3)	Competitive product proposed with well-argued multi-perspective justification of value proposition or advantages. (0.6pts)	Competitive product proposed with well-argued technical, environmental, societal justification of value proposition or advantages. (0.8pts)	Competitive product proposed with exemplary technical, environmental, societal justification of value proposition or advantages and impacts. (1pts)
4)	Good product proposal with design, high level BOM, masses and manufacturing processes. (0.6pts)	Excellent product proposal with design, BOM for key materials, CAD model (+2pts) masses and manufacturing processes, diagrams. (0.8pts)	New and innovative solution/design, detailed BOM, CAD model (+2pts) masses and manufacturing processes, diagrams, FEA model showing mass to meet main load case(s) (+2pts). (1pts)
5)	Circular business model canvas fully complete with logical descriptions. (0.6pts)	Circular business model canvas fully complete with logical and referenced descriptions. (0.8pts)	Circular business model canvas fully complete with logical, nuanced, and referenced descriptions. (1pts)
General	Limited quantitative referenced data (5 refs) OR only a clear response. (0.6pts)	Quantitative referenced data (>10 refs), AND Showing a high level of systemic reasoning, AND An excellent response, (0.8pts)	Quantitative referenced data (>10 refs), AND Showing a high level of systemic reasoning, AND Tables / charts included, AND Excellent writing and grammar with an exceptionally clear and structured response. (1pts)
Points	3	4 (+2pts)	5 (+2pts) (+2pts)

WORKSHEET

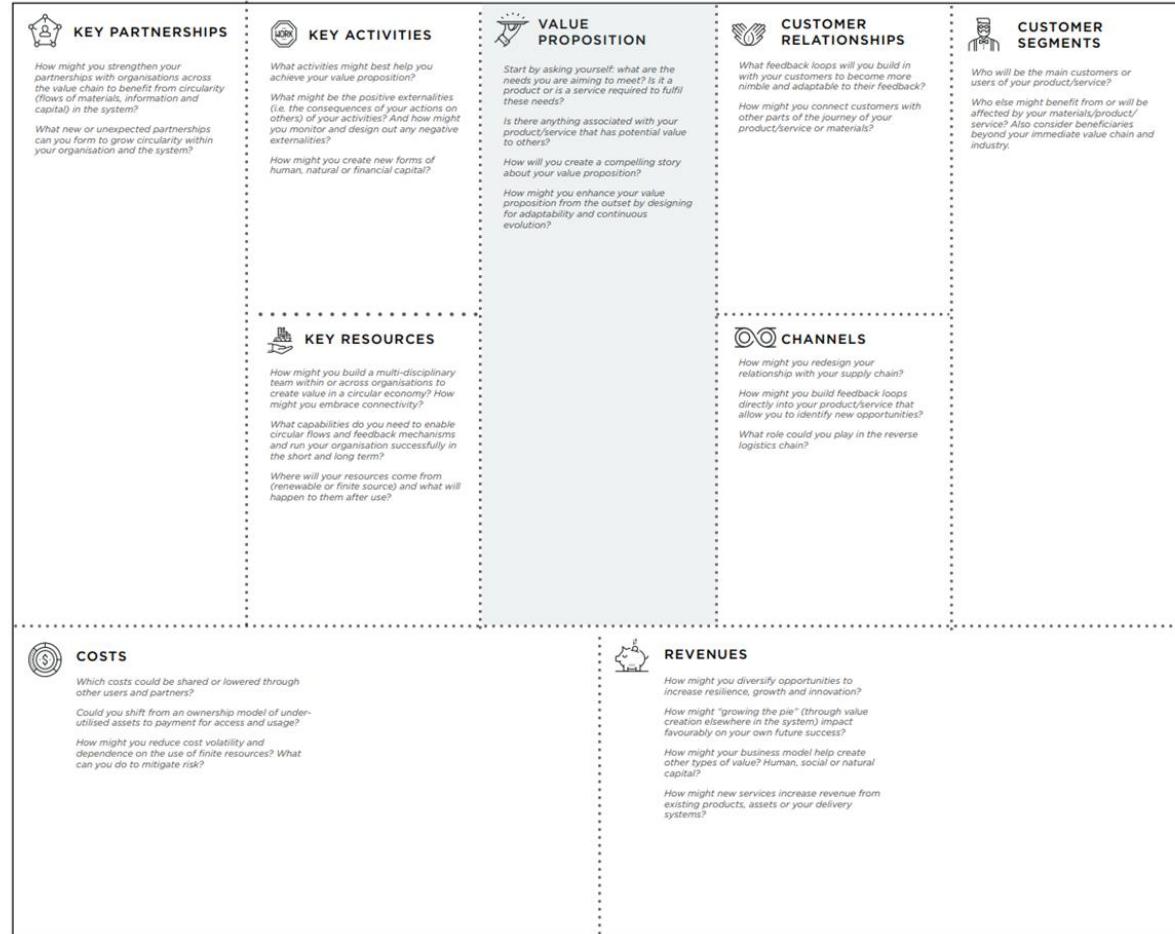
Business Model Canvas

 A3 or bigger

The business model canvas has been developed by Osterwalder & Pigneur (strategyzer.com). You might have filled one of these in before - here we have added some prompts and questions that you might find helpful in the context of the circular economy.

If you need more space, create your own canvas using post-its.

Given in report Annex



Marking rubric –

Q2: Best carbon footprint materials

- **Best carbon footprint materials (5 pts)**

- Materials selection
- Design for circularity

No.	Question	Points
1	List the materials used in the product and describe their upstream scope 3 impacts	(1 pt.)
2	Propose best carbon footprint materials for the product (scope 3 upstream)	(2 pts.)
3	Examine the EU end-of-life and waste legislation and give two routes to meet circularity and recycling targets at end-of-life with re-use of recovered materials (scope 3 downstream)	(2 pts.)

Marking rubric –

Q2: Best carbon footprint materials

Question	Satisfactory	Excellent	Exemplary
1)	Materials well described with good description of scope 3 impacts (0.45pts)	Clear and nuanced description of materials and their upstream scope 3 impacts with referenced sources (0.6pts)	Company specific materials description with referenced sources and flow diagrams with scope 3 impacts attributed to supply chain including raw materials extraction (0.8pts)
2)	Lower carbon footprint materials proposed with well-argued and multi-perspective discussion of advantages and issues (0.9pts)	Lower carbon footprint materials proposed with well-argued technical, environmental, societal perspectives of advantages and 2 specific issues (1.3pts)	Lower carbon footprint materials proposed with <u>quantified</u> technical, environmental, societal perspectives of advantages and 3 quantified issues (1.6pts)
3)	Good description of EL treatment, two CE scenarios and transition well described (0.9pts)	Excellent description of EL treatment, clear and nuanced description of two CE scenarios and transition with associated challenges (1.3pts)	Excellent description of EL treatment, quantified descriptions of two CE scenarios, legislation, and transition with associated challenges (1.6pts)
General	Limited quantitative referenced data (5 refs), OR A clear response, (0.75pts)	Quantitative referenced data (>10 refs), AND Showing a high level of systemic reasoning, AND An excellent response (0.8pts)	Quantitative referenced data (>10 refs), AND Showing a high level of systemic reasoning, AND Tables / charts included, AND Excellent writing and grammar with an exceptionally clear and structured response (1pts)
Points	3	4	5

Marking rubric – Q3: Circular supply chain

- **Circular supply chain (5 pts)**
 - Manufacturing route including supply chain,
 - Supply chain systems map template, MFA, circularity metrics

No.	Question	Points
1	Detail your products manufacturing route and circular supply chain	(1 pt.)
2	Draw a supply chain systems map	(2 pts.)
3	Model the materials flow (MFA) and model the degree of circularity of the incumbent versus your proposed solution	(2 pts.)

- First draw boxes of the main supply chain steps (companies involved)
- Then connect these blocks with 4 sets of lines using the color code in the file.
- Use thicker lines where the flows are stronger using experience and what data you can find.

- **Monetary flow**
 - Payment for virgin products, payments for waste products, payments for recycled products, payments for leased services, payments for waste disposal
 - income from selling products, income from selling waste bi-products to a different company, income from supply a service, income from royalties/licensing etc
 - investments in: own facilities (primary), own facilities (re-furbish, repair, remanufacture etc), in a supply chain partner (JDA) / shared assets, in wider stakeholders

- **Mass flows**
 - Virgin products
 - Post-industrial waste, End of life waste
 - Re-use of recovered products: re-furbish, repair, remanufacture
 - Use of recycled materials to replace virgin feedstock
 - Use of lower embodied energy virgin feedstock to replace primary (petrochemical) feedstock
 - Lease of materials / ownership & take back

- **Emissions flows**
 - Examine scope 1, 2, 3 (upstream and downstream of where your 'start-up' is in the supply chain
 - As a first pass examine CO2e
 - As a second pass, emissions examined through broader lens: climate change (CO2e), freshwater impact, Chemical and plastic pollution reduction, Forest and seabed impacts, biodiversity impacts, suit pollution impacts)
 - Look at where in the supply chain the emissions occur

- **Information flow**
 - How can information flow be enhanced?
 - Sharing of LCA data
 - Blockchain/other
 - Enhance recycling stream purity

- **Mappings**
 - Where are you circular (7 principles)
 - Examine which SDGs you address
 - Direct (scope 1 & 2, scope 3 upstream and scope 3 downstream at end of life)
 - Indirect (scope 3 downstream in the use / consumption phase)
 - Which impacts do you reduce? What are your SMART (quantified) initiatives?

Draw two supply chain maps of:

- 1) Linear incumbent supply chain
- 2) Their proposed circular alternative

Draw product and supply chain flows: higher thickness is higher intensity

- **Monetary-flow**
- **Mass-flow**
- **Emissions-flow**
- **Information-flow**

(1) scope 1&2, 3 upstream &
downstream (EL)
(2) use/consumption)Which impacts
do you reduce?
(quantify)

	Climate change	Freshwater loss	Chemical & plastic pollution	Forest & seabed loss	Biodiversity loss	Salt nutrient pollution
Scope 1 direct						
Scope 2 indirect						
Scope 3 upstream						
Scope 3 downstream						

Your design space

SDG	(1)	(2)
1 No Poverty		
2 Zero Hunger		
3 Good health		
4 Education		
5 Gender		
6 Clean water		
7 Clean energy		
8 Decent work		
9 Innovation / industry		
10 Reduced inequalities		
11 Cities and communities		
12 Consumption / production		
13 Climate		
14 Life below water		
15 Life on Land		
16 Peace & justice		
17 Partnerships for goals		

MSE-433
What are
your
SMART
quantified
initiatives?

Specific	Measurable	Attainable	Relevant	Time-oriented	Slow	Close	Narrow	Regenerate

Examine
• Business
• Supply
chain
• Production
• Materials

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Where are you
circular?

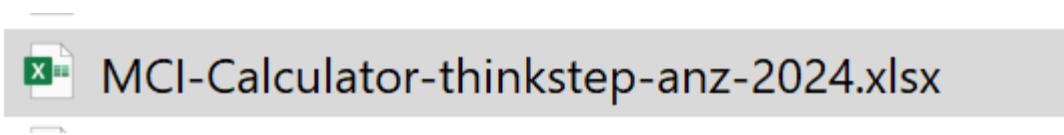
Letter / Wakeman

7 principles
1 Longevity
2 Reuse (refurbish / repair/ remanufacture)
3 Resource- efficient manufacturing
4 Recycling / design for disassembly
5 Collaboration in value chain
6 Local sourcing & production
7 Business model innovation

Draw product
and supply
chain flows:
higher
thickness is
higher
intensity

Monetary-flow
Mass-flow
Emissions-flow
Information-flow

- Please use the Material Circularity Indicator to assess the degree of circularity (use the excel thinkstep tool available on moodle)
 - a. Linear incumbent
 - b. Your proposed circular solution



MFA suggestions

- Write in python
- Use 14 day free trial of:
 - [Create Sankey Diagrams with our Software | e!Sankey](#)
- Use stan to web: [Home](#)
- University Freiburg
 - <https://www.blog.industrialecology.uni-freiburg.de/index.php/2017/12/11/launching-of-the-circularsankey-web-application/>

3)	Adequate materials flow (MFA) model made for top 3 product constituents and the degree of circularity of the incumbent versus your proposed solution well modeled used a tool (0.9pts)	Detailed materials flow (MFA) model made for top 5 product constituents including circularity in the mass flow and the degree of circularity of the incumbent versus your proposed solution well modeled used a tool (1.3pts)	Customized materials flow (MFA) model made for all product constituents including circularity in the mass flow and the degree of circularity of the incumbent versus your proposed solution well modeled used a tool (1.6pts)
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Question	Satisfactory	Excellent	Exemplary
1)	Products manufacturing route and circular supply chain well described with references (0.45pts)	Products manufacturing route described in a flow chart and circular supply chain described including geo-locations of each step and references (0.6pts)	Products manufacturing route described in a detailed flow chart (machine and cell level) and circular supply chain described including geo-locations of each step and transportation and references (0.8pts)
2)	Supply chain systems map lacks detail (lacking 1 or more of: Monetary, mass, emissions, information) (0.9pts)	Detailed supply chain systems including: monetary, mass, emissions, information flows (1.3pts)	Detailed supply chain systems including accurate and referenced thicknesses of relative flows: monetary, mass, emissions, information flows (1.6pts)
3)	Adequate materials flow (MFA) model made for top 3 product constituents and the degree of circularity of the incumbent versus your proposed solution well modeled used a tool (0.9pts)	Detailed materials flow (MFA) model made for top 5 product constituents including circularity in the mass flow and the degree of circularity of the incumbent versus your proposed solution well modeled used a tool (1.3pts)	Customized materials flow (MFA) model made for all product constituents including circularity in the mass flow and the degree of circularity of the incumbent versus your proposed solution well modeled used a tool (1.6pts)
General	Limited quantitative referenced data (5 refs), OR A clear response, (0.75pts)	Quantitative referenced data (>10 refs), AND Showing a high level of systemic reasoning, AND An excellent response (0.8pts)	Quantitative referenced data (>10 refs), AND Showing a high level of systemic reasoning, AND Tables / charts included, AND Excellent writing and grammar with an exceptionally clear and structured response (1pts)
Points	3	4	5

Marking rubric – Q4: Impact assessment

- **Impact assessment (20 pts)**

- State main environmental and societal burdens of the product and how their approach mitigates these
- SimaPro / Ecoinvent LCA of product, **sensitivity study expected (2pts extra)**
- Split into scope 1,2,3 upstream and 3 downstream categories

No.	Question	Points
1	State main environmental, societal, and human health burdens of the product and how your approach mitigates these	(5 pt.)
2	Perform an LCA of your lower impact product versus the linear incumbent, including a sensitivity study, using SimaPro and Ecoinvent	(10 pts.) (+2pts.)
3	Split the CO ₂ e impacts into scope 1, 2, 3 (upstream and down-stream) categories. Map LCA impacts to planetary boundaries (PBs) and to the SDGs focused on society and human health.	(5 pts.)

Question	Satisfactory	Excellent	Exemplary
1)	State three main environmental, societal, and human health burdens of the product (9x burdens) and how your approach mitigates these, well referenced (2.25pts)	State three main environmental, societal, and human health burdens of the product (9x burdens) and how your approach mitigates these versus time and level of market adoption, well referenced (3pts)	Nuanced argument of the three main environmental, societal, and human health burdens of the product (9x burdens) and how your approach mitigates these versus time and level of market adoption, well referenced, with barriers to adoption of your approach (3.5pts)
2)	Product carbon footprint LCA made of linear incumbent and a convincing lower impact alternative (4.5pts)	Recipe 2016 method LCA made of linear incumbent and lower impact alternative with attention to detail with clear interpretation (6pts)	Exemplary LCA made of linear incumbent and circular alternative with attention to detail, including a sensitivity analysis (extra 2 pts) on important factors or unclear data, with clear interpretation (7pts) + (2pts)
3)	Good and accurate segmentation of CO2e scope 1, 2, 3 for linear versus lower impact solution; LCA impacts mapped to PBs and SDGs focused on society and human health (2.25pts)	Excellent presentation of CO2e segmented by scope 1, 2, 3 for linear versus lower impact solution; LCA impacts mapped to PBs in figure and SDGs focused on society and human health in figure / table (3pts)	Exemplary presentation of CO2e segmented by scope 1, 2, 3 for linear versus circular solution; quantified LCA impacts mapped to PBs in figure and SDGs focused on society and human health in figure / table. (3.5pts)
General	Limited quantitative referenced data (5 refs), OR A clear response (3pts)	Quantitative referenced data (>10 refs), AND Showing a high level of systemic reasoning AND An excellent response (4pts)	Quantitative referenced data (>10 refs), AND Showing a high level of systemic reasoning AND Tables / charts included, AND Excellent writing and grammar with an exceptionally clear and structured response (6pts)
Points	12	16	20 (+2)

Marking rubric – Q5: Cost model

- **Cost model of product (5 pts)**
 - Manufacturing and reuse and CAPEX including downstream

No.	Question	Points
1	From your bill of materials and manufacturing process flow diagrams already given, make an estimate of the part cost as a function of manufacturing volume: a) start-up, b) medium volume production, c) full-scale production	(3 pt.)
2	Detail the CAPEX needed for a), b), c)	(1pts.)
3	Detail how you would invest in your supply chain and with wider stakeholders towards becoming a NetPositive company	(1pts.)

Marking rubric – Q5: Cost model

Question	Satisfactory	Excellent	Exemplary
1)	Satisfactory cost model made from your bill of materials and manufacturing process flow diagrams already given, to give an estimate of the part cost as a function of manufacturing volume: a) start-up, b) medium volume production, c) full-scale production (1.2pts)	Excellent cost model made from your bill of materials and manufacturing process flow diagrams already given, to give an estimate of the part cost as a function of manufacturing volume: a) start-up, b) medium volume production, c) full-scale production; including sensitivity study (1.6pts)	Exemplary cost model to give an estimate of the part cost as a function of manufacturing volume: a) start-up, b) medium volume production, c) full-scale production; including sensitivity study; consideration of gross margin; including cost of carbon; with excellent input data (references /interviews) (2pts)
2)	CAPEX detailed by cell for cases a), b), c) versus time in the plant (0.45pts)	Excellent description of CAPEX detailed by cell for cases a), b), c) versus time in the plant (0.6pts)	Exemplary description of CAPEX detailed by cell for cases a), b), c) versus time in the plant (0.75pts); NPV/SROI calculation (+2pts)
3)	Description of how you would invest (details of what, when, and how much in monetary terms) in 2 specific stakeholders in your supply chain towards becoming a NetPositive company (0.45pts)	Description of how you would invest (details of what, when, and how much in monetary terms) in 2 specific stakeholders in your supply chain towards becoming a NetPositive company; linked into cost model (0.6pts)	Exemplary description of how you would invest (details of what, when, and how much in monetary terms) in 3 specific stakeholders in your supply chain towards becoming a NetPositive company; linked into cost model and SROI calculation (0.75pts)
General	Limited quantitative referenced data (5 refs), OR A clear response, (0.9pts)	Quantitative referenced data (>10 refs), AND Showing a high level of systemic reasoning, AND An excellent response (1.2pts)	Quantitative referenced data (>10 refs), AND Showing a high level of systemic reasoning, AND Tables / charts included, AND Excellent writing and grammar with an exceptionally clear and structured response (1.5pts)
Points	3	4	5 (+2pts)

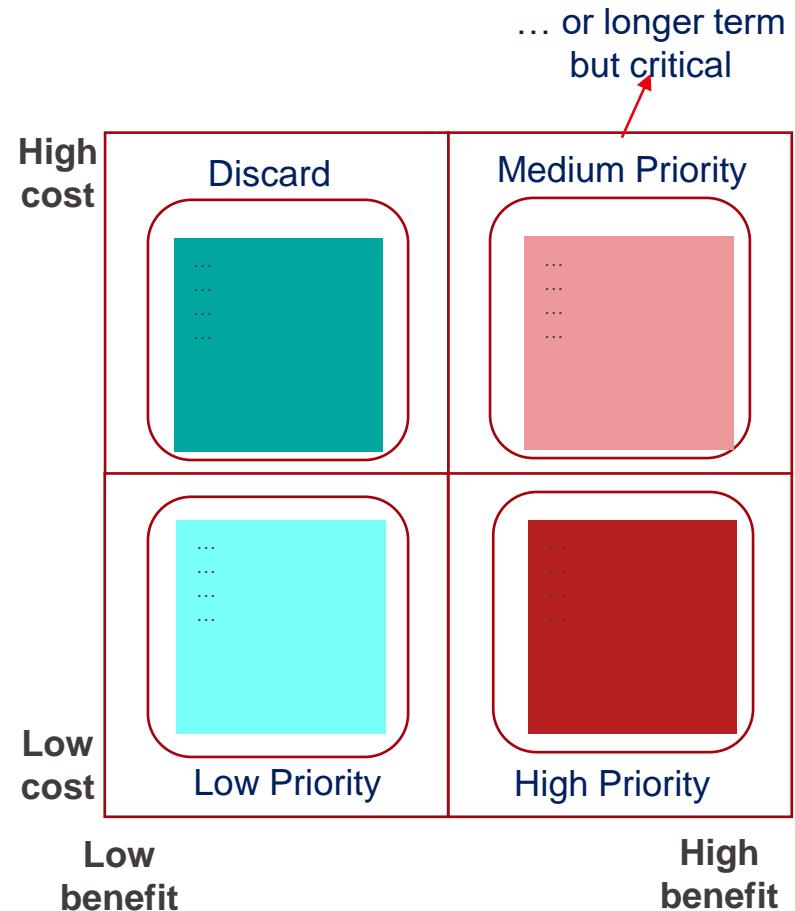
Marking rubric – Q6: SMART sustainability initiatives and stakeholder engagement plan

- **Initiatives (10 pts)**

- Give SMART sustainability initiatives quantified by the studies and stakeholder engagement plan

	Question	Points
1	Give a minimum of three SMART sustainability initiatives for the product /company towards becoming NetPositive Complete the equivalent of templates 1, 2.	3
2	State and justify your three most prominent change management challenges or barriers and for each example, discuss how will you overcome these three barriers? Complete template 3 Who are the key stakeholders to engage? Identify three to five key people in business / influential institutions / government / NGOs and complete equivalent of templates 3, 4.	3
4	Give quantified absolute targets and recommendations versus time: 2030, 2040, 2050 and make a roadmap (compare this to other companies NetZero strategies in the same product space).	4

- Brain storming of initiatives
 - Material focused
 - Product focused
 - Operations focused
 - Supply chain
 - Industry wide
- Develop strategic mix of
 - **Short**
(fast to implement, low cost/high benefit)
 - **Medium**
(transition to the future)
 - **Longer term**
(high risk, high benefit, maybe high cost)



Simple SMART initiative template 2

Detail your top (minimum three) initiatives and detail how you will make them SMART (quantified absolute and accountable targets). What is the expected impact?

SMART objectives	1.	2.	3.
Specific			
Measurable			
Achievable			
Relevant			
Time-oriented			
Expected IMPACT			

Simple SMART initiative template 3

Detail for each initiative the next steps, challenges, resources needed, key dates,

Initiative	Next steps	Change management barriers	Change management challenges	Resource needs	Key dates

- Who are the stakeholders in a wider sense across the supply chain?
- Detail 3 to 5 members within your personal and professional network, in the company you are studying or in related influential institutions (e.g. business associations, government organisations, non-profit organisations, NGOs, academia).
- Identify those that can assist you in influencing sustainability-related change within your targeted product and company.
- For these targeted people, how would you propose to contact them and interact with them? What could the win-win be and any barriers or opportunities that might be important (relational or other)

Stakeholder (Person/Link on edIn)	Organizati on	Job Title	Influence	How to contact	How to interact	Win-win, next steps	(Relational) barriers/opportunities

Question	Satisfactory	Excellent	Exemplary
1)	3 SMART initiatives given in absolute terms for the product /company towards becoming NetPositive Completed templates 1, 2. (1.2pts)	2 SMART initiatives, for each of short, medium, long term (6 total) given in absolute terms for the product /company towards becoming NetPositive. Completed templates 1, 2. (1.6pts)	3 SMART initiatives, for each of short, medium, long term (9 total) given in absolute terms for the product /company towards becoming NetPositive. Completed templates 1, 2 with nuanced details. (2pts)
2)	3 change management challenges or barriers given with discussion of how you will overcome these barriers. Template 3 complete. 3 generic (not name specific) stakeholders identified and templates 3, 4 complete. (1.2pts)	3 change management challenges or barriers given with discussion of how you will overcome these barriers. Template 3 complete. 3 name specific stakeholders identified including one NGO and templates 3, 4 complete. (1.6pts)	4 change management challenges or barriers given with discussion of how you will overcome these barriers. Template 3 complete. 4 name specific stakeholders identified including one NGO and one community group and templates 3, 4 complete. (2pts)
3)	Sustainability strategy defined - absolute targets and recommendations given versus time: 2030, 2050 and roadmap made. (1.8pts)	Sustainability strategy defined - quantified absolute targets and recommendations given versus time: 2030, 2040, 2050 and roadmap made. (2.4pts)	Sustainability strategy defined - quantified absolute targets and recommendations given versus time: 2030, 2040, 2050 and roadmap made (compare this to 3 other companies NetZero strategies in the same product space). (3pts)
General	Limited quantitative referenced data (5 refs) OR only a clear response. (1.8pts)	Quantitative referenced data (>10 refs), AND Showing a high level of systemic reasoning, AND An excellent response, (2.4pts)	Quantitative referenced data (>10 refs), AND Showing a high level of systemic reasoning, AND Tables / charts included, AND Excellent writing and grammar with an exceptionally clear and structured response. (3pts)
Points	6	8	10

Tips to prepare a good report

The report should contain the following sections, LIMITED to 10 pages:

- **Heading** on first page, with title of the project, authors' names and **affiliation** (section), and course information.
- **Abstract** (one paragraph < 200 words) clearly presenting the **objective** of the case study, **challenges** and **approach**, **key results** and a short **conclusion**.
- **Introduction** (~1 page) including brief **background information** on the problem with key references, main **challenges**, **objective** of your work, **hypotheses** to be tested, **significance** of your work, and the **structure** of the report.
- **State of the Art** (~2 pages) where you describe what is known in the field (compilation of at least three technical papers), and what is relevant to your case study. All figures and tables must be cited in the text, and properly referenced.
- **Case study results and discussion** (~6 pages) structured according to the 6 categories (Q1. Define circular product, Q2. Best carbon footprint materials, Q3. Circular supply chain, Q4. Impact assessment, Q5. Cost model of product, Q6. Initiatives.) and where you develop **your idea**, with clear and explicit **hypotheses**, detailed analyses, calculations and results. This is where you **critically analyze** and interpret your results **in light of the state of the art**, in particular the technical papers from that section. The **accuracy** and reproducibility of your results should be addressed. You should add **sensitivity analyses**, where you check the influence of one parameter on the final results. You can also include a section on how the results could be further improved. Illustrations e.g. graphs, pictures or tables should be used and systematically referenced in the supporting text. Figures without written description are useless. To avoid extreme final file size, make sure to paste as jpg or pdf your xls graphs, sketches, etc.
- **Conclusions** (~0.5 page). This is a summary of the work, stating **what was learnt**, implemented and how this work could be **expanded** and/or applied to a specific context.

NOT counted in the 10-page limit:

- **Authors' contributions**, a paragraph where you indicate the contribution of each author of the report. You should also specify that 'All authors reviewed and approved the final written document.'
- **Acknowledgements**, a paragraph where you acknowledge persons and institutions which you have contacted or visited, have provided data, etc.
- **References**, with one section for **published peer-reviewed data**, and one section for non-peer reviewed data such as company reports, magazines data and misc. internet data with access date (see following slide).
- **Appendix**, where you can include relevant technical information, details on calculations, etc.

- You are encouraged to reference papers, patents, company reports, press-releases, and other sources to justify your arguments and enhance your assignments.
- This includes figures, drawings, and tables. Please use the APA referencing format/style in your document (See [References \(apa.org\)](https://www.apa.org)).
- Please ensure you have reviewed EPFL guidelines on citation and copyright (see [Citation and copyright – Library - EPFL](#)).
- Cite all external sources – be it websites, videos, or other content.
- You are strongly encouraged through the marking rubric to perform further research and to use references to substantiate your answers and arguments and to be creative.

Group project presentations

- 20 pts total
- May 19, 2025
- 10 minutes presentation, 5 minutes questions
- Everyone from each group must present
- Graded over same 6 categories as in report, see next slide
- Aim for 10 content slides (plus outline & cover) in landscape format
- Have some spare slides in annex to answer questions
- Large fonts especially on charts (are they visible at the back of the room?)

Group project presentations

- Graded over 6 categories (20 pts total)
 - **Define product (2 pts)**
 - Value proposition versus incumbent, new design
 - Circular business model canvas
 - **Best carbon footprint materials (2 pts)**
 - Materials selection
 - Design for circularity
 - **Circular supply chain (2 pts)**
 - Manufacturing route including supply chain,
 - Supply chain systems map template, MFA, circularity metrices
 - **Impact assessment (6 pts)**
 - State main environmental and societal burdens of the product and how their approach mitigates these
 - SimaPro LCA of product
 - Split into scope 1,2,3 upstream and 3 downstream categories
 - **Cost model of product (2 pts)**
 - Manufacturing and reuse and CAPEX including downstream
 - **Initiatives (6 pts)**
 - Give SMART sustainability initiatives quantified by the studies and stakeholder engagement plan

- You are encouraged to utilize AI tools to aid the research of your assignment, however we consider that you will learn more restricting this to data searches.
- If used, document them and include your prompts in your report as an annex. There is no page limit for prompts.
- Where AI assistance is utilized, and also for references in general, you need to own the results and it is strongly recommended to check the sources and to rewrite this in your own words.
- It is your sole responsibility to fact-check and ensure the accuracy of your work.

Best group projects prizes

3 best projects selected on 19th May

- 1st Prize: Bag + 75 CHF EPFL shop (La Boutique) per student
- 2nd Prize: 50 CHF EPFL shop (La Boutique) per student
- 3rd Prize: 25 CHF EPFL shop (La Boutique) per student

The course grading is on 100 pts, based on 4 assessments:

1. debate (10 pts)
2. report* (50 pts)
3. presentation* (20 pts)
4. 1hr written exam (multiple choice questions, 20 pts)

(*) The presentation and report are graded using marking rubrics (see detailed guidelines on the course moodle page)