LERNFABRIK ECODESIGN

Interreg Baltic Sea Region

EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND

MANUAL
for Learning Factory Ecodesign workshops
- How to design for the circular economy

Dr. Max Marwede, Tapani Jokinen, Christian Clemm,
Andre Paukstadt, Florian Hofmann
Fraunhofer IZM 16.10.2018

LERNFABRIK ECODESIGN

Umwelt Bundesamt

Fraunhofer IZM

Imprint

Contact

Dr. Max Marwede, Christian Clemm, Tapani Jokinen
Dept. Environmental and Reliability Engineering
Fraunhofer IZM · Berlin
lernfabrik@izm.fraunhofer.de
www.izm.fraunhofer.de

Conrad Dorer
German Environment Agency (Umweltbundesamt) · Dessau-Roßlau
conrad.dorer@uba.de
www.uba.de

The Learning Factory Ecodesign was developed within the EU-project EcoDesign Circle and co-funded from the German Environment Agency (Environmental Research Plan – project number 3715 37 309 0) and the European INTERREG Fund for the Baltic Sea Region.

Intro

This manual is for ecodesign trainers, consultants and academics who would like to understand the **Learning Factory EcoDesign** training approach, process and methods. The manual should enable the reader to prepare, run and facilitate the **Learning Factory EcoDesign**. It mainly consists of "slides" for the participants, which describe the tasks given during the training, complemented with notes for the facilitator. You can find the templates for the workshop and more information about ecodesign on the **Sustainability Guide** (https://sustainabilityguide.eu/ecodesign/).

Some previous knowledge about ecodesign and Circular Economy as well as know-how regarding the execution of trainings is required to prepare and run the **Learning Factory EcoDesign**. Additionally, we can offer a "train-the-trainer" seminar in order to elaborate on the before mentioned skills and practice, using some of the needed tools. In case you are interested, please get in contact with us.

Yours sincerely,

Max Marwede, Tapani Jokinen, Christian Clemm,
Andre Paukstadt and Florian Hofmann

Content

Mission, goals and target group

The **goal** of the **Learning Factory EcoDesign** is to provide a quick and easy way for the participants to evolve from an ecodesign beginner into an ecodesign practitioner. The **Learning Factory EcoDesign** offers the participants methods and know-how to develop economically and environmentally friendly products and services, to minimize their environmental impacts along their life cycle and to motivate companies to take a step towards the Circular Economy.

The **mission** of the **Learning Factory** is to convey to practitioners and teachers particularly from the sectors design, engineering and economics how to enable circular systems. Therefore, the participants shall take part in a user-centric ecodesign process, using ecodesign tools and methods to minimize the environmental impacts of products along their life cycle, and to maximize the benefits these products provide to businesses, users, network partners and society as a whole.

The **Learning Factory EcoDesign** should sensitize the participants to ecodesign, ease access into the topic, provide tools for practical work, and convey the crucial issues regarding ecodesign.

The **Learning Factory EcoDesign** is for **professionals** from product design and -development (designers and engineers), sales, marketing and business development – people who have some experience in their working environment and are motivated beginners in the field of ecodesign. In general, anyone with an interest in learning how to adopt ecodesign practices and who would like to seize the opportunities offered by Circular Economy may participate.

The approach of the **Learning Factory EcoDesign** training is constantly evolving. Especially the first trainings are important for making adaptations, taking into account the participant's feedback. ANNEX I "Adaptations" (page 64) gives an overview of the adaptations that have been made after the first trainings.

General method (training approach)

The training approach integrates methods and know-how from user-centric design, ecodesign, and the Circular Economy principles into the design-thinking process (double diamond, design-sprints), creating an ecodesign sprint. Due to diverging and converging sprint phases, the participants will have the opportunity to develop a wide range of ideas, before narrowing them to a few more detailed approaches.

Based on this approach, Ecodesign Challenges will be solved in a practical way, by identifying user needs and environmental impacts, defining a design challenge, creating innovative ideas to solve the challenge, prototyping a circular product-service-system while identifying ecodesign requirements, services, partners, and business opportunities within that system, and developing a Circular Economy business model. Simultaneously, the following questions will be answered: What does the user need? How do I extend the lifetime of products and close the loop for components and materials through reuse, repair, remanufacturing and, as the very last step, recycling? Which business models are suitable for “circular products”?

During the training, the participants will work in multidisciplinary groups, just like in a real life working environment. In this way, the social skills, which are necessary to ensure the success of a group, will be developed.

The training will constitute a mixture of teaching theoretical concepts, presenting methodologies and conveying know-how in a practical, participatory, creative and problem-based way. The knowledge and methods will be applied either to a generalized example or a concrete example from real life practice. In order to solve complex problems, it is important to recognize systems and to understand them, ask the right questions and learn about principles and methods. The participants will make mistakes, but will be able to correct them, while working out their own solutions. They have to deal with the conflict between goals, limitations and barriers and look for ways to overcome these obstacles.

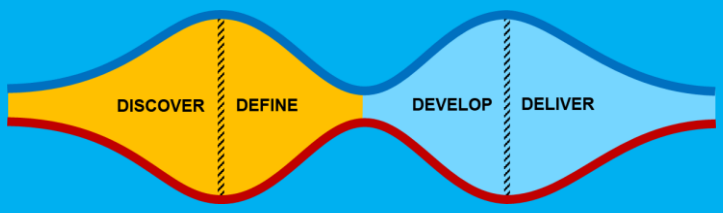
For motivation and inspiration, examples from real life practice on a product level as well as on a company level (economic business models) will be shown to the participants. A short introduction to environmental assessment will provide first insights into the complex structure of quantification of environmental impacts.

The training process

High-Level Learning Factory EcoDesign Sprint Process

The EcoDesign sprint is a process that marries the best of user-centered innovation and design thinking with sustainable design practices. We have adapted the *Design sprint* methodology, integrated ecodesign practices and life cycle thinking.

1.Discover
Understand the needs and challenges.
2.Define
Define the problem: Translating research insights into opportunities for design.
3.Develop
Ideate: Generate ideas for solutions to the problem.
4.Deliver
Prototype it in the *Business Model Canvas* and *Circular Life Cycle Canvas* by looking at the whole system. Build the solution and test it.



Design thinking was developed by IDEO and Stanford's design school and utilized by Google Ventures ´Design Sprint Methods`.

LERNFABRIK ECODESIGN

 Source: Double Diamond design process model developed by the British Design Council in 2005.

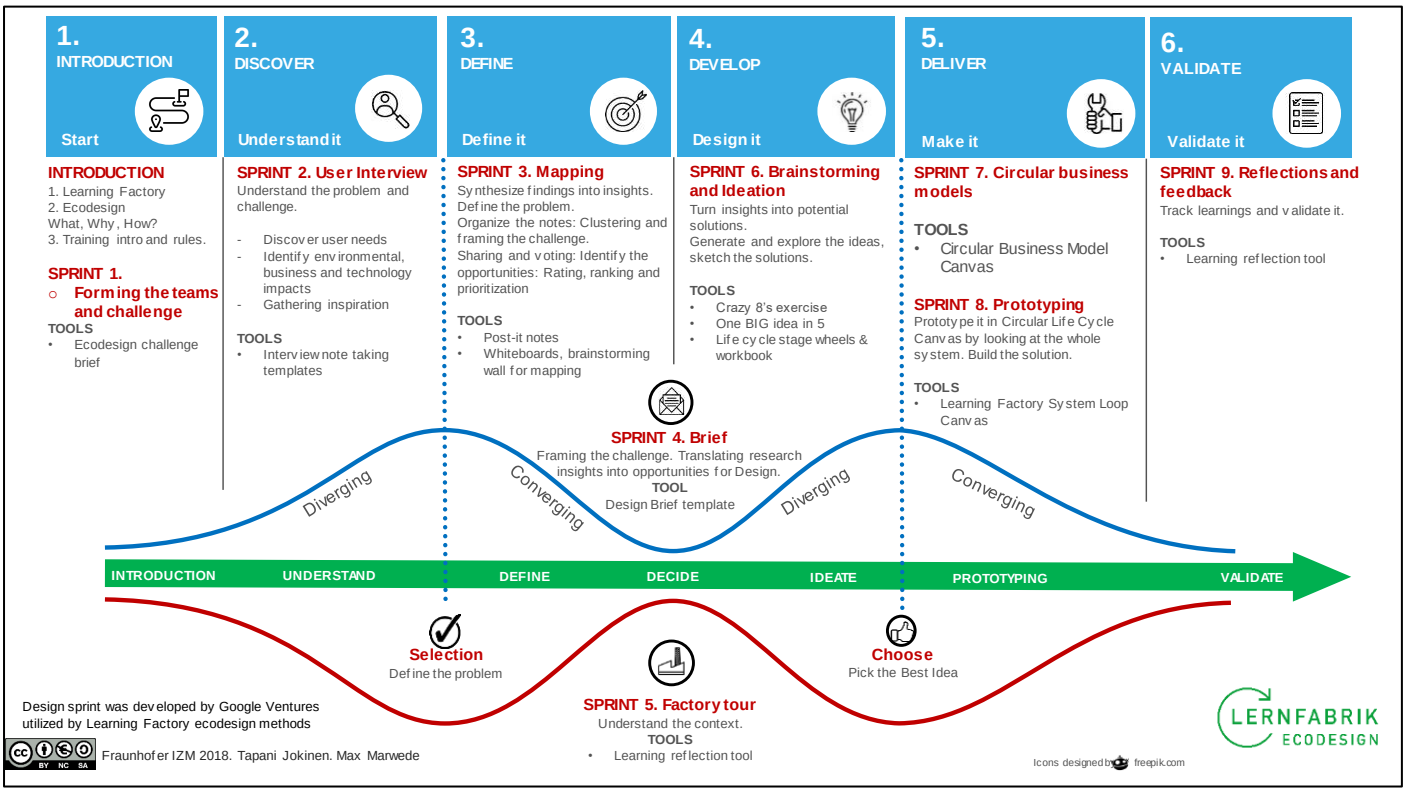
The overall training approach is based on the Design sprint methodology. The Design sprint is a methodology of agile user experience and a product design process that puts business, technology and especially the user in the centre. Basically, it is a process of structured brainstorming for answering critical business questions through design, prototyping, and testing new ideas with users throughout the course of the training. The „double diamond" shows that there are divergent and convergent phases (see graphic above). In all creative processes you combine divergent thinking (creating ideas, collecting insights) with convergent thinking (clustering, summarizing, developing solution). The double diamond shows that this takes place twice. In the first two phases (discover and define) the design challenge is defined (problem definition phase), in the third and fourth phase (develop and deliver) the solution is created (solution phase). We added two „phases". The introduction phase to set the mind-set and bring everyone on the same level of knowledge and the validation phase, where your results are validated. The first diamond is to understand and define the problem – **Design Thinking.** The second diamond is for solving the problem, ideate, test and iterate the ideas for implementation - **Design Doing.**

"Sprinting" means that you have to fulfil a task in a defined short period of time. This „time-boxing" is essential to trigger the right types of behaviour from the participants. It is not only important because it accelerates the generation of results but also takes advantage of the core part of human nature – energy economy and social collaboration. And there are also time limits in real life. The time limits set people under stress, so make sure that there are enough breaks. Also emphasise again that the goal of the training is to understand the way of thinking and learn the methods - the actual results are not that important. That means that people can also start to have fun and be creative during the process. Our experience showed that participants are sometimes „annoyed" by the strict timing but as mentioned above it is part of the methodology. You can remind the participants that when they use this approach in real life, they can extend the time-spans of each sprint. In reality, they will also have time in between phases to validate the results or look for more information. Furthermore, it would also be more of an iterative process, allowing one to jump back in case new insights occur. In the two-days training it is not possible to allow extra time for that.

Umwelt Bundesamt

Fraunhofer IZM

Overview of the training schedule

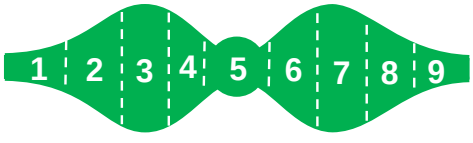


The training is organized into six phases: Introduction, Discover, Define, Develop, Deliver and Validate.

The phases furthermore are divided into 9 sprints:

1. **Sprint 1 INTRODUCTION.** Forming the teams for different ecodesign challenges. Set up the training mission.
2. **Sprint 2 DISCOVER (Research phase).** Discover user needs and challenges. *Method*: User interview to collect insights for the challenge.
3. **Sprint 3 DEFINE.** Synthesize findings into insights. Define the problem and opportunities. *Method*: mapping and clustering.
4. **Sprint 4 DESIGN BRIEF.** Framing the opportunity. Translating research insights into opportunities for design. *Method*: Design Brief.
5. **Sprint 5 FACTORY TOUR (optional).** Show real production environment; Showcase the effect of eco-design on the environmental impact during production.
6. **Sprint 6 DEVELOP**. Ideate – find solutions for the design challenge: turn insights (from the first diamond) into potential solutions. *Method*: Creativity tools such as brainstorming & sketching, clustering and prioritization.
7. **Sprint 7 DELIVER.** Develop your business idea and explain how it works within the circular business network. *Method:* Circular Business Model Canvas.
8. **Sprint 8 DELIVER.** Prototype the circular system based on the selected idea (system design). Prototyping allows to develop a circular system and test it out. *Method:* Circular Life Cycle Canvas
9. **Sprint 9 VALIDATE.** Reflections and Feedback

For better guidance this manual provides a graphic in the upper right corner, which always shows the current step.



Preparation: before you start

Rough planning (months in advance)

Timing

- Planning should start about three months before the training
- Set a date on which the training should take place
- Consider who should attend the training and how to invite them to the training
- Go through the training concept and adapt it to the target group if needed
- Set up an agenda: plan duration for individual work phases, breaks, explanations or moderation, decide whether and how to implement the “Factory Tour”

Invitation

- Write an invitation text (topic, date, location, what is the goal, what is to be done, who will participate,…) and design a registration form (online or PDF) [see ANNEX II „Invitation Letter“ and ANNEX III „Application Form“, page 65 and 66]
- If training will be held in a company, consider which department should attend the training and get in touch with it (recommendation: marketing, management, product development, environmental management, controlling / financing, production)
- Identify and address stakeholders (recommendation: associations, business development, research institutes, incubators,…) who can invite contacts from their networks to the training (about 6 – 8 weeks before the training)

Venue

- Reserve a room large enough for the number of participants: The room should have enough room on the walls to attach post-its or templates - better are mobile whiteboards / pin boards. Each workgroup should have a whiteboard / pin board. In addition, there should be space to set up working islands (tables to either stand or sit around) for each workgroup (size of group: 4 – 6 persons)
- If Sprint 5 “Factory Tour” takes place, contact the person responsible for the production facilities. Clarify how they can be integrated into the training (optional training part: visiting the manufacturing environment)
- Designate one or more moderators (one moderator for two working groups is recommended); if possible arrange a first briefing with the moderators

Preparation: detailed planning

2 – 4 weeks before the training

Organization
- Organization of meals (coffee, tea, cold drinks, lunch, snacks,...)
- Identify the design challenge(s) [for example by using the information from the application form; see ANNEX III „Application Form“, page 66] or create your own. Prepare the pitch of the challenges within the training (see page Seite 22)

Workflow
- Precise planning of the workflow and the moderation (what information and materials should be available at which time)
- Prepare a presentation explaining the objectives, the steps and the tasks of the training

Materials
- Narrow felt-tip pens (blue or black)
- Post-its in 5 different light colors, large enough so that the writing is readable
- Thick printing paper for notes, drawings, …
- Small adhesive dots in three different colors (e.g. red, yellow, green)
- Wrapping paper to cover the pin boards or walls (thus can be written directly on the paper)
- Scissor
- Masking tape
- Whiteboards or pin boards (at least one for each team)
- Whiteboard markers or fat markers (e.g. in red, blue, black, green,…)
- Beamer
- Laptop
- Timer or clock (Smartphone works as well)
- Gong / singing bowl / bell to attract the attention of the group
- Camera for documentation
- Prepare worksheets and templates and print them out for each workgroup. You can download all templates in high-resolution here.
  - A4 Team Template (page 24)
  - A4 “The Ecodesign Challenge” (page 25)
  - A4 “Design Brief” (page 36)
  - A4 Environmental impacts template (page 56)
  - A0 “User Interview” (page 29)
  - A0 Circular Economy Business Model (page 48)
  - A0 Circular System Canvas (page 54)

Preparation: last preparations

One day before the training

Venue

- It is best to set up the room the day before the training, i.e.:
  - Prepare worksheets and templates and print them out for each workgroup
  - Make sure that there is enough room on walls/windows/cupboards/pinboards to post post-its
  - Set up working islands for teams of 4-6- people
  - Provide moderation materials and tools (a place or table for the moderation materials should be available)
  - Equip the working islands with post-its and narrow felt-tip pens; possibly distribute only the colour that should be used first and post-its in different colours only when the respective work task take place
  - Test beamer and laptop
  - Provide space (tables) for cold drinks, snacks and coffee & tea inside the room, so that the participants can cater for themselves

Moderation

- Clarify the roles of the facilitators (one person can have several roles)
  - Moderator/facilitators explain tasks and present content
  - Coach helps teams in the group work, if needed: explains task again, helps on the method or gives impulses and ask questions to help out
  - Host takes care of wellbeing of participants. Checks the energy level, takes care of breaks, moderates “energizers” and is the first person to be asked in case organisational questions and requests from the participants (http://thetrainingworld.com/resources/Training_Methods_and_Activities/Energizers/)
  - Time keeper: keeps track of the overall process and plays gong / singing bowl / bell to end each sprint or attract the attention of the group

During the training

Moderation

- Clarify the roles of the facilitators/coaches/host/time keeper to the audience: who is in charge of what.
- Please ask permission for photographing and filming and possible publish pictures in social media.
- Make sure to stick to your planned timing – a delay in one task is difficult to catch up on during later tasks.
- Put emphasis on the idea of sprints, so that the teams will not be as frustrated by the short timing of each sprint - understanding the method is more important than arriving at a perfect solution to the challenge. Running a marathon in sprints is hard work but lots of fun.
- Explain that the training is about the learning journey not the end results. It is a great opportunity to test wild ideas and become creative.
- Make sure to guide the discussions within teams during sprints when required. For example, teams will sometimes have a hard time to come to a consensus on certain issues – it is important to remind them that it is more about learning the methods than to arrive at a result that represents everyone's ideal solution to the challenge.

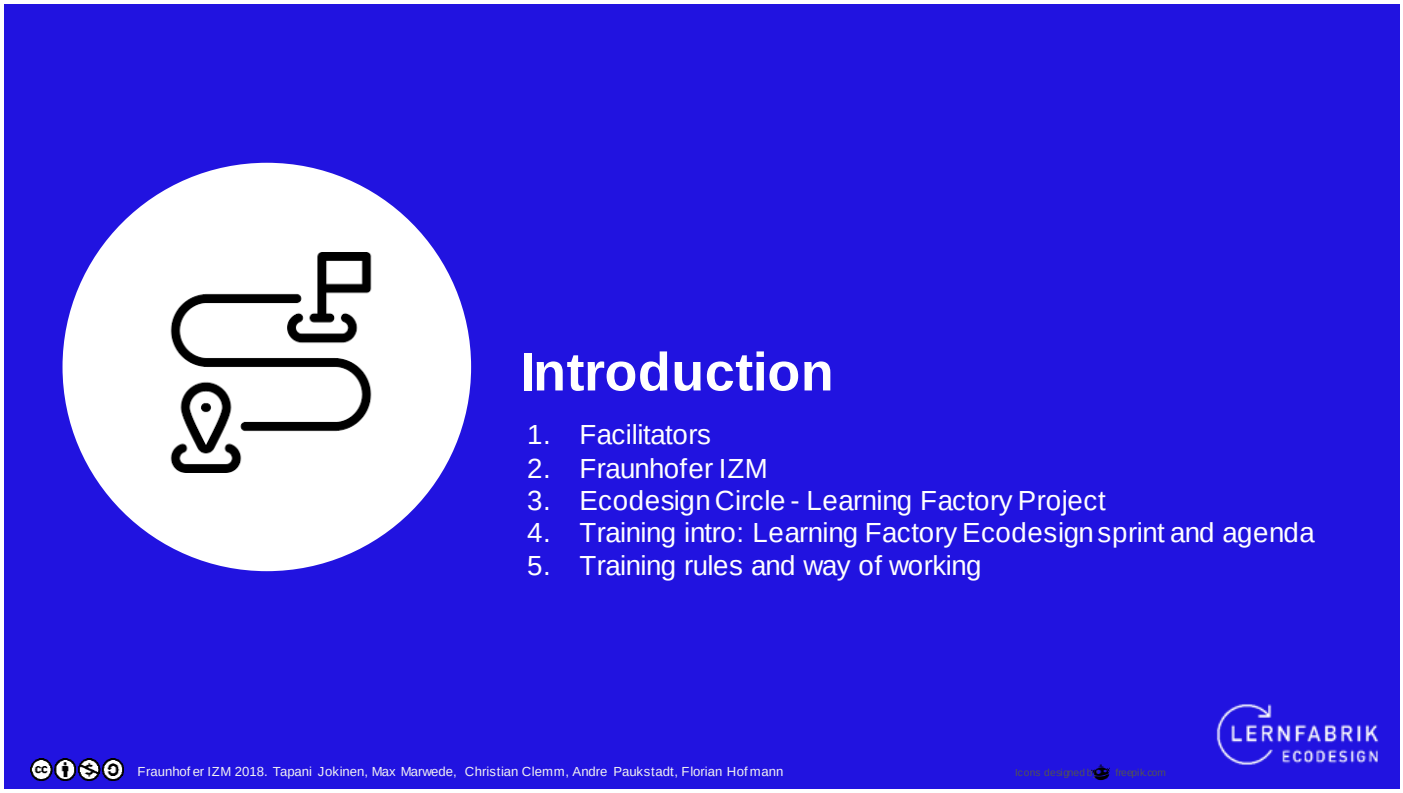
Venue

- Make sure that there are enough beverages, coffee, snacks and fruits and that people can help themselves.
- Also make sure that there is enough fresh air in the room.
- Tables should provide enough space for the desired size of each team, but should be small enough to enable dynamic discussions.
- Show countdown-time for each sprint (either use large analogue timer or digital timer via beamer).

THE TRAINING

Day 1:

Day 2:



Task
- Welcome everybody
- Introduction of the facilitators
- Introduction to overall training (goals and process, agenda)
- Short explanation of what to expect from the training
- Introduction to training rules and way of working

Objectives
Giving the participants a first glimpse of what the training is about

Task description
1. Oral introduction of facilitators (name) and their role (moderator, coach, host)
2. Explanation of the sprint-concept and the agenda
3. Provide the rules and how to work

Timing
10 minutes

Notes/insights
Make sure that the roles of the facilitators/moderators are clearly defined, so that people know whom to address with questions. Avoid facilitators also participating as a team-member.
Ask how participants would like to communicate with each other and facilitator (first names or surnames).

Learning Factory Ecodesign Training
Agenda

1.5 Day

DAY 1		DAY 2	
	Introduction		**Develop**
13:00-14:05	Welcome and introductions Get to know each other	9:00-10:30	Sprint 5 "Start a Factory" Tour
	Discover	10:30-12:00	Sprint 6 "Brainstorming and Ideation"
14:05-14:50	Sprint 1: "Team up and set the Design Challenge"	12:00-12:45	**Lunch**
14:50-15:05	**Coffee Break**		**Deliver**
15:05-15:35	Presentation "What is eco-design?"	12:45-14:05	Sprint 7 "Circular Economy Business Model Development"
15:35-16:15	Sprint 2 "User/expert interview"	14:05-14:20	**Coffee Break**
16:15-16:30	**Coffee Break**	14:20-15:05	Sprint 8 "Protoype Circular System" (incl. env. impact analysis)
	Define		**Validate**
16:30-17:30	Sprint 3 "Mapping"	15:05-15:30	Sprint 9 "Ecodesign Strategy Validation"
17:30-18:05	Sprint 4 "Design Brief"		
18:05-19:30	Check out and Get Together	15:35-16:00	Feedback and goodbye
20:00- ...	**Dinner (optional)**		

LERNFABRIK ECODESIGN

For different agendas, see ANNEX IV "Agenda Variations" (page 67)

Goals of the training

- Awareness raising; point of entry into the topic; know-how, where to get started
- Understand the benefits of eco-design
- Get to know eco-design principles and strategies
- Get to know simple method to develop circular economy business models
- See good examples of sustainable business models
- Get to know user-centric design and system-design methods
- Understand life-cycle thinking
- Learn about environmental assessment methods
- Learn how to work interdisciplinary

MIND-SET-TOOL-SET- SKILL-SET-KNOWLEDGE-SET

LERNFABRIK ECODESIGN

Notes/insight

Make clear that the training is not just about the know-how but also about the mind-set (creative way of thinking) and the skills (e.g. working interdisciplinary, system-thinking). If you have time please ask participants what their personal goals are.

Umwelt Bundesamt

Fraunhofer IZM

Learning Factory training rules

1. No negativity - defer judgement!
2. All ideas are valid at this stage. Every idea is welcome, even crazy ones. Encourage wild ideas! Don´t worry about duplicates!
3. Build on the ideas of others! Mutate and combine ideas - snowball effect!
4. Come up with as many ideas as you can! Go for quantity!
5. Record all ideas, be visual!
6. Stay focused on the topic!
7. Take turns talking - one conversation at a time!
8. No computers, tablets or cell phones!
9. Everyone should contribute - team effort!
10. No domination of individuals – everyone is equal

LERNFABRIK ECODESIGN

Way of working

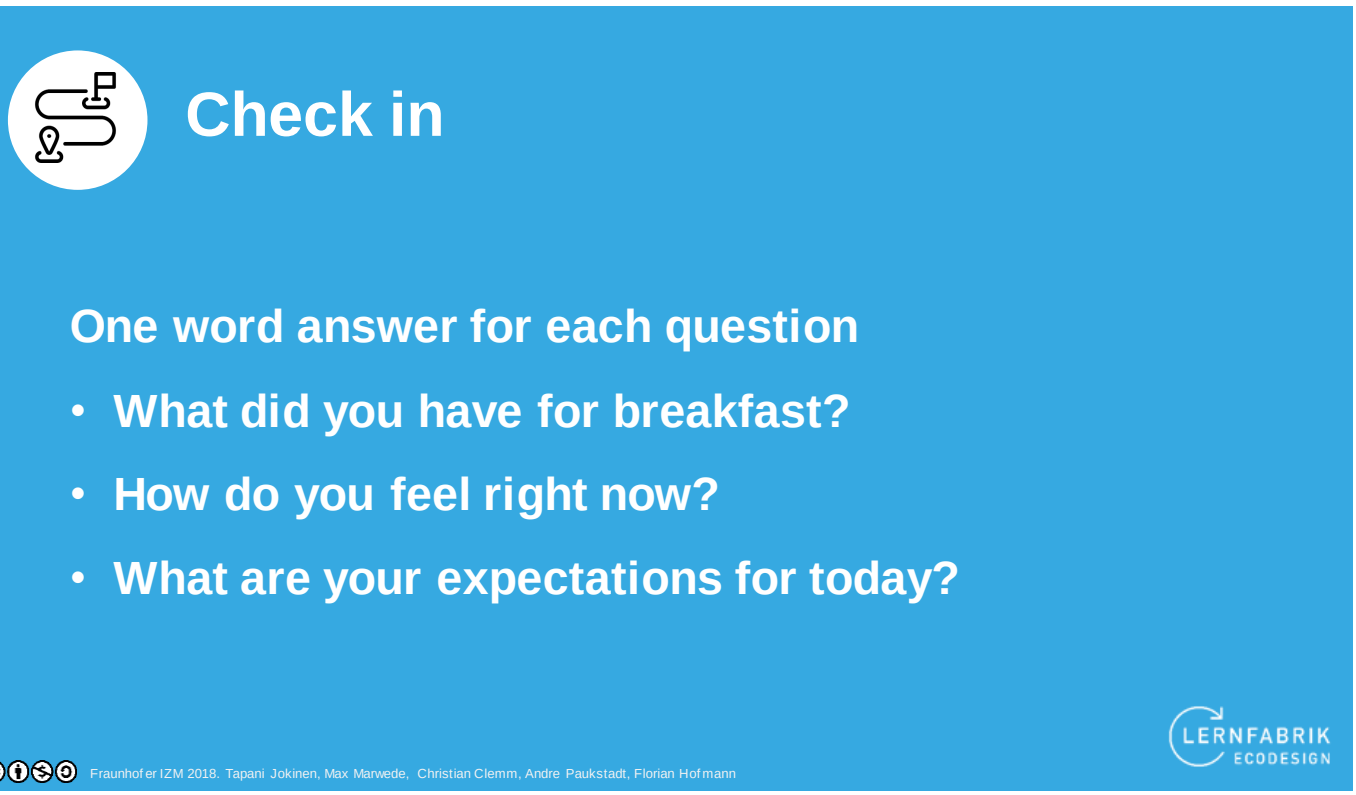
Design is a team sport. Together everyone achieves more.

- X- functional, combining rational business and creative thinking co-creation in a multidisciplinary environment to unlock creativity.
- IPR and possible patens belong the Team. Group effort.
- Promote group thinking and group work.
- Highly interactive hands-on way of working, innovate with speed through fast sprints to learn in practise how to ecodesign.
- Be optimistic, have fun and laugh more.
- Share your passion, inspire and get inspired.
- Play more, work more, explore more, learn more.
- Communicate, tell stories.

LERNFABRIK ECODESIGN

Umwelt Bundesamt

Fraunhofer IZM



Task:
Check up on participants by asking them to answer three questions with one word each

Objectives:
- Help the participants feel welcome in the training space
- Get a feeling for the "vibe" (through question 2) and understand the expectations of the participants
- Give each participant the opportunity / a chance to introduce him or herself to the group

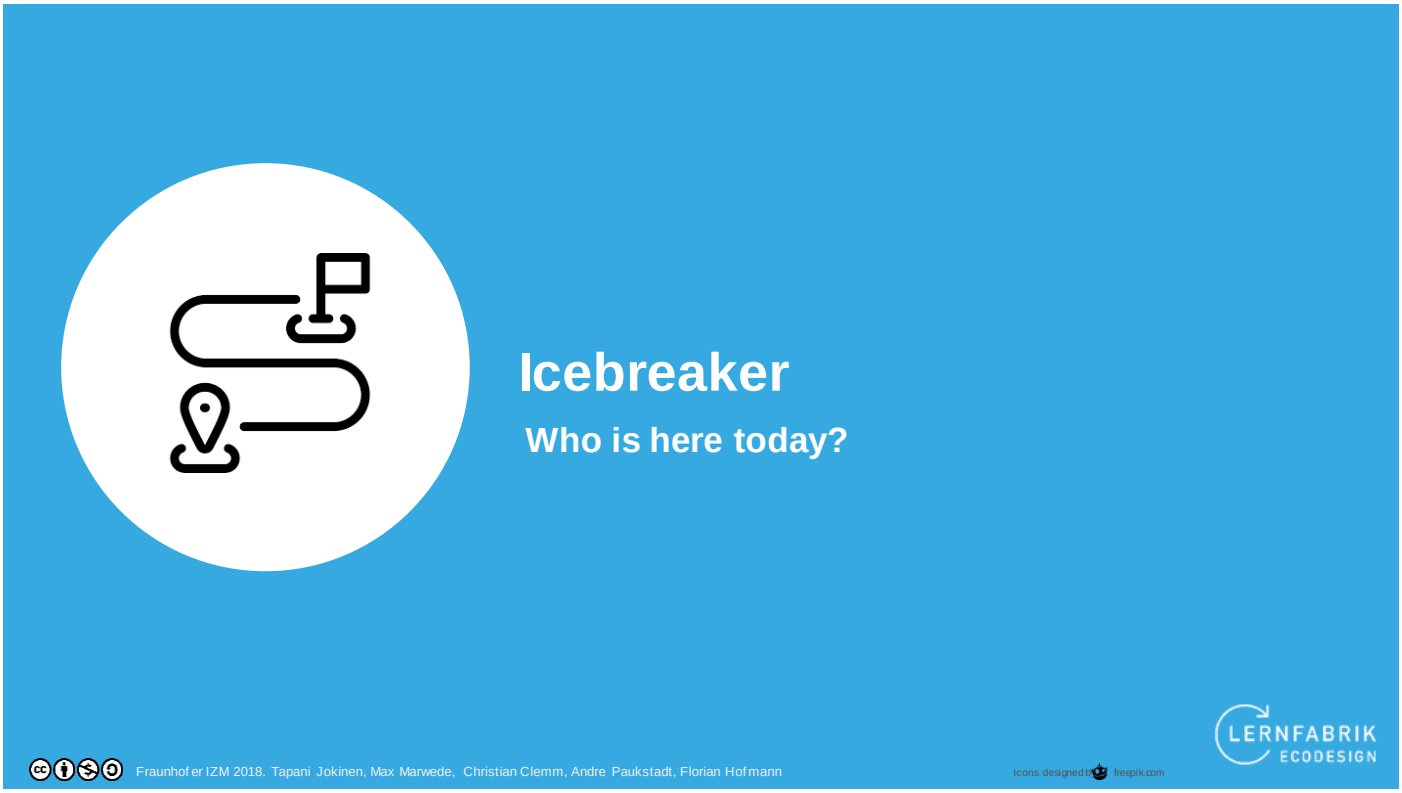
Task description:
1. Participants read the questions on the slides and think of an answer (1 minute)
2. Each participant answers

Timing:
5-15 minutes, depending on the number of participants

Tools/Materials:
Slides

Optional changes/activities:
Participants can start talking in „popcorn style" (i.e. in a chaotic order, not everyone has to answer) or via throwing a ball to each other (the one who has the ball talks). With more time, participants can also answer in a full sentence.

Notes/insight:
The facilitator usually starts and it is important to follow the rules (just 1 word). Furthermore, the facilitator is always the contact person for the speaking participant. So keep eye contact.



Task:
Introduction of the participants through icebreakers

Objectives:
Get some insight about the motivation of the participants; enable participants to learn more about themselves and something about the other participants, establish an atmosphere of trust and friendship

Task description:
1. Oral introduction: Everyone says one sentence: name, profession, and why is he/she here
2. Everyone sketches their neighbour, talks to the neighbour asking why he/she is here (3-5 min), pins the results on the wall and tells who he / she met.

Timing:
20-30 minutes depending on the number of participants

Tools/Materials:
Pen and paper

Optional changes/activities:
For more ideas search for ice-breaker (e.g. https://blog.sli.do/10-ice-breakers-to-kick-off-your-conference/)

Notes/insight:
There are also more dynamic ice-breakers where people have to move through the room in order to get to know each other. Choose ice-breaker depending on type of audience (more formal, more creative).

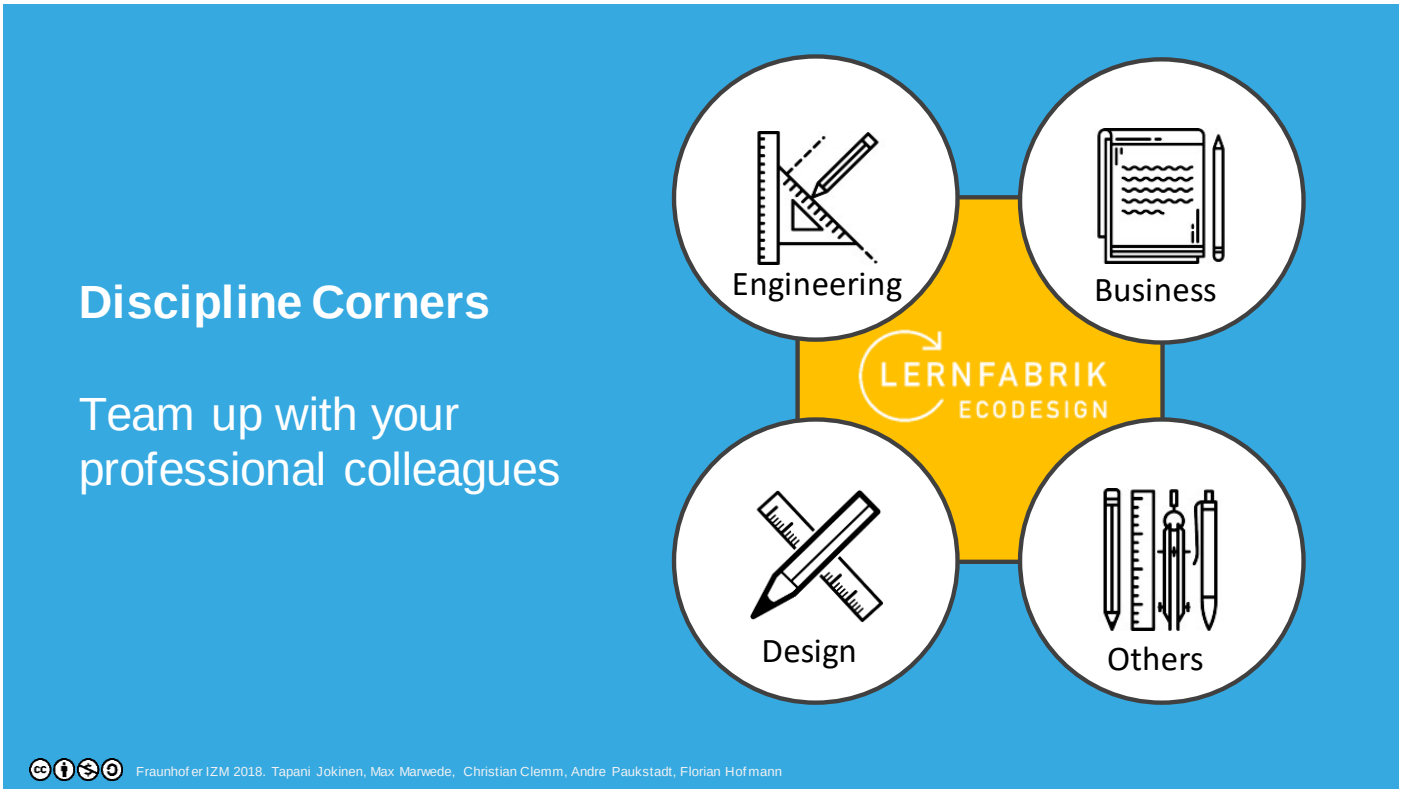
Make a quick sketch ´coquis´ of your team mate

Tools:
Pen
Post-it

Pair up with your neighbour!

Image: geoff_mcfetridge_interview_designboom

Notes/insights
This exercise shows that everyone can draw and it motivates participants to be visual.
Use post-it notes so later on team can stick the sketches to team template (page 24).



Task:
Sort the participants according to their profession in order to mix diverse teams in the next step

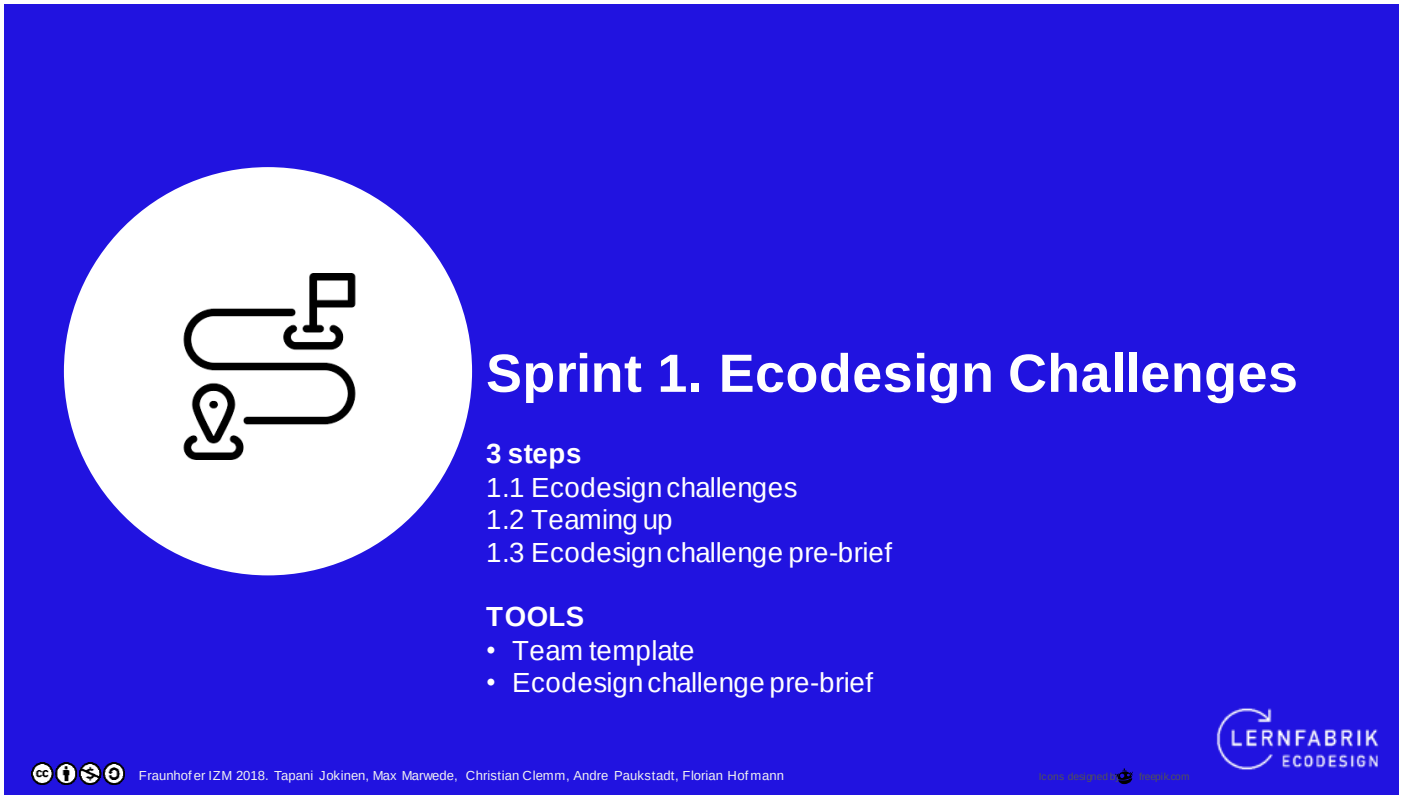
Objectives:
The goal of this activity is to be able to create interdisciplinary teams in the next step.

Task description:
1. Assign a profession to each corner of the room
2. Introduce the 4 corners with the 4 profession fields
3. Each participant should step into the corner that fits the most to his/her profession
4. Each participant receives a coloured dot for their name tag according to their profession (e.g. blue for designers)

Timing:
<5 min

Tools/Materials:
Places (corners, tables) are assigned to one profession
Different coloured dots (can be placed on the name-tag of each participant)

Notes/insight:
The next step is forming the working groups. The moderators should make sure that the groups are well mixed regarding the professional background.



Task:
Present possible ecodesign challenges and form teams. The challenge represents the problem the participants work on throughout the whole workshop.

Objectives:
Arouse interest to join one challenge and form a team of 4-6 people per challenge

Task description:
Presentation of 4-6 design challenges (explain the environmental aspects of that challenge), depending on the number of participants. Decide whether you will pre-select challenges or let participants pitch their own challenges (2 minutes). Pre-select challenges from participants by asking for “challenges” before the training (challenges should have a relation to the “Factory” part of the training, challenges should be product-centric and simple enough to deal with in the training). Ask participants to join a team of the challenge holder or one person representing the challenge. Distribute people evenly on different teams (4-6 people per team) and make sure that different disciplines are represented in each team (check colour codes on name tag). Let the Teams fill out the “**Team template**” (page 24) as well as the “**Ecodesign challenge brief**” (page 25)

Timing:
3-5 minutes for pitch, 10 minutes for forming interdisciplinary teams, 20 minutes in team to define roles and discuss challenge, i.e. fill out templates.

Tools/Materials:
“Team template“ (page 24) and „Ecodesign challenge brief“ (page 25)

Optional changes
Do the ecodesign sprint within your organisation and select challenge and team beforehand.

Notes/insights
Take into consideration that the challenge holder might influence the discussion within the team because he/she already has more knowledge about the topic. If you wish to avoid this „influence“, you can exclude the challenge owner from the team. Instead, he / she can be interviewed as an expert in sprint 2 (see page 27). The challenge is preliminary, after the first „diamond“ the actual design challenge will be defined in the design brief. For more information on framing a design challenge see http://www.designkit.org/methods/60.

S 1.1 Possible challenges

Join a team! Choose one challenge or pitch your own.

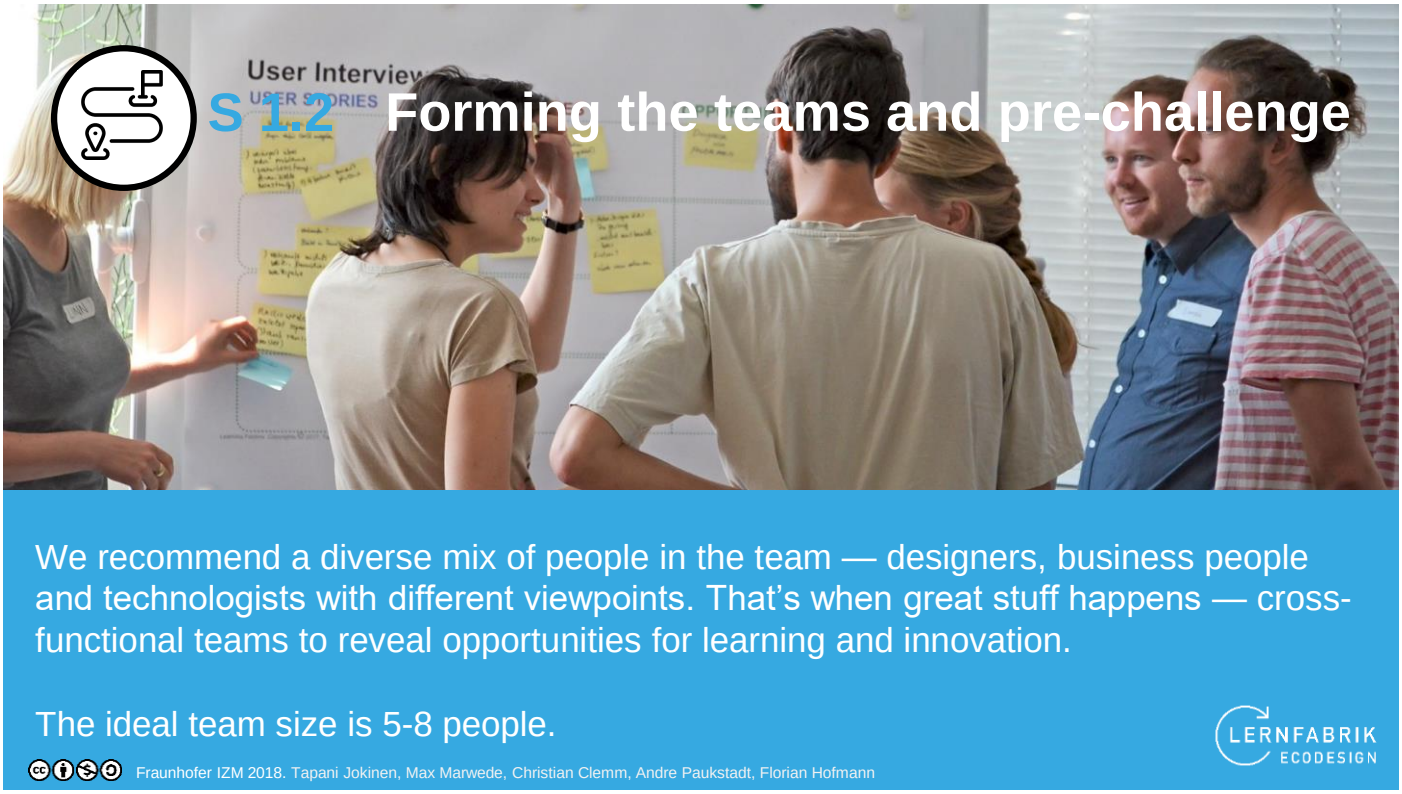
- **Small electric mood light (candle LED)**
- **Electric water kettle**
- **Mobile accessory protective gear**
- **Puzzlephone module**
- **Printer**
- **Your own product related idea?**

LERNFABRIK ECODESIGN

These are possible ecodesign challenges the teams can start with.

Notes/insights

The challenge owner should not join his / her own challenge team, but he / she is the perfect expert for the user interview. Furthermore, superior and inferior shouldn't join the same team.



Task:
Get to know each other in the team and assign team roles

Objectives:
Create clear roles within the team, provide an overview of the team members and get to know them

Task description:

1. Participants should choose roles within their own team
   - Time keeper: Is the person that takes care of the time. Therefore his/her task is to keep the team on track, announce „deadlines" and push the teams if the time is almost over.
   - Team moderator: In this case the team moderator has the role of a team leader. The team lead makes sure that everyone in the team has an equal access to the conversation. The task of the team lead is less to bring his/her own input, it is more to summarize and collect the given input from the team.
   - Expert: Each team member bring in his/her expertise and knowledge into the discussion
2. Participants should also share their expertise with the group
3. Teams should choose a team name in order to strengthen the team spirit

Timing:
5-10 min

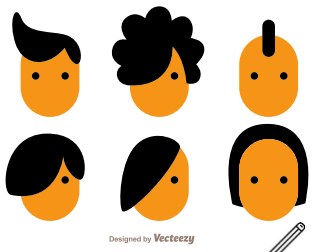
Tools/Materials:
A4 print out of team template (page 24)

Notes/insight:
Make sure that the participants understand their roles and responsibilities. Naturally, people start to chat and exchange during that "exercise". Therefore, give enough time so that people can get started to get to know each other but do not expand that time too long. Maybe also explain different types of team-players (see e.g. Belbin's team roles: https://www.belbin.com/about/belbin-team-roles/) and let the team agree on communication rules within the team. You can also mention that some people feel more confident in the "diverging" phases, other prefer the converging phases. The team-work can be reflected after the first day within the teams.

Team name: Team „Phone Protection Gear“

Team moderator: Anke

Time keeper: Tom



Print out in DIN A4 or bigger

Team: Name, expertise, role

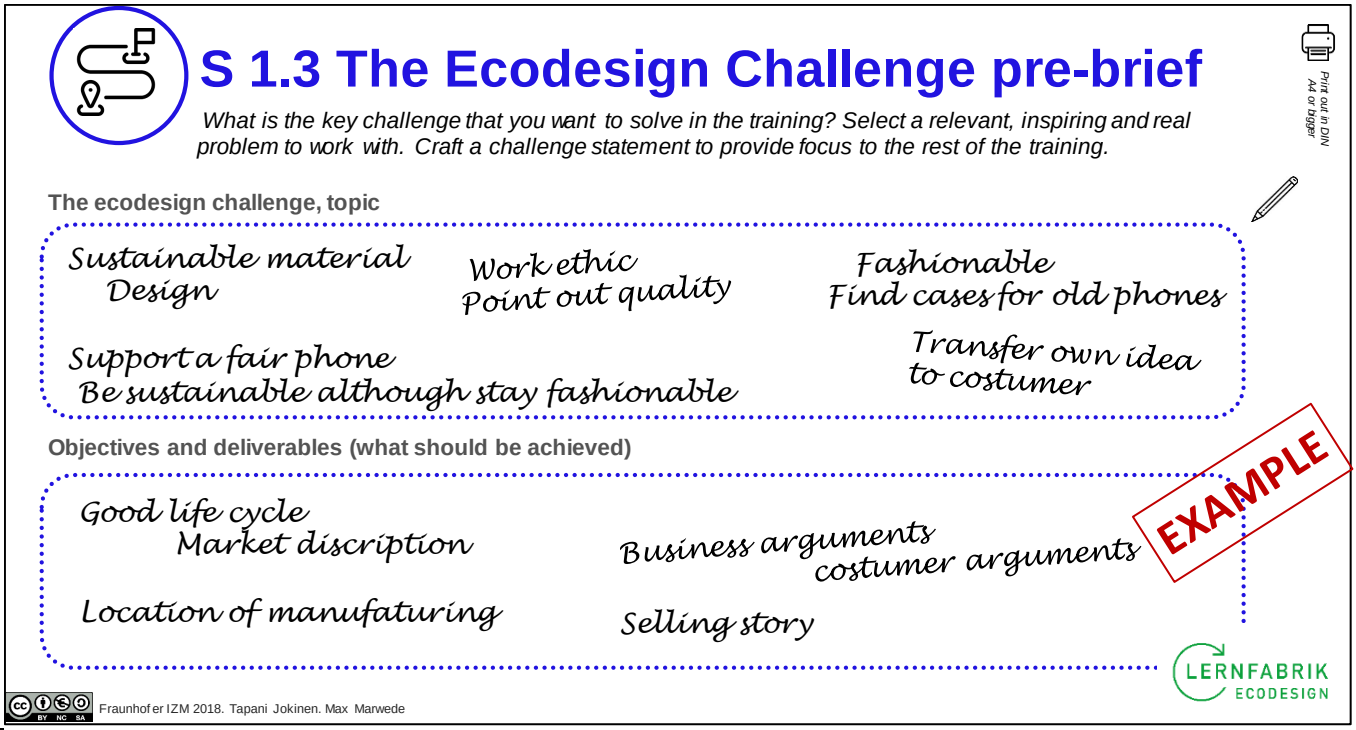
1. Stefanie, environmental science
2. Mike, engineering + materials + risk
3. Tom, design + business
4. Anke, quality management
5. Eduard, product design
6.
7.
8.

EXAMPLE

LERNFABRIK ECODESIGN

Note/insight

Keep the time! Usually teams will spend the time to get to know each other and will ask for more time to fill out the template.



Task:
Pre-define the challenge for the “problem phase”. Teams discuss and fill out template in order to form a common understanding of the challenge in the group.

Objectives:
Get a common understanding of the challenge before starting with the “problem definition phase” (the first diamond).

Task description:
Give each team some time to pre-define the challenge they will work on.

Timing:
10-15 min

Tools/Materials:
A4 print out of the template “The Ecodesign Challenge” for each team (page 25)

Optional changes
Use the checklists (ANNEX V “Checklists”, p. 69) to assess the “benchmark” in order to identify the environmental challenges. You can compare the assessment of the benchmark to the assessment of the final ideas (see Sprint 9 Validate p. 59). You can also use the MESO Matrix developed by the Technical University of Denmark for the assessment (http://www.ecodesign.dtu.dk/Ecodesign-Guide).

Notes/insight:
Explain that there is enough time to understand the challenge during the „problem definition phase“ and that after this phase the team will end up with a better defined challenge, i.e. the „Design Brief“ (page 36).

Task:
Introduction to the topic ecodesign

Objectives:
Set the frame, bring all participants on the same level of understanding

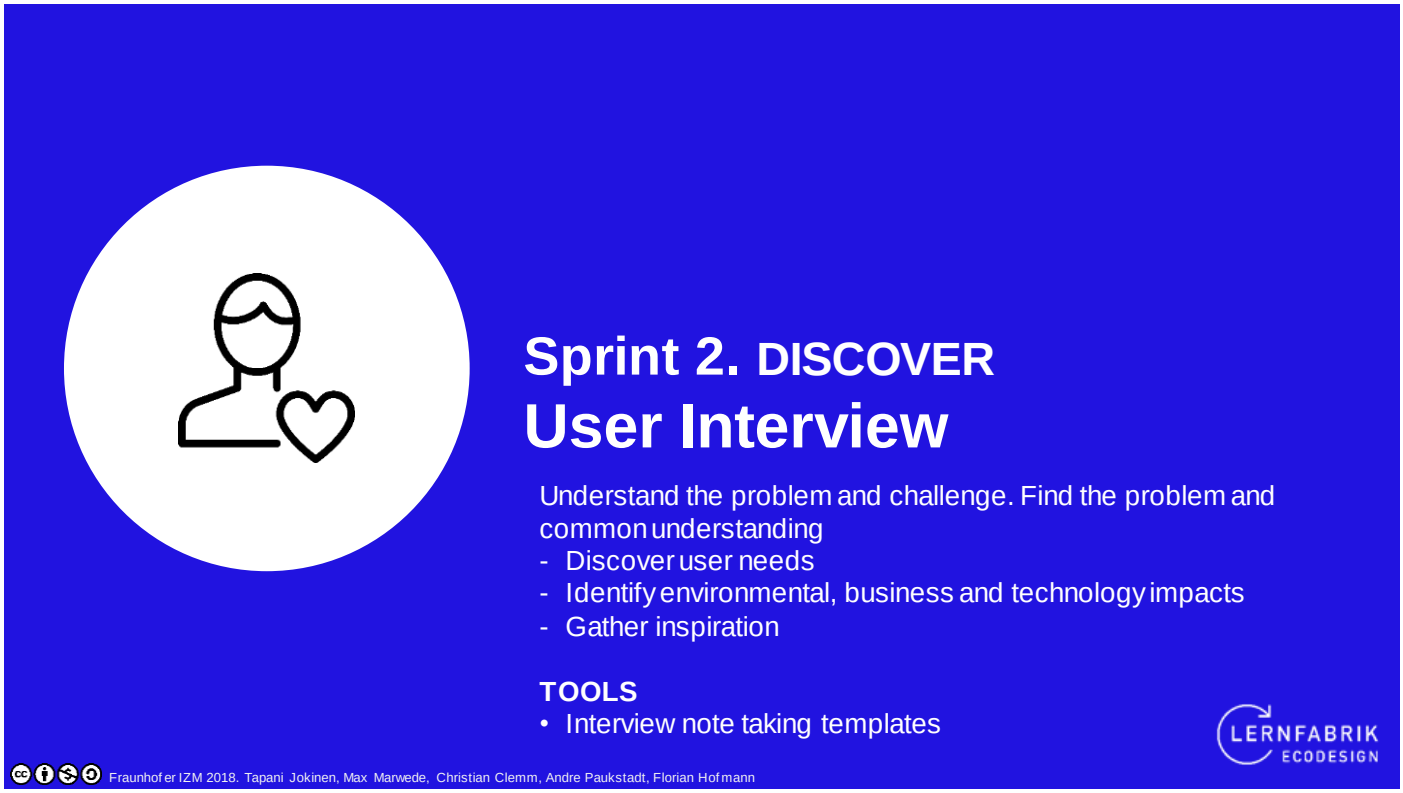
Task description:
Tell the participants, why ecodesign is important, what is the understanding of ecodesign in this context.
WHAT – WHY – HOW

Timing:
15-20 minutes

Tools/Materials:
For this part of the training you need to prepare a presentation explaining ecodesign (What is ecodesign? Why is it important? How to ecodesign?).

Optional changes:
Keep the time and keep it short. Participants will learn the methods by doing the sprints

Notes/insights:
Make it inspirational and tell stories.
Depending on the background of the participants and their understanding of ecodesign their insight into the topic may differ widely. Adapt the introduction to cater to the level of expertise of participants. Do not be afraid to start „with the basics“.



Task:
Understand the challenge better by understanding what a „user“ wants and needs or an expert knows about the topic (e.g. environmental impacts, technology aspects …).

Objectives:
Participants get more insight into the challenge.

Task description:
Within the team one person who is familiar with the challenge is selected as “expert” user (the person you are designing for) to be interviewed. One person is selected as interviewer. The others take notes and can also ask: each insight is noted on one post-it. After the interview is finished, notes are pinned on the **template “User Interview”** (page 29) – one person starts with his/her notes, the others follow. Similar insights should already be clustered together in the process.

Timing:
5-10 minutes to select the expert and prepare the interview, 10-15 minutes for the interview, 20-30 minutes to pin and cluster insights

Tools/Materials:
Template „User Interview“ (page 29)

Optional changes
There are many methods for gathering insight from experts or users, for more methods refer to http://www.designkit.org/ or http://medialabamsterdam.com/toolkit/.

Notes/insights
The time needed to prepare the interview questions should not take too long. Gathering insights from the narration is more important. Questions will emerge automatically in the course of the interview.
Show template “user interview” before the interview so that people know which information they should look for during the interview. Be sure that the template is already hanging on the pin-board.

User Interview

Goal: Collect user stories, challenges, key findings, insights and turn those into opportunities. Clarify the problem at hand, and identify the needs of potential users and the challenges they face in their everyday life.

- Who are the users?
- How do customers use the product and where do they struggle?
- What problems do they encounter, and which ones can the product you're building help them solve?
- Likes, dislikes, motivations
- What are the main environmental impacts of a comparable solution / existing product?

User/ Expert Interview

Directions:
Activity: Group

1. Ask the expert. Select the user / expert from the team or other groups to be interviewed.

2. Prepare interview questions. Use the template.

3. To help set the context, ask users about their experiences using the product.

4. Ask about their likes and dislikes.

5. Ask questions that will elicit user stories rather than yes or no responses.

6. Make sure ⅔ of the interview is devoted to the user talking and your team listening.

7. Each participant writes down notes – one insight per sticky note.

8. Interview roles: interviewee, interviewer, and note taker

LERNFABRIK ECODESIGN

User Interview

USER STORIES

Key moments of the user experience. Ask user about their experiences using the product / service. What do they like and dislike about it? What core needs and motivations do user have?

CHALLENGES

Pain Points
Conflicts and frustrations. User experience, business, technology, environmental challenges, constrains. Competitive landscape

Environmental impacts
+positive
- negative
"What are the main environmental impacts of a comparable solution / existing product?"

OPPORTUNITIES

Framing the opportunity, not the solution at this stage.

LERNFABRIK ECODESIGN

USER STORIES

Phone use up to 8 years

Functio-nality has 1st priority

CHALLENGES

Screen protection

EXAMPLE

Water protection

limitation: One case for different Phone types

+ save re-sources due to longer life cycles

-.....

OPPORTUNITIES

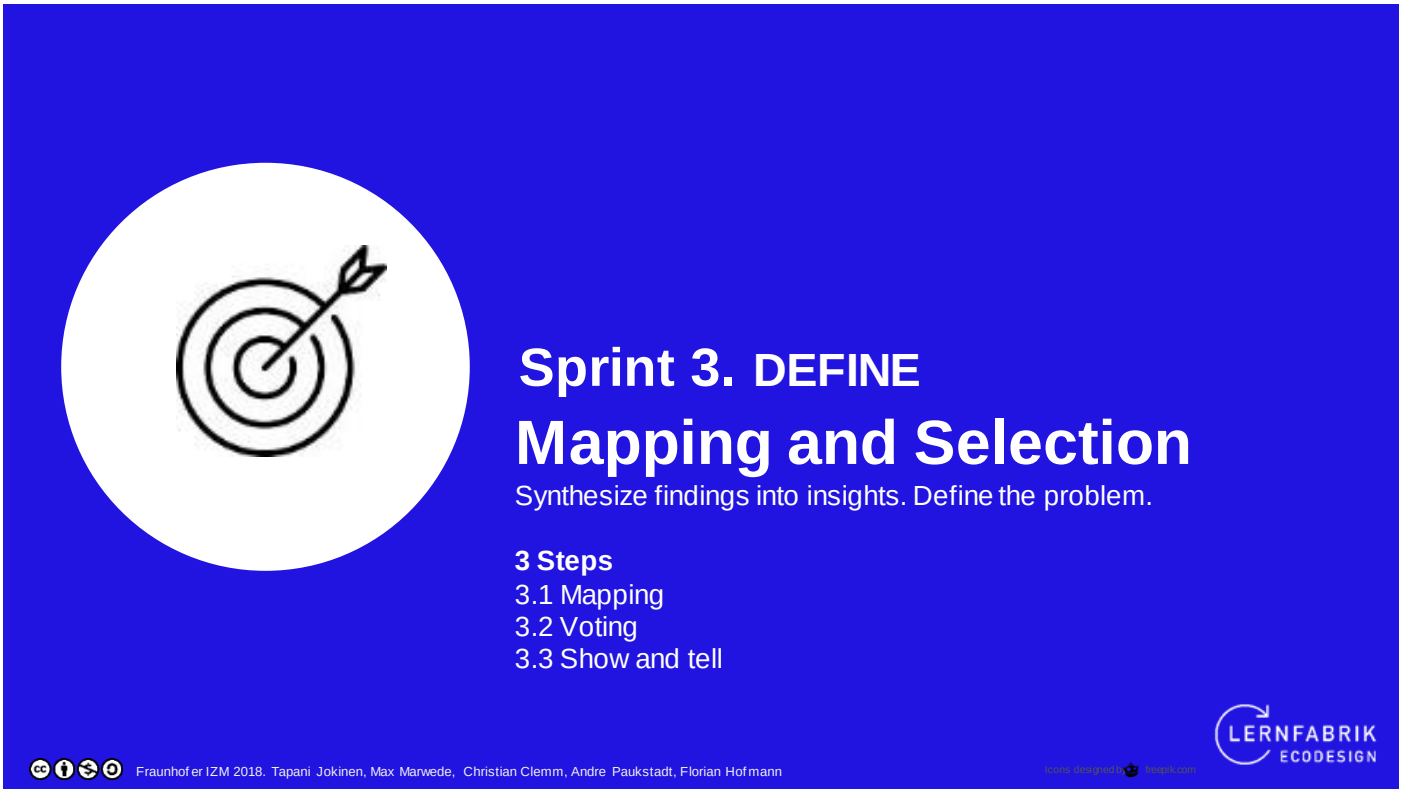
multi use

mark which material is used

LERNFABRIK ECODESIGN

Umwelt Bundesamt

Fraunhofer IZM



Task:
Team synthesize insights.

Objectives:
Cluster and summarize insights in order to select one „promising“ challenge.

Task description:
Participants cluster insights, i.e. sticky notes, into groups. The groups should not reflect different aspects of the same problem but different themes (problems) identified during the interview. Each cluster should be given a heading. Later the participants are going to vote on the “theme” they want to proceed with.

Timing:
This exercise is tricky and takes time: 15-25 minutes for clustering, 5-10 minutes for voting.

Tools/Materials:
Blank wall for clustering. Bigger sticky notes or moderation cards for headings. Three sticky dots per person for voting.

Optional changes
Let participants have a coffee. During that time you as facilitator can pre-cluster the insights. Then discuss with the team, whether they see the same cluster, rearrange the sticky notes according to their ideas and name the clusters together with the participants

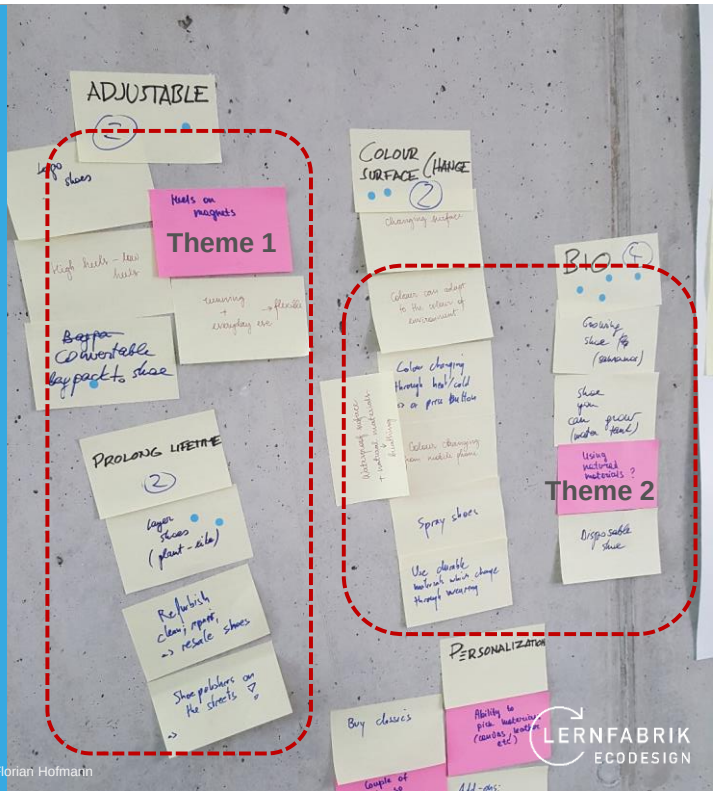
Notes/insights
Help with clustering if needed – it is tricky if you’ve never done it before. Our experience is that the clusters often reflect different aspects of the same problem. Explain that the idea is to focus on one „challenge“ but of course the other insights can be still taken into account in the following exercises. People should put their dots on a cluster heading in order to „create“ majorities – they can accumulate or distribute dots (see example on page 33). The decision criteria is how important the „challenge“ seems to be and how interesting it is to proceed with this challenge (potential for ideation).

S 3.1 Map of different challenges

Directions:
Activity: Group

- Start grouping challenges, opportunities and similarities into categories and **create themes.**
- Look for overlaps or duplicates to get started. Form clusters based on similarities. **Combine related notes**

TOOLS
- Post-it notes
- Whiteboards for mapping



Note/insight:
Mentoring is important if team has no experience. Facilitators can help and guide.

S 3.1 Mapping, clustering and themes

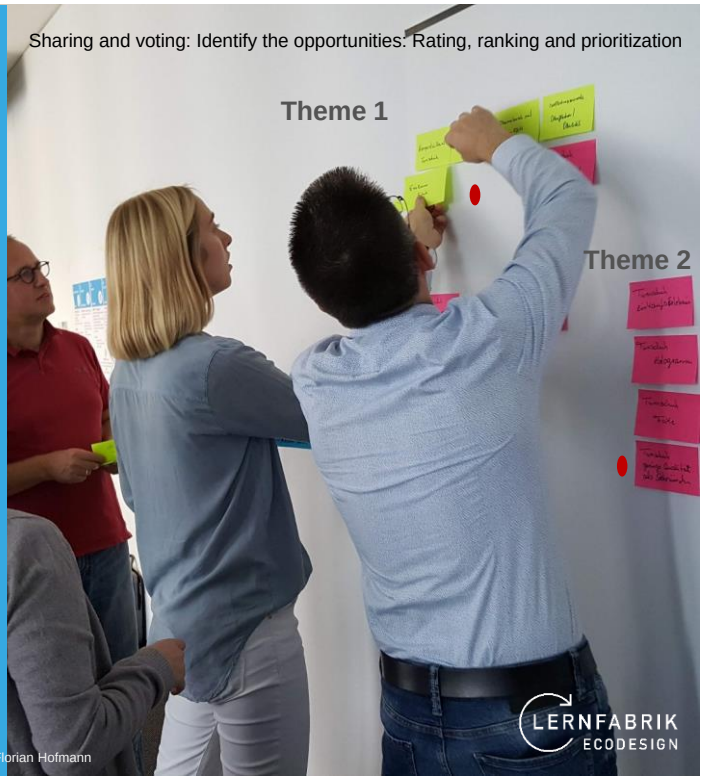
S 3.2 Voting

Directions:

Activity: Individual/ Group

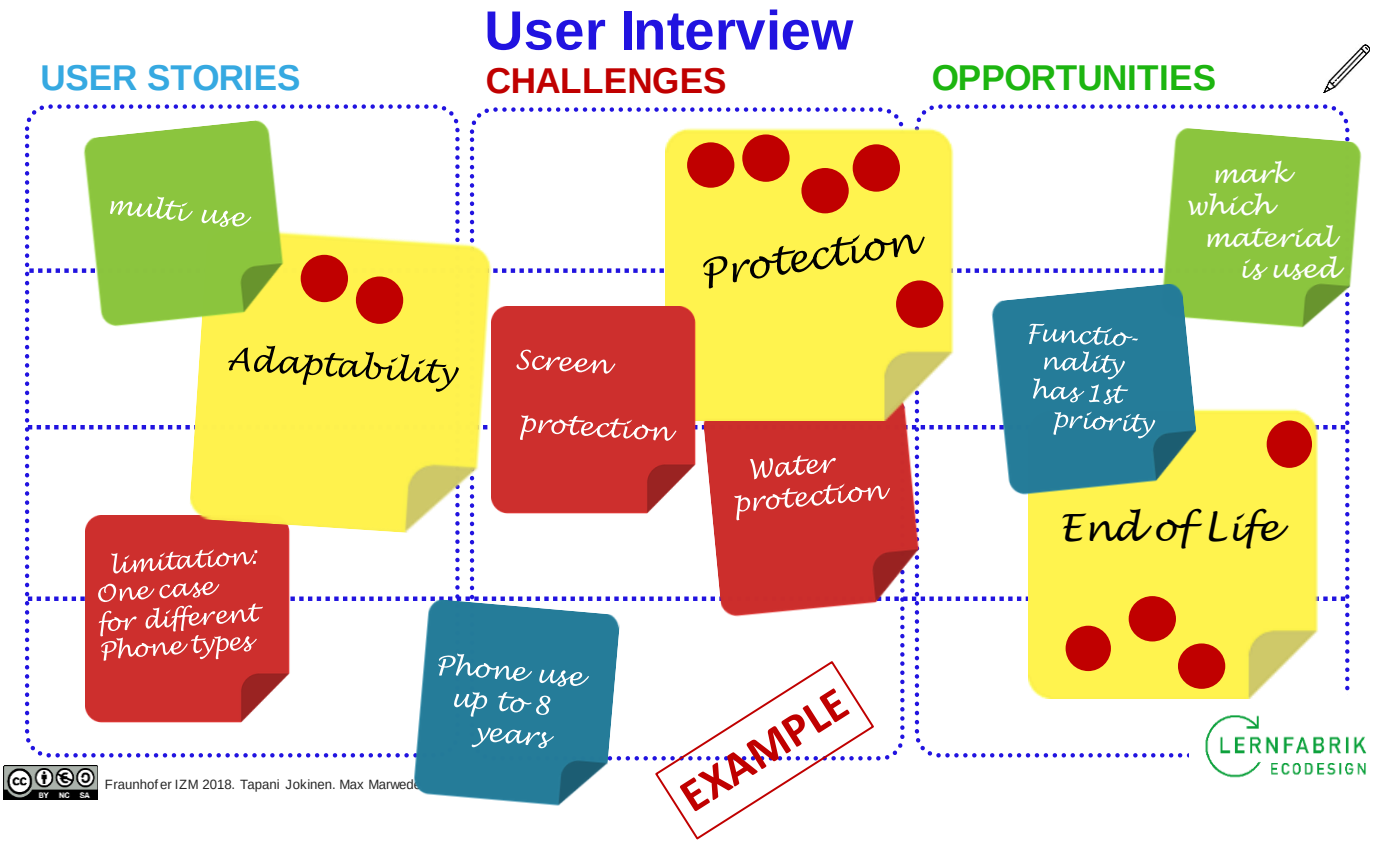
Each team member gets 3 dots.
Give the group max.10 min

- It's ok to vote on your own.
- It's ok to put more than one dot on the same note.
- We'll pay more attention to notes that have multiple votes, so think strategically.
- Vote on the best ideas, the ones that bring the most insight and should be pursued.
- We are not trying to get to one direction at this point in time.
- After this sprint you will present the results



Notes/insight

Mentoring is must to help the team select the best opportunities and combine the opportunity areas.



S 3.3 Show and tell

- **Each team will present their voting results: best ideas - opportunity areas.**
- **Share your passion, inspire and be inspired to get feedback on each idea and build on it.**

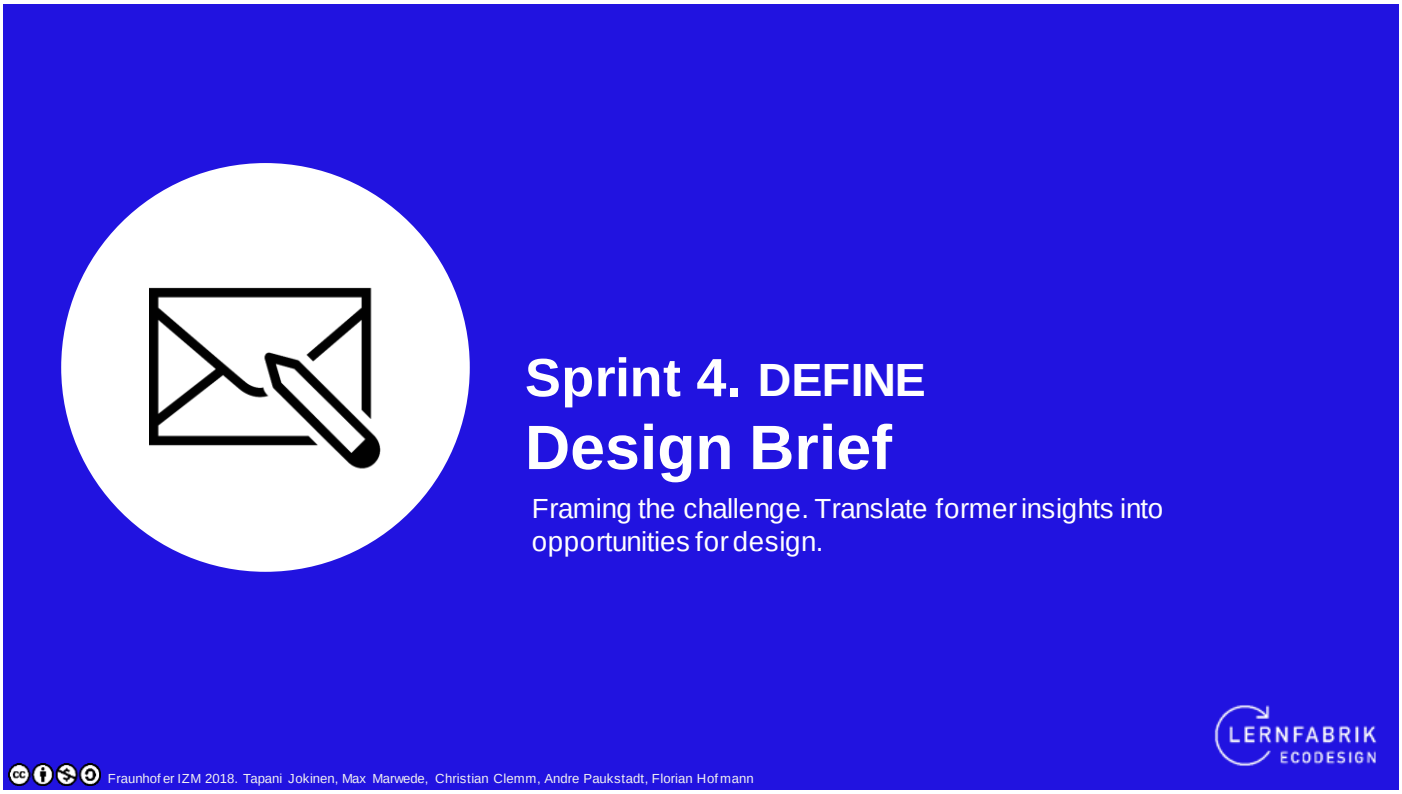
Task:
Each team presents their main results to the other teams

Objectives:
Each „Show and tell“ should give the opportunity to get feedback from all participants and be inspired by the results of other teams.

Task description:
Each team presents the main results of the previous task. All participants gather around the pin-boards to listen and ask questions and provide input after the presentation. One facilitator moderates the Q&A session after each presentation.

Timing:
2 min presentation each team and 2-3 min questions and answers from the „audience“, i.e. total 20 min for 4 teams.

Notes/insights
Show and tell takes time but is an important task. Make sure as moderator that the audience shows appreciation for the work by saying thank you and clapping hands after each presentation (usually everybody will join you clapping).



Task:
Write a Design Brief

Objectives:
Define the challenge for the ideation phase. Translating former insights into opportunities for design.
A design brief is a clear concise description of the issue(s) that need(s) to be addressed by a problem solving team. It is used to center and focus the team at the beginning, keep the team on track during the effort, and is used to validate that the effort delivered an outcome that solves the design brief (http://www.ceptara.com/blog/how-to-write-problem-statement).

Task description:
Each team defines the target group, the challenge, the objective and the envisaged solution. To define your problem, answer each of these questions:

- What is the problem or need?
- Who has the problem or need?
- Why is it important to solve?

Timing:
10-20 minutes

Tools/Materials:
A4 template „Design Brief“ for each team (page 36)

Optional changes
In addition, the challenge can be summarized in one sentence according to the form described at page 37. (see https://www.sciencebuddies.org/science-fair-projects/engineering-design-process/engineering-design-problem-statement). In case you developed a Persona, you can use the Persona as subject who you solve the challenge for.

Notes/insights
The design brief has to be clear, concise and concrete to set off the thoughts in a certain direction but still allows divergent thinking. The solution has not yet to be defined (there is enough time in the next “diamond”), but the basic idea in which direction the solution should go can already be sketched.

S4. Design Brief

Directions:
Activity: Group

1. **Pick the best opportunity area from research and write a Design Brief.**
2. **Frame the challenge. Translate research insights into opportunities for Design. Design problem. Craft a challenge statement / brief to provide focus to the rest of the training.**

LERNFABRIK ECODESIGN

Design Brief

Understand users needs and environmental impacts along the life cycle. Synthesize findings into insights. Translating research insights into opportunities for design. Set the aspiration and focus on ideation and product development by framing the challenge.

Print out in DIN A4 or bigger

For whom? Persona, target segment

Early adapting eco warriors

EXAMPLE

The problem (user's need, environmental impacts, other constraints)

Phone protective gear that is functional and at the same time sustainable and been asked for by the consumers.

The product/service, solution

A blend of material choice with apperance to reduce material use and celebrate the users eco-credentials.

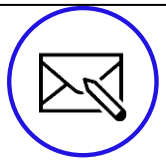
Objectives, goal (What should the "solution" achieve? Which environmental impacts shall be reduced?)

Encourage users to retain their phone for longer because of attachment to the protective case. Case is sustainable and enjoyable still despite damage.

LERNFABRIK ECODESIGN

Umwelt Bundesamt

Fraunhofer IZM



Design Brief in a Nutshell. HMW = How Might We

The format for writing a problem statement uses your answers to the questions and follows these guidelines:

Who need(s) **what** because and **why**.

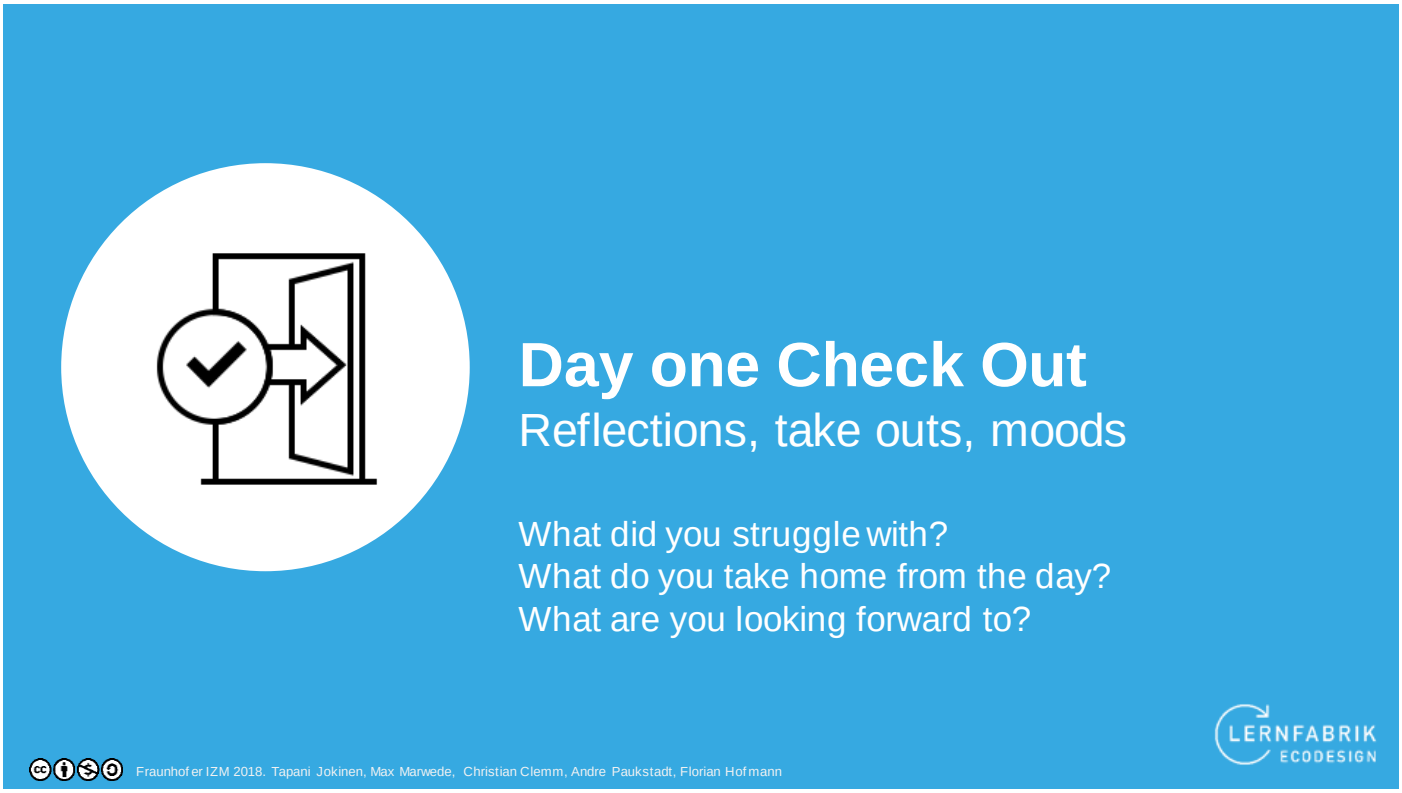
_____need(s) _____ because _____.

OR

How might we_____?

LERNFABRIK ECODESIGN

Alternative way how to frame a design challenge.



Task:
Participants are checking out and closing the day

Objectives:
Participants reflect on the day and share this with the group
Feedback for facilitators
Participants should be motivated for the next day

Task description:
1. Think about all the questions on the slide
2. Answer the questions „popcorn style“ (i.e. in a chaotic order, not everyone has to answer); alternative: let everyone speak

Timing:
10-20 min depends on amount of time left and number of participants

Tools/Materials:
Optional: A soft „talking piece“ which can be thrown (a talking piece is simply an object that passes from hand to hand. When one is holding the piece, one is invited to speak and everyone is invited to listen. Using a talking piece has the powerful effect of ensuring that every voice is heard and it sharpens both speech and listening.)

Optional change
1. The participants can also write their answer on a post-it and collect them all in the middle on one large sheet of paper. Afterwards the participants have the chance to talk about their post-its (3 colours for the three questions).
2. Let the team reflect on how the cooperation within the team worked out and what they could change during the next day to facilitate the team work. Let each team present their insights.

Notes/insights
It is important that the facilitator keeps eye contact with the participants. It is also important not to respond too much to the answers of the participants (only at the end shortly). Extra time for shy people.

Task:
Explain effects of design on environmental impacts of production and/or other life cycle phases.

Objectives:
Participants get a better understanding about the impact of design decisions on the later life cycle phases. Early reflection on product-design decisions.

Task description:
Show different manufacturing processes (or manufacture a simple product) and explain which and how much material, auxiliaries and energy is needed and which emissions and waste is created. Discuss following questions with the participants:

- How does the product design influence the manufacturability?
- How can product design reduce the use of energy, materials and auxiliaries or number of processes required?
- Is it possible to re-use waste, emissions and waste heat?
- How can design facilitate repair (e.g. interconnection technologies) or recycling (separation of materials). What are the limits and trade-offs (e.g. robustness vs. reparability, functions which require certain technologies/materials which are not so environmentally friendly, …)?

Timing:
1,5 to 2 h. We suggest to do the factory tour before the ideation or before the validation of the ideas. Plan time for a reflection period so that the teams can translate the findings to their own challenge.

Tools/Materials:
Experts who can explain the manufacturing process and environmental experts who can explain the environmental impacts

Optional changes
Disassembly exercise of products to assess reparability and recyclability.

Notes/insights
The Ecodesign Sprint is an ideation training for circular product-service-systems. Later in the actual product development phase, product developers will decide which materials, functions and mechanical design attributes the product will have. Nevertheless, this exercise is important to already discuss, explain and emphasise the importance of product-design so that later on designers and engineers will take the questions above into account.

SPRINT 5. Electronics Manufacturing Factory Tour

Directions:

Activity: Group

Visiting Start a Factory in the context of how and where the product is manufactured. Field visits allow the team to understand the effort of the life cycle phase “manufacturing”, i.e. materials, auxiliaries and energy required; products, waste and emissions “produced”.

- Introduction
- Tour to “Start a Factory”
- Storytelling : Come together and tell us what you have learned
    - *What are your key insights?*
    - *How do you save materials, energy, emissions in the production processes (main principles)?*
    - *Could “Start a Factory” be useful for you? How?*

LERNFABRIK ECODESIGN

SPRINT 5. Factory Tour Debrief

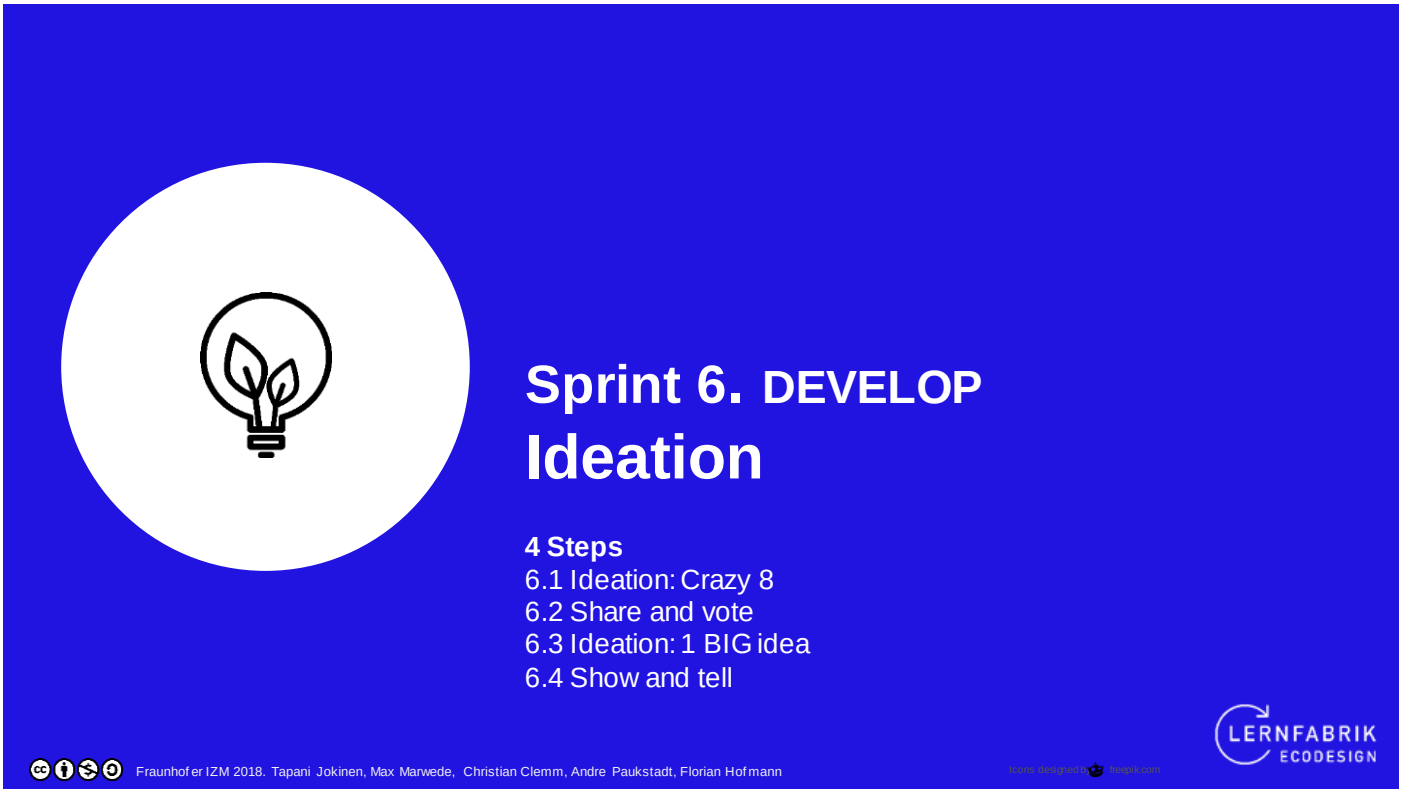
Storytelling: Come together and tell us what you have learned

- *What are your key insights?*
- *How do you safe materials, energy, emissions in the production processes (main principles)?*
- *Could “Start a Factory” be useful for you? How?*

LERNFABRIK ECODESIGN

Umwelt Bundesamt

Fraunhofer IZM



Task:
Ideation: create ideas

Objectives:
Create one promising idea for the design challenge, for which the team can prototype a circular system.

Task description:
This is the diverging phase of the 2nd diamond. In the first step, there is an individual brainstorming followed by clustering of ideas and voting for the best idea. This one is elaborated in a group brainstorming.

Timing:
10 minutes for individual brainstorming, 10-15 minutes for presentation of ideas to team (2 minutes/person), 20-30 minutes for clustering similar ideas and voting, 5 minutes for group brainstorming. This is followed by a „show & tell" session in which every team presents their big idea to the other teams for feedback (2-3 minutes per team).

Tools/Materials:
Sticky notes (one idea per note), Whiteboard for clustering, Large paper or flipchart for group brainstorming

Optional changes
There are many ideation tools. As facilitator you can play with the available tools, see for example: http://www.designkit.org or http://medialabamsterdam.com/toolkit.

Notes/insights:
This is the fun part, so encourage teams to play more, explore more…go with the crazy ideas. Especially engineers stick to feasability and so "brainstorming" needs to be practiced. As a moderator you can trigger new ideas by asking "what if" questions, such as: What if there are no technical or economical limitations?

Sprint 6. Brainstorming & Ideation

- Turn insights into potential solutions. Generate as many ideas as possible and explore the challenge. Build on the ideas of others.
- Sketch the solutions. Be visual. In live brainstorms we write down on post-its and then put them on a wall.
- Encourage wild ideas. Wild ideas can often give rise to creative leaps without the constraints of technology or materials.

S 6.1 Crazy 8´s

Directions:
Activity: Individual

1. Each participant writes or draws down as many ideas as possible - one idea per sticky note.

2. Individual (silent) brainstorming. If team is OK you may talk and share ideas during the ideation.

3. Set the timer for 8 minutes.

4. When the timer goes off, put your pens down.

S 6.2 Share and Vote

Directions:
Activity: Team

Hang the sketches up the wall. Each person has 2 minutes to present their ideas on the wall then team to choose an idea within 5 minutes through voting and discussion.

1. Explain post-its
2. Discuss
3. Clustering the themes. If two (or more) ideas are similar, group them!
4. Giving headings for clusters
5. Each person gets three **vote**
6. Team review & selecting one most popular cluster to proceed with

6.2 Notes/insight

Mentoring is a must to help the team to select the best idea and combine the opportunity areas.

S 6.3 ONE BIG IDEA

Understanding the details better
Activity: Group

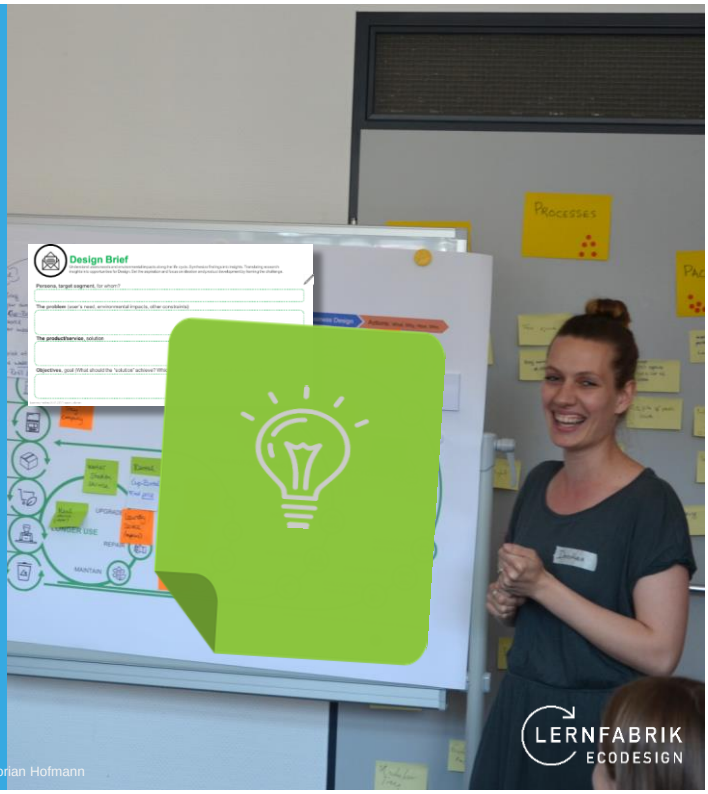
Take the best idea and continue the previous exercise. If you have more than one winning solution, involve the whole team in a short discussion to combine the winners into a single BIG IDEA. Rumble all-in-one: Collaborate, consolidate, supplement and extend the ideas into solution sketch.

1. Group brainstorming + notetaker
2. Sketch it out showing multiple states of the ideas
3. Include words to create a sketch that can communicate on its own
4. Add a memorable title

S 6.4 Show and tell

Each Team has 2 minutes to present their ideas to others.

First the **brief** and then their **BIG IDEA** on the wall



Task:
Develop a Circular Business Model based on the prototyping results.

Objectives:
Synthesize findings, think about alternative business models

Task description:
Fill out template „**Circular Business Model Canvas“** (page 48).

Timing:
20-30 minutes

Tools/Materials:
Template „Circular Business Model Canvas“ (page 48)

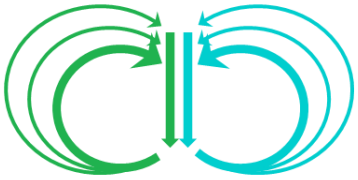
Optional changes
Do the “Circular System Prototyping” beforehand (Sprint 8, page 49). Both ways work.

Notes/insights:
The business aspect of a product or product-service system idea is essential, as in the current economic system, the principles of the Circular Economy are sometimes regarded as inhibiting to make profit. Figuring out innovative ways to generate revenue flows (other than simple sales of products) is thus crucial. Show some examples of functioning Circular Economy Business Models beforehand.

Strategies of value creation in the circular economy

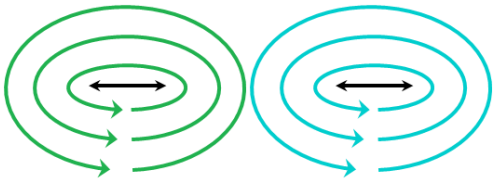
VALUE CREATION OF THE INNER CIRCLE

The tighter the circle, the less a product has to be changed, the higher the effects of value retention.



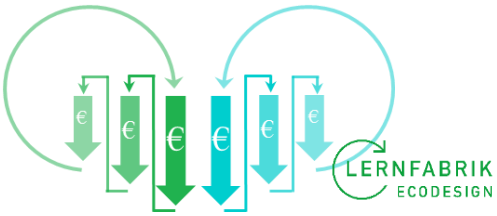
VALUE CREATION THROUGH LENGTHENING AND INCREASING NUMBER OF LIFE CYCLES

Maximizing the number of consecutive cycles and the duration of each cycle. Each prolonged cycle avoids material, energy and labor of creating a new product or component.



CASCADED USES ACROSS INDUSTRIES

Minimizing resource value destruction in the circle chain by reclaiming and linking up waste outputs as useful inputs into next life production process



Ellen MacArthuer Foundation (2015): Towards a circular economy; Lacy et al. (2014): Circular Advantage: Innovative business models and technologies to create value in a world without limits to growth Hofmann (2017): Circular added value

Types of business models

Characteristics/ Key aspects	Long Life Model	Modularity Model	Re-Value Model	Access Model	Service Model
Ownership of product	Customer	Customer	Customer	Company	Company
Revenue streams (for company)	Sales of initial product, Post-purchase services	Sales of initial product, Sales of spare parts	Sales of repaired/ refurbished products /recycled materials, Repair services	Access fee	Service fee
Realization of resource efficiency/ Value exploitation	Reduction in resource consumption through longevity of product	Reduction in resource consumption through lifetime extension	Addition of new value to products/materials after first life	High utilization per product, pay-per-use has effect on customer's use habit	Maximal value exploitation of resources due to professional planning
Realization of resource circularity/ Material loop	Encouragement of second-hand market and repair/ service market	Encouragement of reuse by facilitating repair/ upgrade	Encouragement of reuse by enabling second life	Prolongation of EOL through regular maintenance	Prolongation of EOL through regular maintenance
Collaboration amongst stakeholders	High quality demand throughout supply chain	Guarantee of compatibility between components	Knowledge transfer on technology, use patterns, failure mechanisms	Return of product post-consumption, Company-customer relationship	Recollection of product/ materials; direct feedback from customers
Product Design	Design for durability and reliability	Modular design/ ease of upgradability; Design for easy exchange, upgrade and repair	Design for easy upgrade and repair	Design for durability and reliability, repair at high service level	Design for durability and reliability, repair at high service level.
Customer motivation	Emotional attachment to brand value /Customer loyalty, Possible revenues from post-use sales	Adaptability and upgradeability of individual needs, Environ-mental awareness	Environmental awareness, Economic feasibility of upgraded/ repaired products	Flexible short-term solution, Economic feasibility, Convenience of product return	Delegation of task to professional

Source: Emmerich, Johanna (2017); "Identification of Circular business models and shortlists of applicable dematerialization options" PolyCE, Deliverable 1.1

Circular Business Models

Directions:

Activity: Group

Drawing sheet for designing, visualizing, and developing your circular business model

1. The questions in each field give you instructions for filling out the building blocks
2. You can add some of your post-its from your circular system prototype to the template
3. Visualize (words, sentences, drawings, etc.) further ideas, thoughts, impulses, and visions on post-its to each building block
4. Circular business modelling is an iterative process of continuous learning with no determined starting or ending point
5. Maybe you have different circular business ideas?

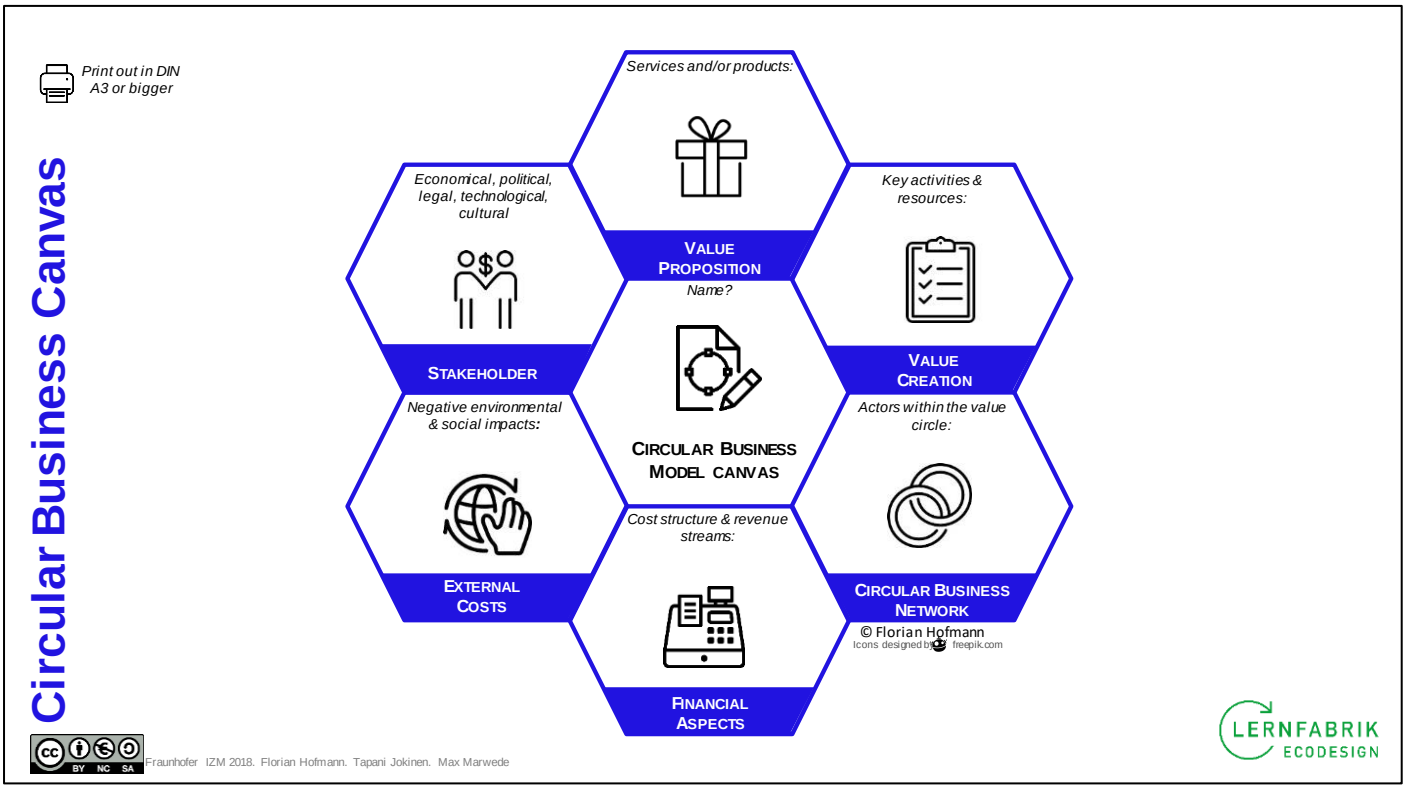
LERNFABRIK ECODESIGN

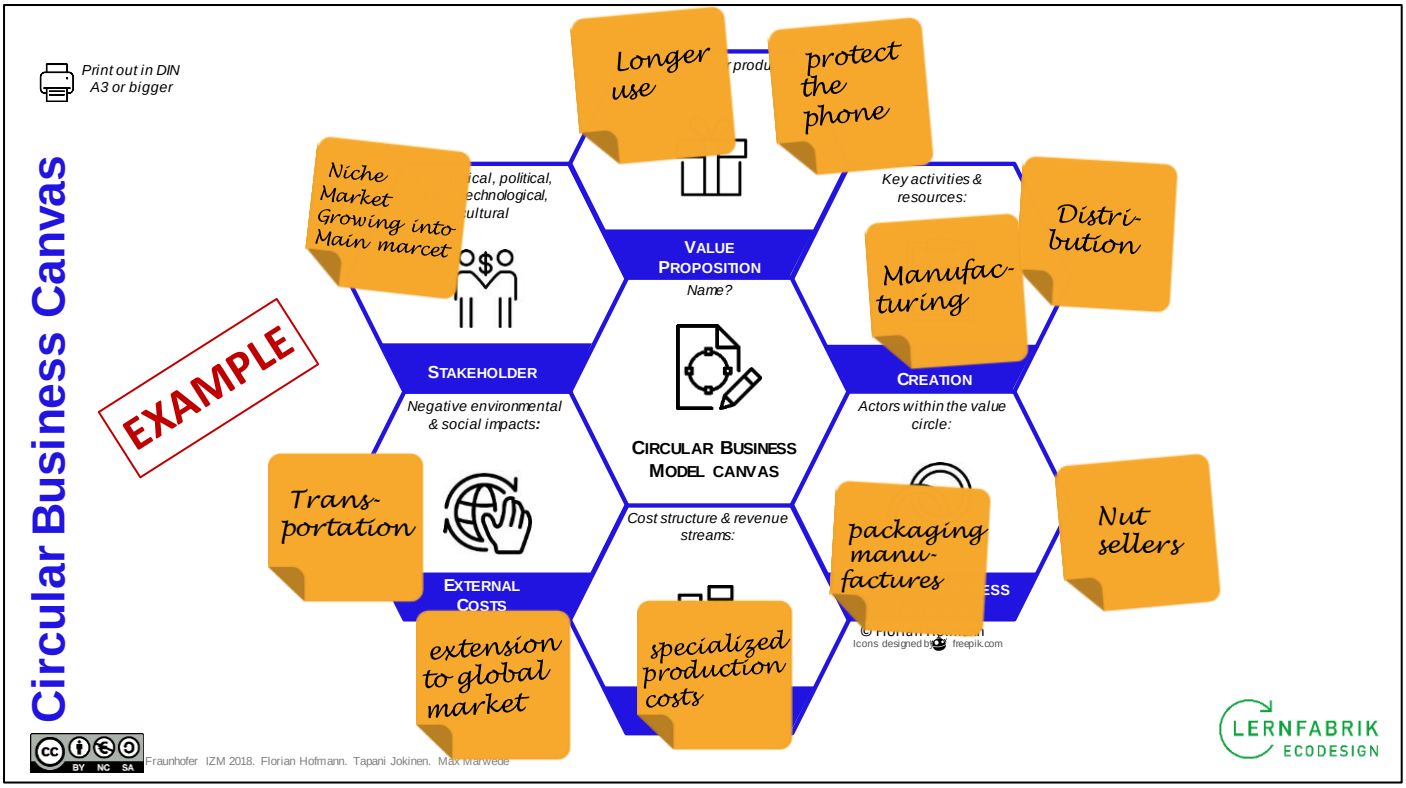
Circular Business Modelling

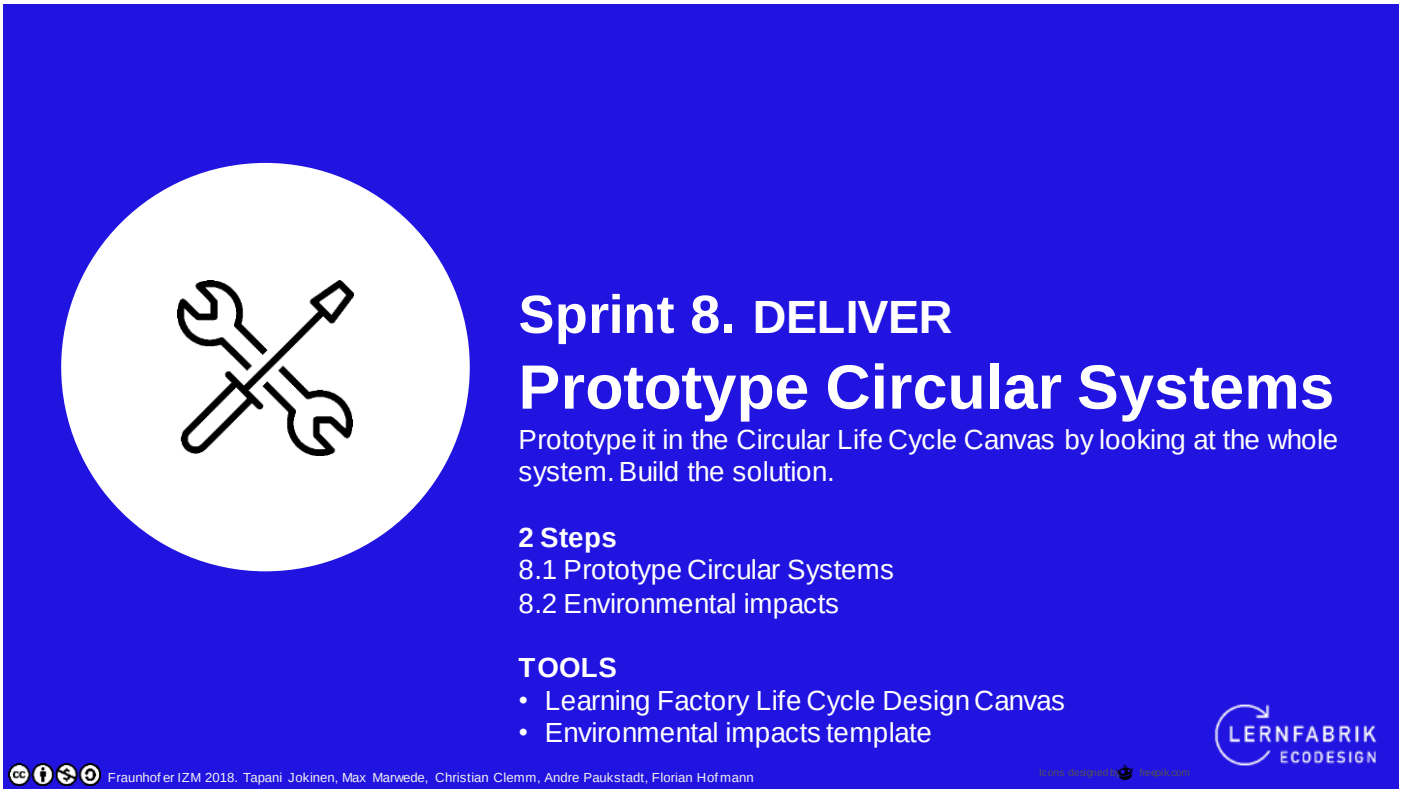
LERNFABRIK ECODESIGN

Umwelt Bundesamt

Fraunhofer IZM


Print out in DIN A3 or bigger
Circular Business Canvas
Services and/or products:
Economical, political, legal, technological, cultural
Key activities & resources:
VALUE PROPOSITION
Name?
STAKEHOLDER
VALUE CREATION
Negative environmental & social impacts:
Actors within the value circle:
CIRCULAR BUSINESS MODEL CANVAS
Cost structure & revenue streams:
EXTERNAL COSTS
CIRCULAR BUSINESS NETWORK
© Florian Hofmann
Icons designed by freepik.com
FINANCIAL ASPECTS
Fraunhofer IZM 2018. Florian Hofmann. Tapani Jokinen. Max Marwede
LERNFABRIK ECODESIGN


Print out in DIN A3 or bigger
Circular Business Canvas
EXAMPLE
Longer use
protect the phone
Niche Market Growing into Main marcet
Distri-bution
Manufac-turing
Trans-portation
packaging manu-factures
Nut sellers
extension to global market
specialized production costs
Key activities & resources:
VALUE PROPOSITION
Name?
STAKEHOLDER
CREATION
Negative environmental & social impacts:
Actors within the value circle:
CIRCULAR BUSINESS MODEL CANVAS
Cost structure & revenue streams:
EXTERNAL COSTS
Icons designed by freepik.com
Fraunhofer IZM 2018. Florian Hofmann. Tapani Jokinen. Max Marwede
LERNFABRIK ECODESIGN



Task:
In this “delivery phase” the team prototypes a circular system and validates the results

Objectives:
Develop a circular product-service system around your idea, validate the results and summarize everything into a Circular Economy business model.

Task description:
This is the core activity of the system design. Participants identify elements which are needed to enable circularity such as product design, service elements, business elements, and partners. The results will be added with post-its on the **Learning Factory Life Cycle Design Canvas** (page 54). In a second step, the team evaluates the system through a simplified (environmental) assessment, identifies negative and positive environmental impacts using the **“Environmental impacts” template** (page 56) and adding their insights on the canvas.

Timing:
20-40 minutes for prototyping, 20-40 minutes for simple environmental assessment

Tools/Materials:
Template A0 „Circular System Canvas“ (page 54)
Template A4 „Environmental impacts” (page 56)

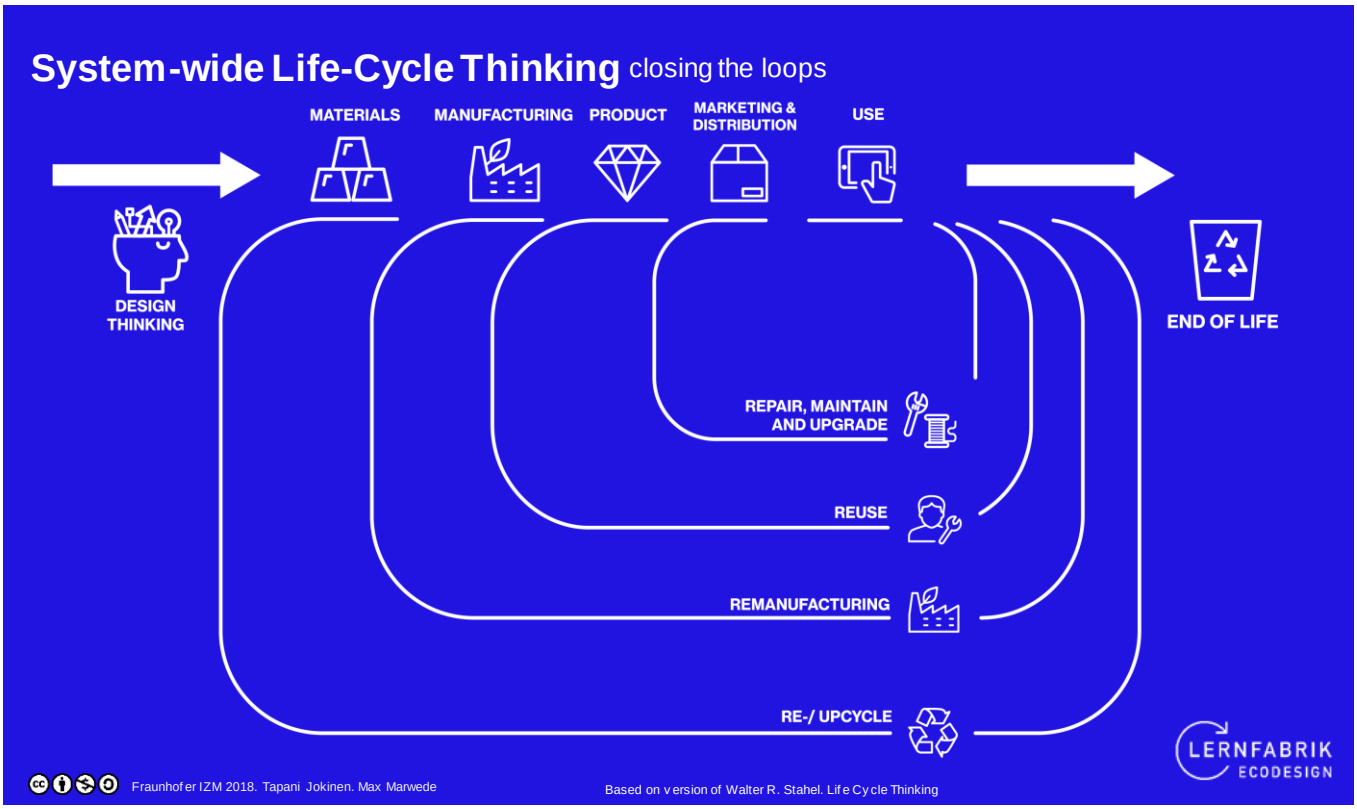
Notes/insight:
You can use ecodesign checklists to support the development process (see ANNEX V “Checklists”, page 69 or go to https://sustainabilityguide.eu/ecodesign/)

S 8.1 Prototype Circular Systems

Prototype

Now it is time for the teams to prototype their idea into a circular system.

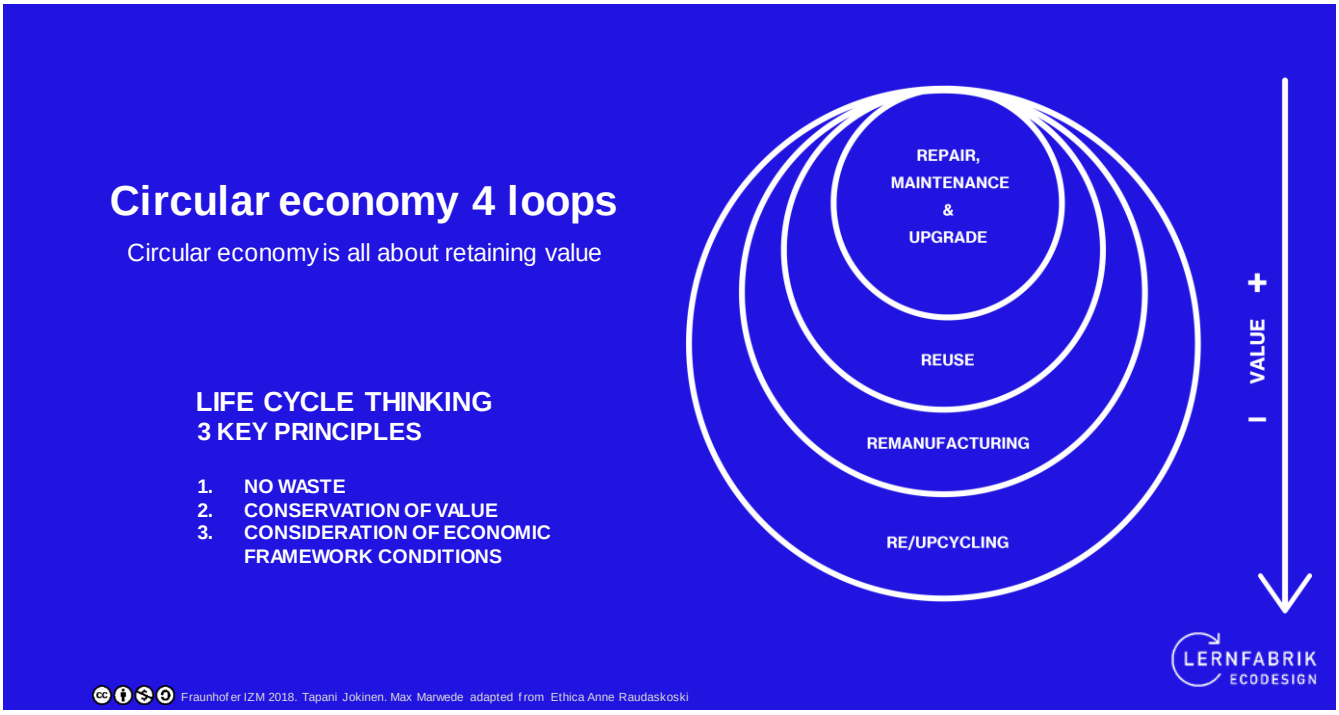
Prototyping allows you to test and develop your idea in a system-wide lifecycle canvas to facilitating the closing of loops and the design and manufacturing of sustainable products. A circular process encourages and necessitates multidisciplinary collaboration in the realisation of whole-system life-cycle design and the closing of loops. Extending the useful life of products is about more than just recycling materials. It is about keeping a product as close as possible to its original state over time, for instance through longer use, repair, upgrading, refurbishment or remanufacturing.



The fundamental principle of circular systems thinking is that everything is interconnected. It is based on three principles:

- Design out waste and pollution
- Keep products and materials in use
- Regenerate natural systems

Ecodesign considers seven life cycle stages: design, materials, manufacturing, product, distribution, use and end of life. Life Cycle Thinking guides the development of sustainable products and shows how to reduce environmental impacts from the conception of a product through its entire life cycle. Closing the loops and extending the useful life of products is more than just recycling materials. It is about keeping a product as close as possible to its original state over time, for instance through longer use, repair, upgrading, refurbishment or remanufacturing. Circular processes enforce multidisciplinary collaboration to manage whole system life cycle design and closing the loops. Ecodesigning a product means making it desirable for people while taking its entire life cycle into account by applying environmental criteria at all stages.



One goal of the Circular Economy is to keep products, components and materials functional as long as possible through repair, reuse, remanufacturing and recycling. Another one is to stay in the inner loop, because the better the integrity of the product is preserved, the more value is retained.

Walter Stahel (2013)[1] highlights characteristics of a circular economy that distinguish it from a linear economy based on extraction, production, consumption and disposal (waste):

- "The smaller the loop (activity-wise and geographically) the more profitable and resource efficient it is." The aim is not to create one globalized circular economy, rather, the most effective strategy is to appropriately scale-link multiple circular economies at local, regional and global scales.
- "Loops have no beginning and no end", so they require continuous collaboration along the entire value chain.
- "The speed of the circular flows is crucial: the efficiency of managing stock in the circular economy increases with a decreasing flow speed"; and therefore companies will have to rethink strategies based on 'planned obsolescence' and create high-quality, durable products.
- "Continued ownership is cost efficient: reuse, repair and remanufacture without change of ownership save double transaction costs." This creates an incentive for companies to sell (lease) the use or service provided by their products, rather than the products themselves.
- "A circular economy needs functioning markets".

[1] Stahel, Walter R. (2013): Policy for material efficiency--sustainable taxation as a departure from the throwaway society. In: Philosophical transactions. Series A, Mathematical, physical, and engineering sciences 371 (1986), S. 20110567. DOI: 10.1098/rsta.2011.0567.

S 8.1 Prototype Circular Systems

In Learning Factory Life Cycle Design Canvas

Directions:

Activity: Group

1. Add your post-its from the ideation phase to the template
2. In four sessions closing the life cycle loops with four filters, add additional elements on post-its
3. After introducing LCA, add post-its of environmental impacts in a fifth session

- **Product (blue):** What does the circular version of the product look like? (Physical product)
- **Service (green):** What are the service elements in each cycle? (Physical and digital service)
- **Business (magenta):** Revenue streams? How do we save costs? (Business development)
- **Partners (orange):** Who do you need so that the system works (e.g. refurbishers, service providers, suppliers, prosumer, co-creators). If possible, think about their needs, they role and how they profit from the system.
- **Environment (blue):** What are the environmental impacts. Materials (raw or recycled materials, auxiliaries, chemicals, toxic or scarce materials). Energy (heat & electricity). Emissions into the biosphere (solid, liquid, gaseous). Health and safety issues. Identify the most important environmental focus areas. How can we reduce the environmental impacts? Which stakeholders do you have to involve?

LERNFABRIK ECODESIGN

Task:
Design a circular product-service-system for your idea

Objectives:
Identify the elements you need in order to close the different loops, keep the product alive as long as possible and create value for your company, the user and the network partners.

Task description:
This is the core activity in the design of the system. Participants identify elements which are needed to enable circularity. They look with different “lenses/filters” at the system in order to answer questions like: “How does the product have to look like to be circular?”, “Which services can I offer to close the loops and provide value/fulfil users’ needs?”, “How can my partners and I make money and save costs?”, “Which partners do I need to provide the services and keep the system running?”. Participants are asked to consider different aspects of the system such as

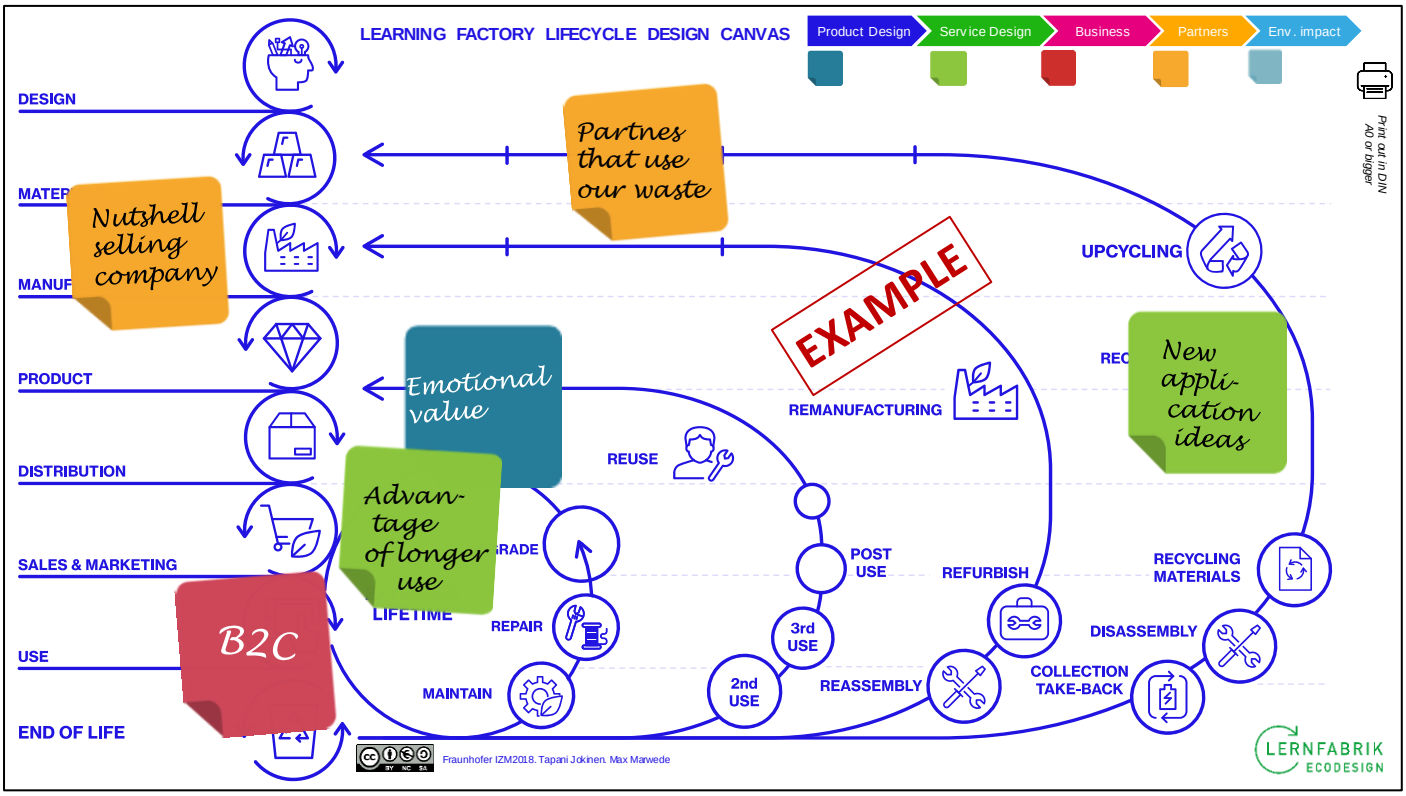
- product design (e.g. design for repair, upgradeability, interoperability, remanufacturability, …)
- service elements (e.g. repair service, platform services, digital services, return logistics, …)
- business elements (profit/costs, value creation, revenue model/sales, leasing, sharing, marketing, image and brand) and
- partners (e.g. repair centres, service providers, …) are required to keep the system alive. Teams can also think about the benefits for the partners. Why should they take part?

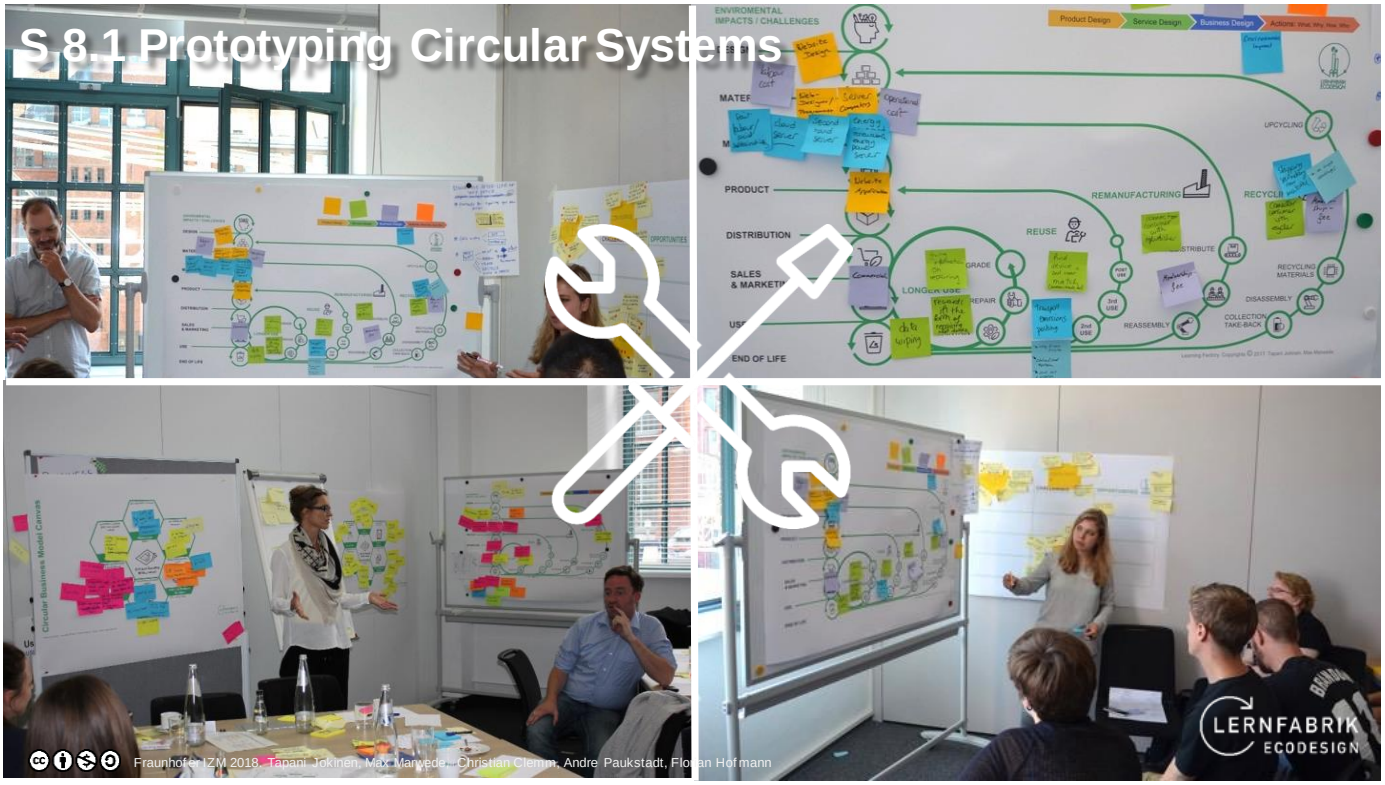
Timing:
30-40 minutes

Tools/Materials:
Template A0 „Circular System Canvas“ (page 54) and sticky notes in 4 different colours.

Optional changes
Show some examples of solutions beforehand in order to inspire the participants.

Notes/insights:
Coaches can “pop-in” the group discussion to help out, ask questions, provide ideas. Participants are sometimes a little lost where to put the sticky notes – the place does not really matter but rather the solutions and ideas. It can be useful to provide more structure to the participants, e.g. by telling them to focus on the “inner loops” first, where the value retention is the highest, and work their way to the outer loops, while taking into account the respective “filters” (product, service, business, partners, env. impacts).

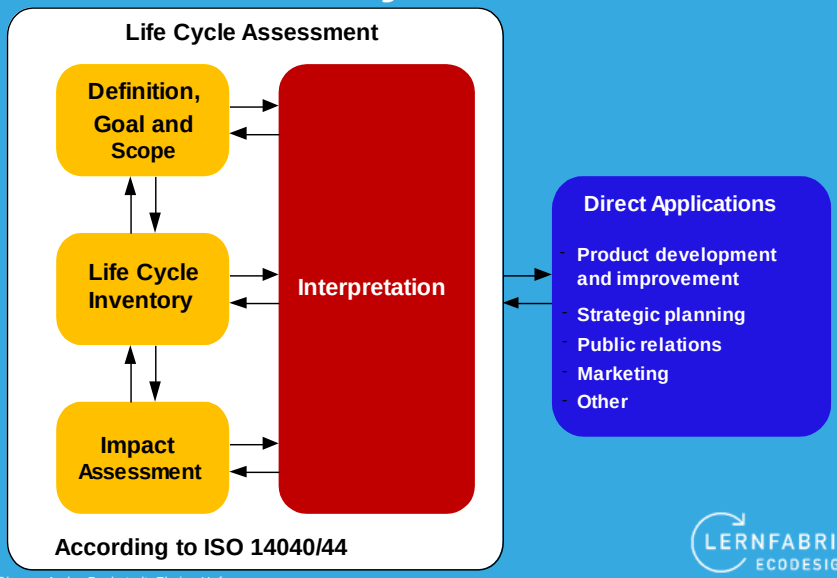




S 8.2 Environmental impacts - LCA Life Cycle Assessment

Directions:
Activity: Group

1. Definition of goal and scope
2. The life cycle inventory (LCI): mapping of all processes associated with the life cycle, and all relevant resource inputs, emissions and waste streams.
3. The impact assessment transforms the LCI into tangible numbers: global warming potential (GWP, in CO2-equivalents), the ozone depletion potential (ODP), resource depletion potential (ADP), and other indicators.



Task:
Screen environmental impact of the system and the life cycle

Objectives:
Improve system to reduce environmental impacts

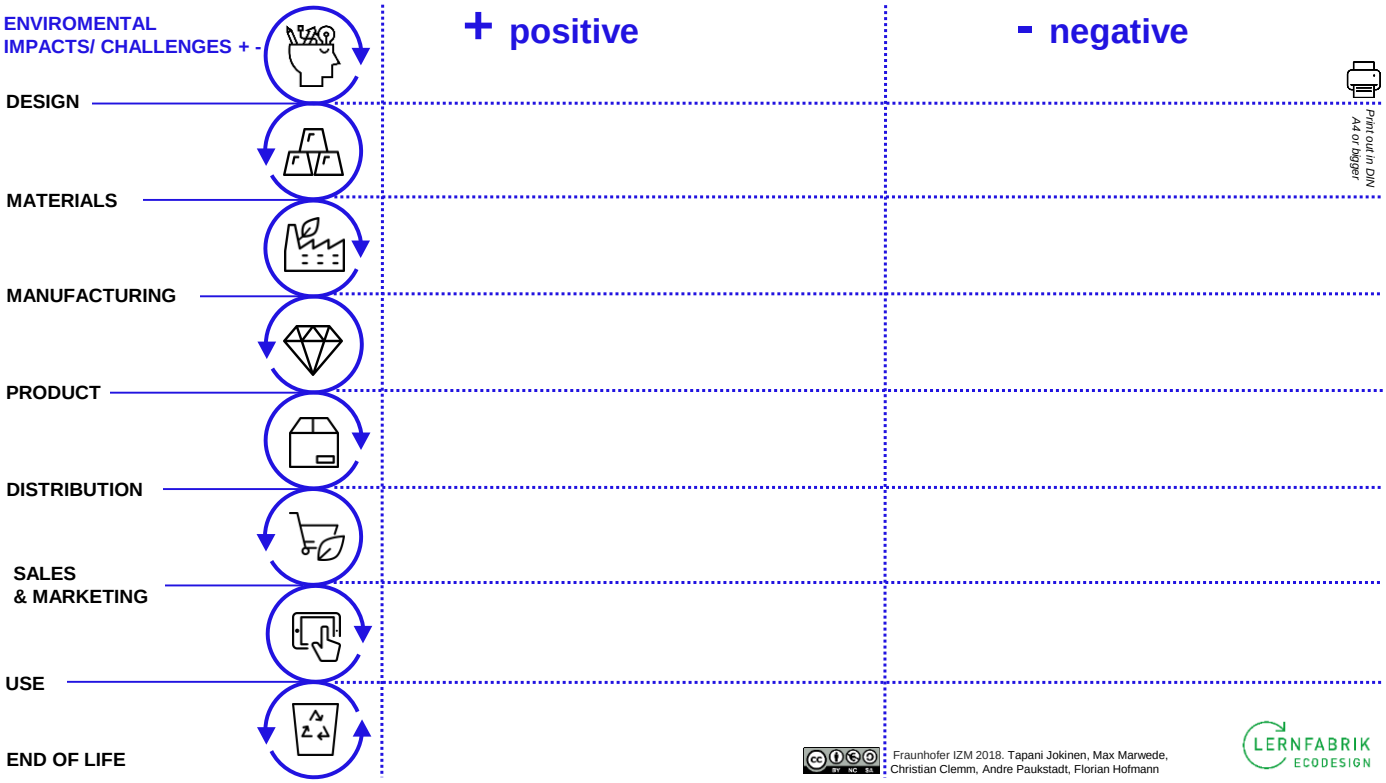
Task description:
Due to timing constraints and because there is just a draft of the full system, it is not possible to do a full Life Cycle Assessment during the training. Therefore, the aim of this screening is to identify the three most important environmental impacts (hot-spots) in the proposed system (e.g. transport, certain manufacturing technologies, use of hazardous or toxic substances, …) and in a second step try to improve the system. After evaluating the negative and positive environmental impacts on the **"Environmental impacts" template** (page 56), the participants add post-its on the **Learning Factory Life Cycle Design Canvas** related to environmental issues they identified (see page 57).

Timing:
30-40 minutes

Tools/Materials:
Template „Circular System Canvas" (page 54) and "Environmental impacts" (page 56)

Optional changes
- Do the exercise in the discovery phase to identify environmental hot-spots of a benchmark product you like to avoid in the new system.
- Use the MESO Matrix developed by the Technical University of Denmark instead (http://www.ecodesign.dtu.dk/Ecodesign-Guide)
- Do the exercise earlier during the prototyping step.
- Use an online tool such as http://pilot.ecodesign.at or http://circulareconomytoolkit.org/Assessmenttool.html to assess the system.

Notes/insights:
Because the system is just a draft, it is not so easy to identify the most important impacts in case you do not have the experience. However, with simple logics and the combined know-how of different disciplines it is possible to identify potential "hot spots". It is helpful if an environmental expert is present at this stage – either as a participant or as a "coach" who can help out with specific knowledge. After a second iteration, when processes and product design are better defined, it makes sense to model the system in a "real" Life Cycle Assessment and test out different scenarios to identify the "least harmful".


ENVIROMENTAL IMPACTS/ CHALLENGES + -
+ positive
- negative
DESIGN
MATERIALS
MANUFACTURING
PRODUCT
DISTRIBUTION
SALES & MARKETING
USE
END OF LIFE
Print out in DIN A4 or bigger
Fraunhofer IZM 2018. Tapani Jokinen, Max Marwede, Christian Clemm, Andre Paukstadt, Florian Hofmann
LERNFABRIK ECODESIGN

S 8.2 Environmental impacts - Simplified Life Cycle Inventory

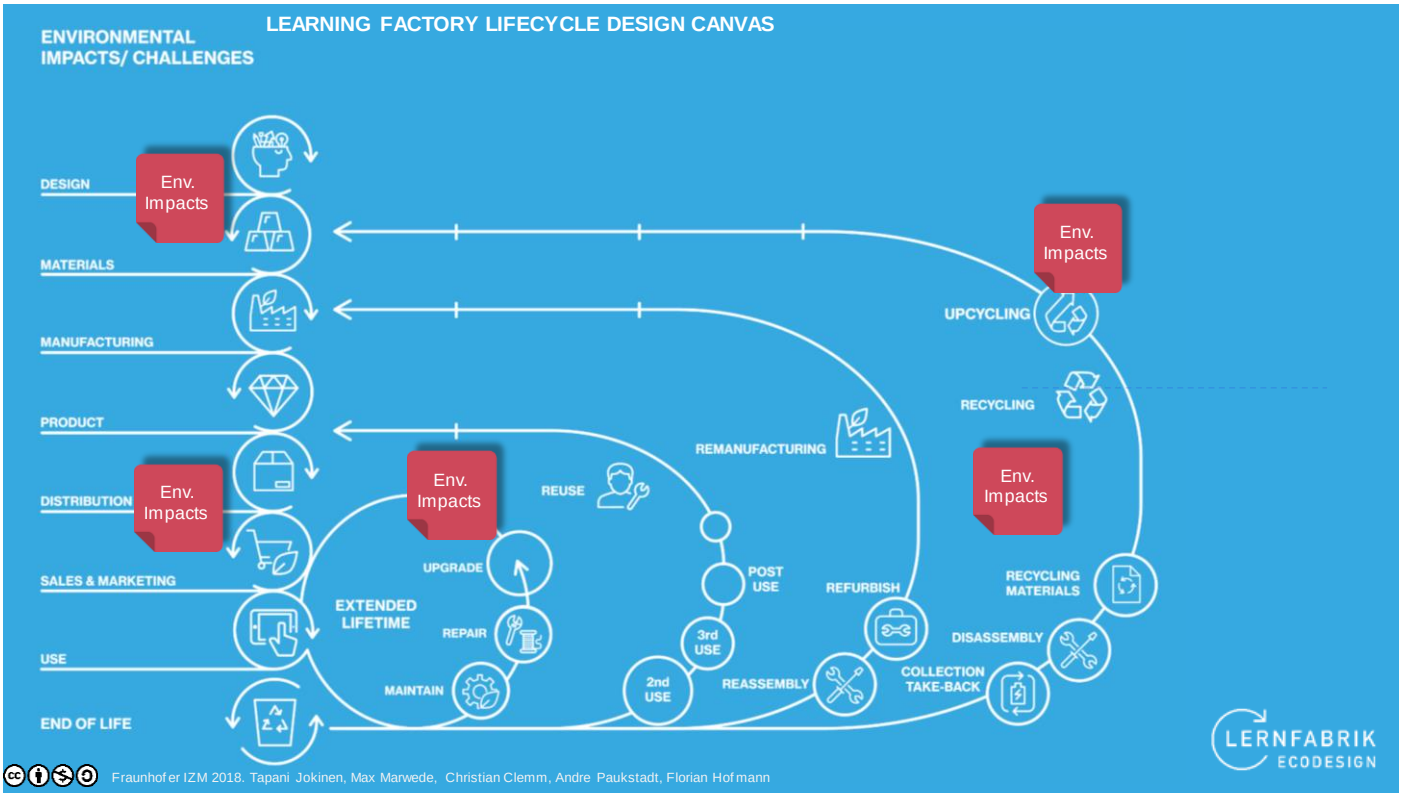
Directions:
Activity: Group

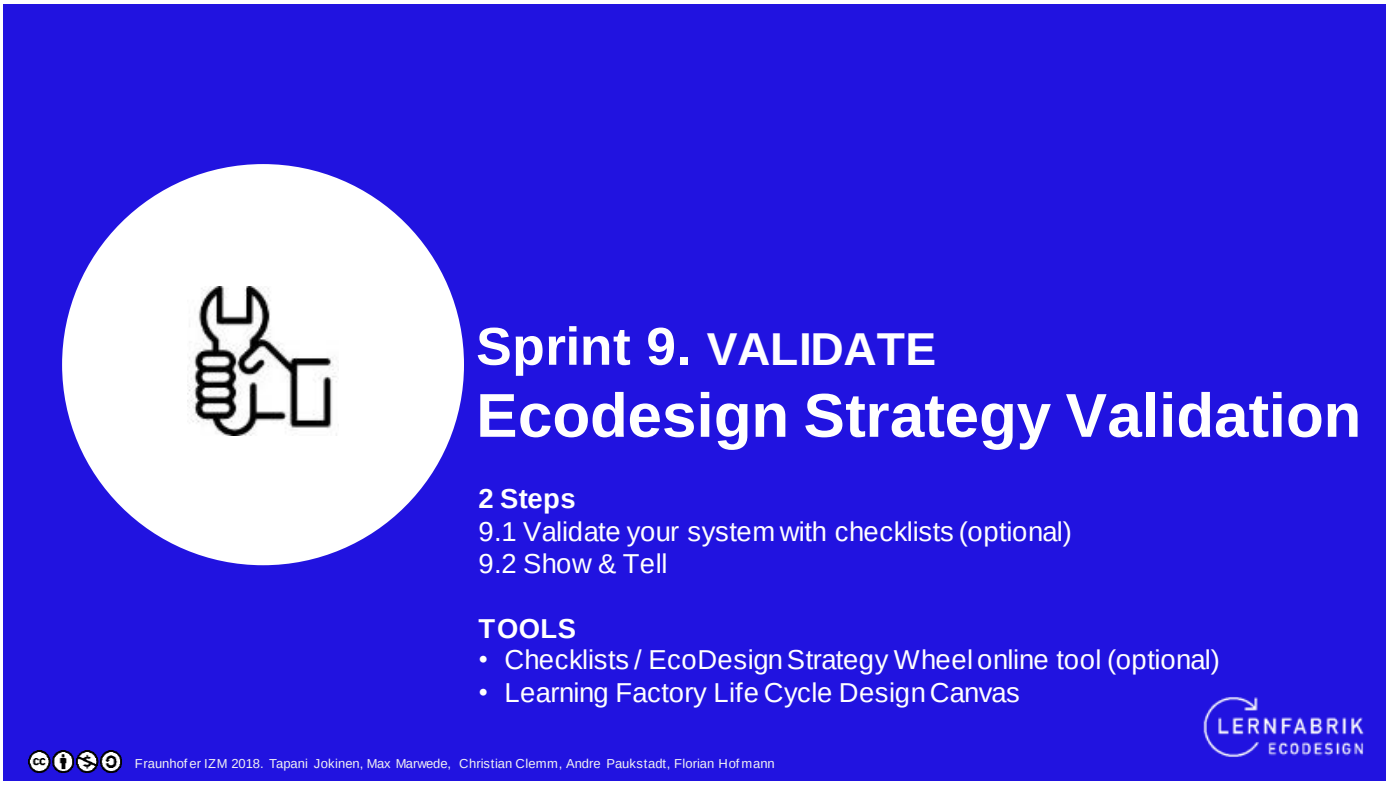
Brainstorm environmental impacts you can think of along the life cycle stages. Use post-it notes (one impact per note) and pin them on the canvas. Think about:

- Materials (raw or recycled materials, auxiliaries, chemicals, toxic or scarce materials)
- Energy (heat & electricity required for all life cycle phases)
- Emissions into the biosphere (solid, liquid, gaseous)
- Health and safety issues

- Identify the most important environmental focus areas
- Think about how to adapt the prototype in order to reduce the environmental impacts. Which stakeholders do you have to involve?

Source: DTU, Environmental improvement through product development - a guide





Task: The teams evaluate their circular system

Objectives: The teams can use the checklists to evaluate their system.

Task description: The teams use the **checklists** (see ANNEX V "Checklists", page 69 or go to https://sustainabilityguide.eu/ecodesign/) to see how well they considered different aspects for the different life cycle stages. The checklists should "inspire" to think about topics which they have not yet considered. Afterwards, in case the participants found improvements in their system, they can adapt their circular systems. End the end they present their final circular system to the other groups and get feedback.

Timing: 30 minutes

Tools/Materials: Checklists [ANNEX V "Checklists", page 69] Learning Factory Life Cycle Design Canvas (from the steps before),

Optional changes: Skip the checklists and present the circular system right away to all participants to get a direct feedback.

Notes/insights: There can be trade-offs between different design-strategies, e.g. between dismantleability and robustness. That means that you cannot "fulfill" one strategy without "underperforming" in another. Mention those "conflicts". The checklists should not be used as "scientifically" based indicators but as inspirational tool.

Task:
Participants are checking out and closing the training

Objectives:
- Participants reflect on the training and share this with the group
- Feedback for facilitators
- Participants should be motivated to bring the insight to their company

Task description:
1. Think about all the questions on the slide above
2. Write the answer of the question on a post-it
3. Put the post-it on a big sheet of paper
4. Answer the question „popcorn style“ (i.e. in a chaotic order, not everyone has to answer); alternative: let everyone speak

Timing:
10-20 min depends on amount of time left and number of participants

Tools/Materials:
Post-it, pens, big sheet of paper

Optional changes
Use a feedback form (online or offline) to receive feedback (see ANNEX VI “Feedback Form”, page 78). Have an open discussion on next steps within the company. Give some ideas how people can use the tools and methods within their company.

Notes/insights
It is important that the facilitator is keeping eye contact with the participants. It is also important to respond not too much to the answers of the participants (only at the end shortly). Consider extra time for “shy” people if needed.
After the check-check out you can encourage participants to use design sprint methods also in their daily jobs. It’s a fast way to gather up people for 15 mins. to solve daily work challenges in fast and effective ways and affirm the power of collaboration. Suggest to gather colleagues from different departments, schedule a date to work 2 hours using the “Circular System Canvas” (see Sprint 8, page 49) on a already existing product.


Congrats!
Dr. Max Marwede
max.marwede@izm.fraunhofer.de
Tapani Jokinen
Tapani.jokinen@izm-extern.Fraunhofer.de
FINISH
Your training is complete! Enjoy the gains and learnings. Well done!
This material is available under Creative Common License "Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0)" (https://creativecommons.org/licenses/by-nc-sa/4.0/). If you would like to use the material commercially, get in contact with Fraunhofer IZM, Berlin (lernfabrik@izm.fraunhofer.de).
LERNFABRIK ECODESIGN
Fraunhofer IZM
Fraunhofer IZM 2018. Tapani Jokinen, Max Marwede, Christian Clemm, Andre Paukstadt, Florian Hofmann

After the training

- Relax and have a beer with the fellow moderators.
- Lessons to learn: take some time to review the training with your fellow facilitators and analyse the feedback.
- It is an iterative learning process for facilitators (learn – build – measure) to constantly improve the ecodesign sprint.

- Focus on which parts worked well and which didn't, and try to figure out why. For example:
  - some challenges may work better than others: product-focused challenges may work better than e.g. digital services; clearly defined challenges may be easier to work with than vague ideas; challenges that anyone can understand are preferable compared to sector-specific issues (depending on the participants of course)
  - some teams may be more effective than others or more balanced; sometimes a team may be dominated by one or two members, limiting the creative output of the entire team

- **Typical feedback and how to deal with it:**
  - *"There was not enough time to think about each task to come to a satisfying solution"* → the exercise is not about "the perfect solution" but for participants to learn the methods, incl. the design sprint method → you should make this more clear in the next training, and possibly remind participants during the training
  - *"In our interdisciplinary team, our ways of thinking were too different, and that made the team work tedious"* → It is part of the goals of the training to get professionals from different backgrounds to work together instead of everyone focusing solely on "their task" → this yields more diverse discussions and results and serves the training goals
  - *"My expectations were not met; I wanted to learn more about a specific topic (e.g. material selection, reparability, life cycle assessment etc.)"* → this training is only a starting point, and interested participants need to be pointed towards ways to further their understanding of ecodesign and related specific topics
  - See also ANNEX I "Adaptations", page 64
- Adapt the training flow, content and tools accordingly

ANNEXES

LERNFABRIK ECODESIGN

ANNEX I “Adaptations”

	Feedback Workshop 1	Adaptation	Feedback Workshop 2	Adaptation
Time management	• Not enough time for each sprint • More time for discussion	• Split workshop into two days • More breaks and additional „energizers“ • Introducing of check-ins and check-outs • One big timer for all groups	• Not enough time	• Better explanation of the “Sprints” (lack of time is part of a sprint) • During the workshop It’s not about the results but about the process • In “real” you have more time between the sprints for research
Room / Material	• Switching between rooms not ideal • Less post-its	• Workshop in <u>one</u> big room	• Request to work more undisturbed • Usage of too many post-its and markers	• Possibility to leave the room for the sprint • Workbook handout as PDF • Usage of reusable templates
Content	• Explanation of tasks sometimes unsatisfactory • Tools not suitable for services • Desire for take away tools • Practical examples were missing • More information regarding environmental impacts of materials and products	• <u>Product centered</u> challenges • Grouping of participants according their working area (design, engineering,…) • More detailed explanation of the sprint method and the task at the beginning • Addition of practical examples • Simplify life-cycle system • Examples of filled out templates • Explain the next steps after the workshop, what can the participants do in their company	• Define the challenges less “open” (more precise tasks to work on) • Small, simple product instead of a complicated one • Life cycle assessment at an earlier step • More practical examples • Presentation was too idealistic (no cost-benefit analysis) • More information about material efficiency • Just create one thing – new product or business	• Deeper look into eco-design principles, business topics and environmental assessments and design thinking • Better predefinition of the challenges
Start a Factory -Tour	• Was interesting but not helpful for the challenge	• Factory tour after Design Brief; discussing transferability	• Was inspiring and interesting but not helpful for the challenge	• Electronic challenge to have a connection to the SaF
Other	• Too many moderators • Additional information in advance of the workshop	• Clear definition of moderator team (distinction between moderator, coach, host, photographer) • Take away workbooks • Get together for networking	• Additional information in advance of the workshop	• Webinar before the workshop to go through the "Sustainability Guide“ • Inviting more interested beginners to the workshop

ANNEX II „Invitation Letter“

Dear Ladies and Gentlemen,

we would like to invite you cordially to the pilot training **Learning Factory EcoDesign**. The training will take place on the *XXXX* on *YYYY* in *ZZZZ* (*starting on DD.MM.YYYY at TT am/pm and ending on DD.MM.YYYY at TT pm*).

The **Learning Factory EcoDesign** is directed at working product designers and developers, engineers, teachers, design lecturers, start-ups, SMEs, business model developers– in general, actors who are interested in learning how to adopt ecodesign practices and profit from the opportunities arising around the Circular Economy.

What can you expect? During the training, you will go through an Ecodesign sprint. The Ecodesign sprint is a process that marries the best of user-centered innovation and design thinking with sustainable design practices. You will learn in an interactive and productive hands-on training how to create MPH´s Minimum Harmful Products and Services and drive sustainability led innovation in practice. Teaming up with the other participants of various professional backgrounds, you will analyze user needs, formulate a design challenge, and develop your own ideas for solutions, and prototype a circular system around your product as well as a suitable business model. You will deal with questions like: "What are the users’ needs?", "How can the product be repaired or reused?”, “Which services can I offer around my product?", “What are suitable Circular Economy business models?", “Which partners do I need to close the loop?” and "How can I minimize the environmental footprint during the life cycle of my product?" However, goal of the training is not to develop the perfect solution but to understand the design process for circular systems and to get to know the tools you can use in your own business to make a step towards the Circular Economy.

If you are interested in participating, please apply here *[LINK]*; the number of attendees is limited. By *DD.MM.YYYY* we will let you know whether you can participate. Your data will be treated confidentially and will not be passed on to third parties.

In case of any questions, feel free to get in contact with *ZZZZ, phone number, e-mail address*

With best regards

NNNN

ANNEX III „Application Form“

Personal data

First name:

Last name:

E-Mail:

Organisation:

Position:

Gender

- ☐ Female
- ☐ Male
- ☐ X

What is your background (studies, profession)?

Selection of up to 2 areas possible. Please specify if you like.

- ☐ Design
- ☐ Engineering
- ☐ Economics
- ☐ Natural sciences
- ☐ Social sciences
- ☐ Other

Please, briefly explain why you would like to participate.

Your interest, your motivation? Is there a current need for transforming your business to Circular Economy? Is there an Ecodesign Challenge you like to solve?

End of the application.

Thank you for your interest.

ANNEX IV “Agenda Variations”

Learning Factory Ecodesign Workshop

1 Day

Agenda

	Introduction		**Develop**
09:00-09:35	Welcome and introductions Get to know each other	12:45-14:20	Sprint 5 “Brainstorming and Ideation 00:00-00:00
	Discover		**Deliver**
09:35-10:10	Sprint 1: “Teaming up and set the Design Challenge”	14:20-15:30	Sprint 6 “Protoype Circular System”
			Validate
10:10-11:05	Sprint 2 “User interview”	15:30-17:00	Sprint 7 “Electronics Manufacturing Factory Tour”
	Define		
11:05-11:55	Sprint 3 “Mapping”	17:00-17:20	Sprint 8 “Circular Economy Business Model Development”
11:55-12:15	Sprint 4 “Design Brief		
12:15-12:45	**Lunch**	17:20-18:00	**Feedback, goodbye and end**

One day test training with students, 19.06.2017

Learning Factory Ecodesign Workshop

Agenda

2 Days

DAY 1		**DAY 2**	
	Introduction		**Develop**
11:00-12:05	Welcome and introductions Get to know each other	9:00-09:25	Welcome, Introduction 2nd day
	Discover	9:25-11:00	Sprint 6 “Brainstorming and Ideation”
12:05-12:50	Sprint 1: “Teaming up and set the Design Challenge”	11:00-11:20	**Coffee Break**
			Deliver
12:50-13:35	**Lunch Break**	11:20-13:00	Sprint 7 “Protoype Circular System” (incl. env. impact analysis)
13:35-14:05	Presentation “What is eco-design?”	13:00-13:45	**Lunch Break**
14:05-14:45	Sprint 2 “User/expert interview”	13:45-14:55	Sprint 8 “Circular Economy Business Model Development”
14:45-15:05	**Coffee Break**		
	Define		**Validate**
15:05-16:05	Sprint 3 “Mapping”	14:55-15:30	Wrap up
16:05-16:50	Sprint 4 “Design Brief		
16:50-17:50	Design in Practice		
17:50-19:30	Check out and Get Together		
20:00- ...	**Dinner (optional)**		

LERNFABRIK ECODESIGN

Two day pilot training with professionals, 12./13.10.2017

Umwelt Bundesamt

Fraunhofer IZM

ANNEX IV

Learning Factory Ecodesign Workshop
Agenda

3 hours

14:00-14:45	Welcome and introductions Get to know each other
14:45-15:10	Sprint 1: “Pitch and teaming up”
15:10-15:50	Sprint 2 “Ideation”
15:50-16:00	Sprint 3 “Design Brief”
16:00-16:10	**Coffee Break**
16:15-17:00	Sprint 4 “Prototype Circular System”
17:00	**End**
17:10-17:15	Optional Feedback Round

LERNFABRIK ECODESIGN

3 hour training for “Fachtag Ökodesign”, 19.01.2018

Learning Factory Ecodesign Workshop
Agenda

3 hours

13:00-13:30	Check in. Welcome and introductions Get to know each other, workshop flow and eco-design intro
13:30-13:45	Sprint 1: “teaming up and eco-design challenges”
13:45-13:55	Sprint 2 “Design Brief”
13:55-14:20	Sprint 3 “Ideation”
14:20-14:30	**Coffee Break**
14:30-15:10	Sprint 4 “Prototype Circular System”
15:10-15:50	Sprint 5 “Develop Circular Business Models”
15:50-16:05	Check Out

LERNFABRIK ECODESIGN

3 hour training for the German Environment Agency, 19.04.2018

ANNEX V “Checklists”

Design check list

Design check list

LERNFABRIK ECODESIGN

Needs analysis	fair, neutral, good or excellent
How does the product system actually fulfil social needs?	**Degree of consideration**
Does the product currently meet the users needs?	○ ○ ○ ○
Is the product able to adapt to changing needs (possibility for upgrades)?	○ ○ ○ ○
Are the product main and auxiliary functions are defined precisely?	○ ○ ○ ○
Is a customization of the product possible?	○ ○ ○ ○
Is your product unique on the market, with its environmental friendly approach?	○ ○ ○ ○

EcoDesign strategies	
• Recognize users needs by observing the market • Be aware of future changes in users needs	• Checking possibility for integration of functions • Precise defining of products functions

Design check list

LERNFABRIK ECODESIGN

Optimized product lifetime	fair, neutral, good or excellent
How does the product become a long lasting part of the user?	**Degree of consideration**
Is the product designed for durability?	○ ○ ○ ○
Is the product designed for maintenance and easy repair?	○ ○ ○ ○
Is the product designed for a second life having a different function?	○ ○ ○ ○
Is the product designed in a timeless look or fashion?	○ ○ ○ ○
Did you check reasons for disposal of similar products on the market (malfunctions, fashion, other)?	○ ○ ○ ○

EcoDesign strategies	
• Apply high quality manufacturing to ensure long life span • Ensure easy maintenance, repair and upgrades • Offering a timeless and/or adaptive look of the product	• Trigger a strong product-user relation (emotional bonding) • Identification of reasons of disposal for current products

ANNEX V

Circular business model check list

Circular business model check list

LERNFABRIK ECODESIGN

Implementation of circular business models	fair, neutral, good or excellent
	Degree of consideration
Do you provide a platform to allow collaboration among product users?	○ ○ ○ ○
Do you sell products or deliver and provide services?	○ ○ ○ ○
Do you retain ownership of your products during the use-phase?	○ ○ ○ ○
Is the circular business model an ambition of individuals (you) or is it largely supported by the company?	○ ○ ○ ○
Are your customers and suppliers aware of circular business solutions?	○ ○ ○ ○
Do you have product-take-back programs?	○ ○ ○ ○
Do you involve customers as well as suppliers in your value-added processes (co-creation)?	○ ○ ○ ○
How closely do you cooperate with your customers, suppliers and the whole circular business network?	○ ○ ○ ○
Are there any legislations or government regulations that need to be followed for implementing circular business model (in terms of product liability, parts recycling, materials usage etc.)?	○ ○ ○ ○

Circular business model check list

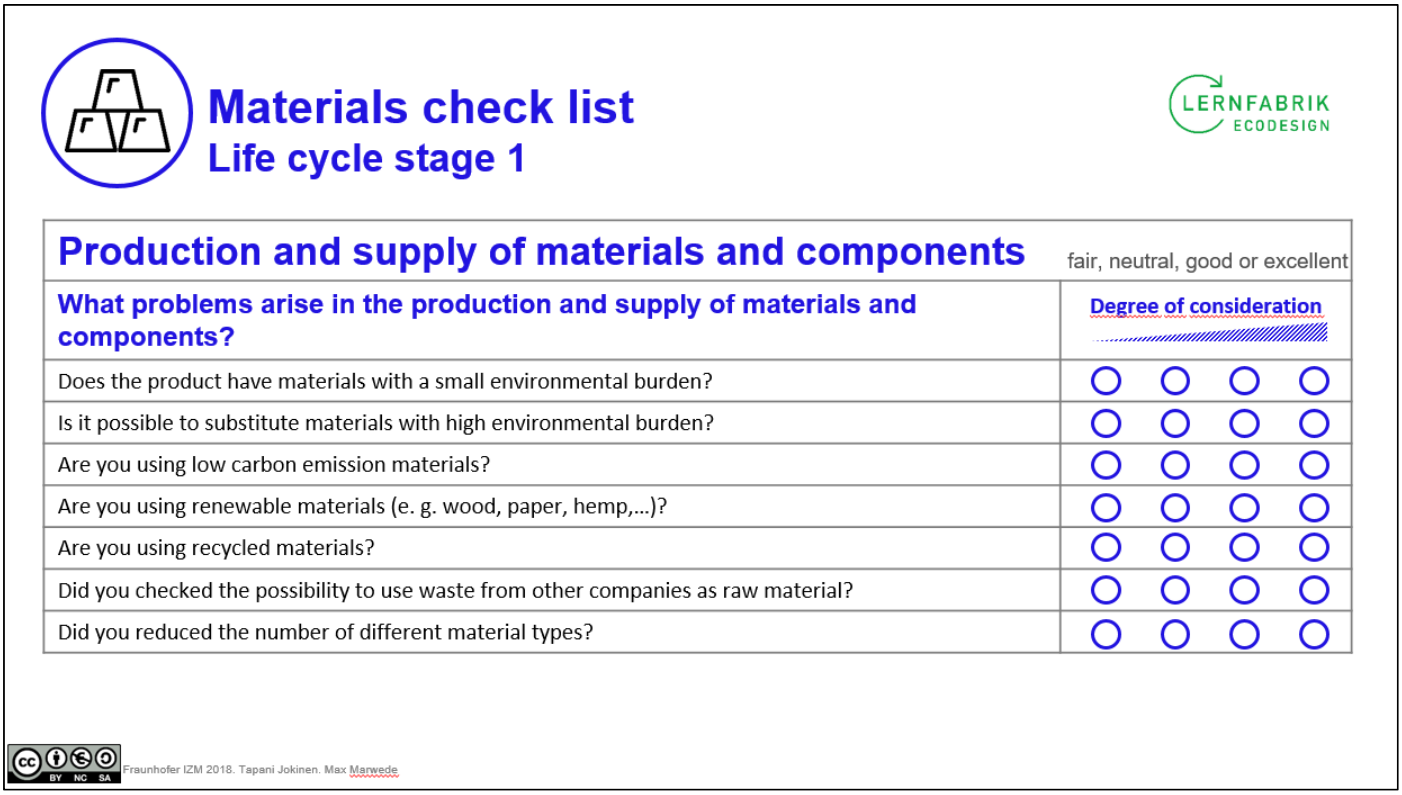
LERNFABRIK ECODESIGN

Implementation of circular business models	fair, neutral, good or excellent
	Degree of consideration
Do you consider environmental and social aspects in the cost-benefit analysis (beside financial aspects)?	○ ○ ○ ○
Do you know the financial and accounting impact of providing services instead of selling products?	○ ○ ○ ○

Fraunhofer IZM 2018. Florian Hofmann. Tapani Jokinen. Max Marwede

ANNEX V

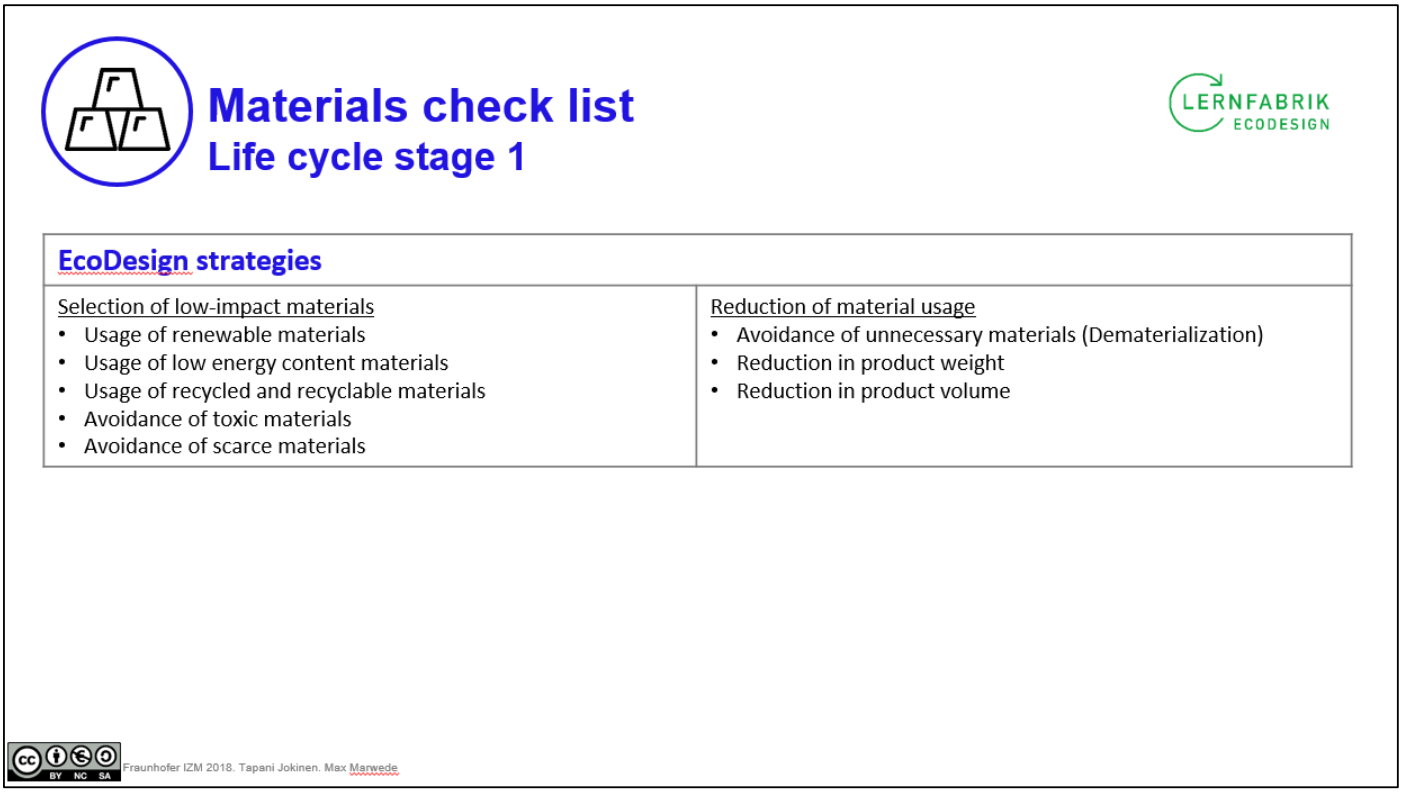
Materials check list – Life cycle stage 1



Materials check list
Life cycle stage 1

LERNFABRIK ECODESIGN

Production and supply of materials and components	fair, neutral, good or excellent
What problems arise in the production and supply of materials and components?	**Degree of consideration**
Does the product have materials with a small environmental burden?	○ ○ ○ ○
Is it possible to substitute materials with high environmental burden?	○ ○ ○ ○
Are you using low carbon emission materials?	○ ○ ○ ○
Are you using renewable materials (e. g. wood, paper, hemp,...)?	○ ○ ○ ○
Are you using recycled materials?	○ ○ ○ ○
Did you checked the possibility to use waste from other companies as raw material?	○ ○ ○ ○
Did you reduced the number of different material types?	○ ○ ○ ○



Materials check list
Life cycle stage 1

LERNFABRIK ECODESIGN

EcoDesign strategies	
Selection of low-impact materials • Usage of renewable materials • Usage of low energy content materials • Usage of recycled and recyclable materials • Avoidance of toxic materials • Avoidance of scarce materials	Reduction of material usage • Avoidance of unnecessary materials (Dematerialization) • Reduction in product weight • Reduction in product volume

ANNEX V

Manufacturing check list – Life cycle stage 2

Manufacturing check list
Life cycle stage 2

LERNFABRIK ECODESIGN

In-house production	fair, neutral, good or excellent
What do you have to consider in the production process in your own company?	**Degree of consideration**
Did you reduce the number of production processes?	○ ○ ○ ○
Did you reduce the number of auxiliaries and operational materials (e.g. water, air, oil,…)?	○ ○ ○ ○
Do you use renewable energy?	○ ○ ○ ○
Do you try to reduce the waste generated?	○ ○ ○ ○
Do you improve the yield?	○ ○ ○ ○
Do you reuse or sell your own waste?	○ ○ ○ ○
Do you sell your (heat-) energy from manufacturing processes to other companies?	○ ○ ○ ○
Do you use (heat-) energy from manufacturing processes from other companies?	○ ○ ○ ○

Manufacturing check list
Life cycle stage 2

LERNFABRIK ECODESIGN

EcoDesign strategies	
• Alternative production techniques • Fewer production steps • Low / clean energy consumption	• Less production waste • Few/ clean production consumables • Sharing waste / energy with other companies (Industrial Symbiosis)

Fraunhofer IZM 2018. Tapani Jokinen. Max Marwede

ANNEX V

Product check list – Life cycle stage 3

Product check list
Life cycle stage 3

LERNFABRIK ECODESIGN

Product related issues I	fair, neutral, good or excellent
What has to be considered in the product development?	**Degree of consideration**
Has the product low number of connections?	○ ○ ○ ○
Are the tools required to disassemble available and simple.	○ ○ ○ ○
Did you reduce the number of tools required to disassemble the product?	○ ○ ○ ○
Is the product build in a modularity way?	○ ○ ○ ○
Is there easy access to parts that likely to need maintenance?	○ ○ ○ ○
Is part inter-changeability applicable?	○ ○ ○ ○
Is the safety for technicians considered?	○ ○ ○ ○
Is there a standardization between product lines and across generations?	○ ○ ○ ○

Product check list
Life cycle stage 3

LERNFABRIK ECODESIGN

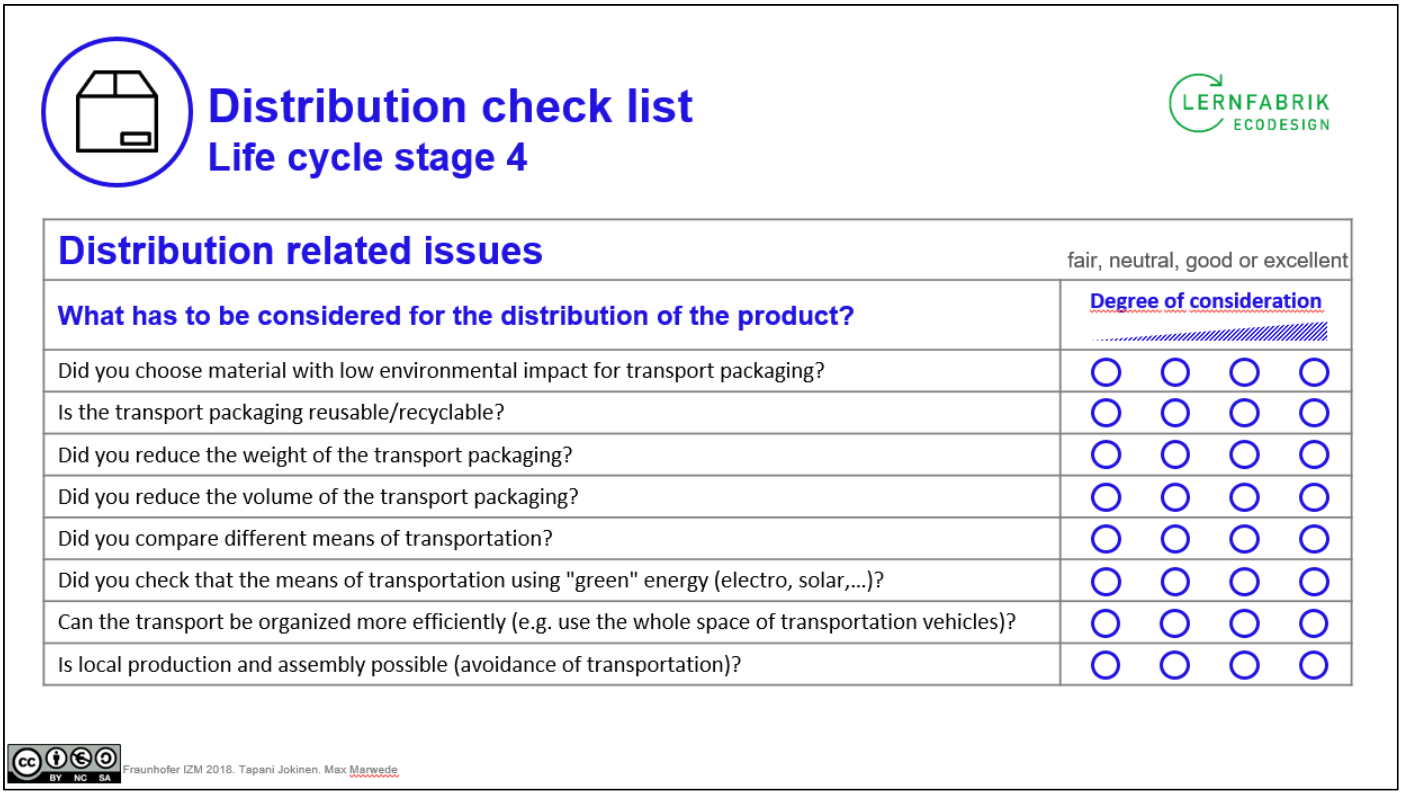
Product related issues II	fair, neutral, good or excellent
What has to be considered in the product development?	**Degree of consideration**
Did you label/mark parts with recycling codes or other permanent ways to identify materials?	○ ○ ○ ○
Did you avoid combinations of materials that are difficult to separate?	○ ○ ○ ○
Is it easy to separate components that are hazardous, toxic or not conventionally recyclable?	○ ○ ○ ○

EcoDesign strategies

Make clear if your product is designed for:
- refurbishment / remanufacturing
- maintenance / repair
- recycling

ANNEX V

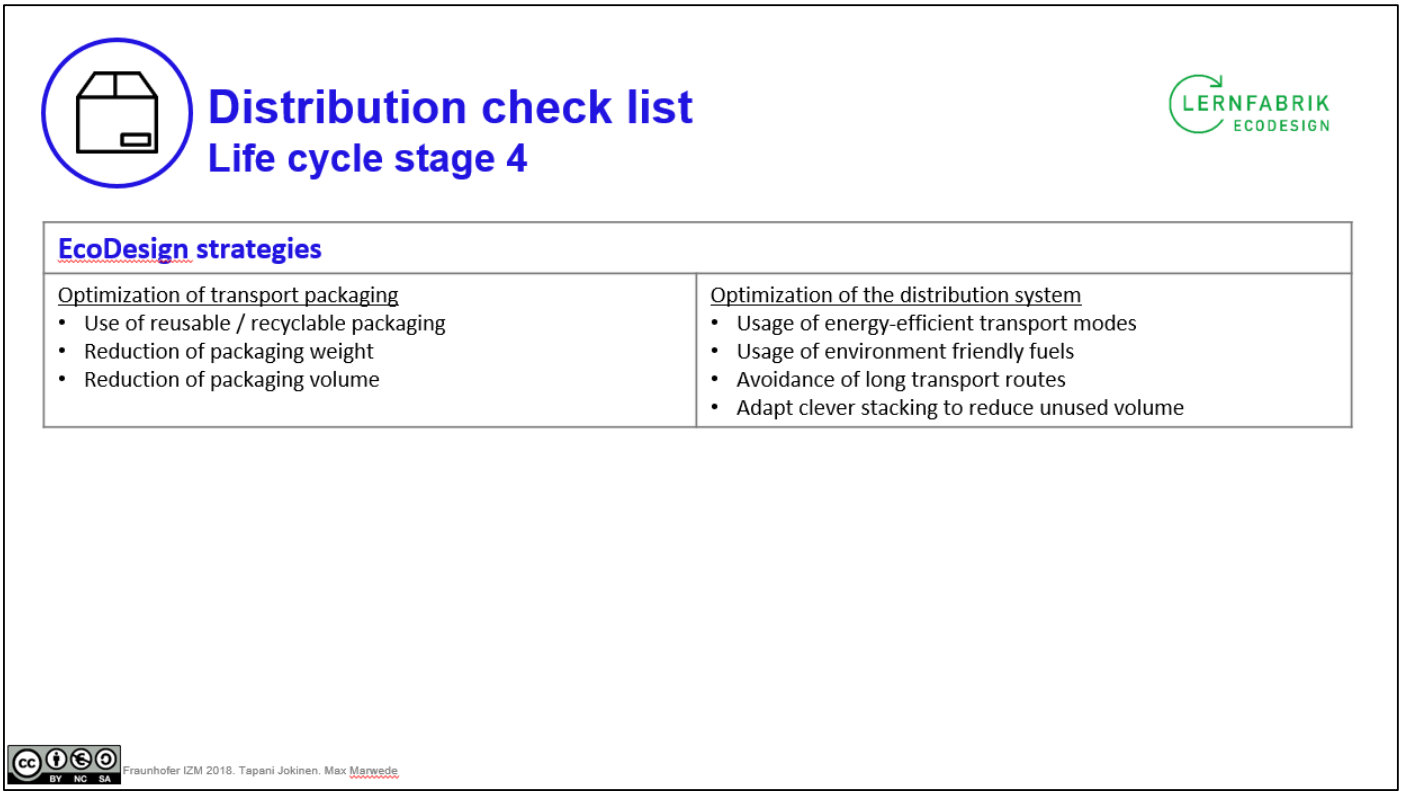
Distribution check list – Life cycle stage 4



Distribution check list
Life cycle stage 4

LERNFABRIK ECODESIGN

Distribution related issues	fair, neutral, good or excellent
What has to be considered for the distribution of the product?	**Degree of consideration**
Did you choose material with low environmental impact for transport packaging?	○ ○ ○ ○
Is the transport packaging reusable/recyclable?	○ ○ ○ ○
Did you reduce the weight of the transport packaging?	○ ○ ○ ○
Did you reduce the volume of the transport packaging?	○ ○ ○ ○
Did you compare different means of transportation?	○ ○ ○ ○
Did you check that the means of transportation using "green" energy (electro, solar,...)?	○ ○ ○ ○
Can the transport be organized more efficiently (e.g. use the whole space of transportation vehicles)?	○ ○ ○ ○
Is local production and assembly possible (avoidance of transportation)?	○ ○ ○ ○



Distribution check list
Life cycle stage 4

LERNFABRIK ECODESIGN

EcoDesign strategies	
Optimization of transport packaging	Optimization of the distribution system
• Use of reusable / recyclable packaging • Reduction of packaging weight • Reduction of packaging volume	• Usage of energy-efficient transport modes • Usage of environment friendly fuels • Avoidance of long transport routes • Adapt clever stacking to reduce unused volume

ANNEX V

Use check list – Life cycle stage 5

Use check list
Life cycle stage 5

LERNFABRIK ECODESIGN

Issues regarding utilization	fair, neutral, good or excellent
What problems arise when using / operating the product?	**Degree of consideration**
Does the product require less energy (direct or indirect) than similar products?	○ ○ ○ ○
Did you reduce the amount of consumables needed?	○ ○ ○ ○
Did you choose consumables with low environmental impact?	○ ○ ○ ○
Is the technical lifetime longer than similar products?	○ ○ ○ ○
Did you reduce the number of maintenance and repair cycles?	○ ○ ○ ○
Can the product be used (energy) efficiently?	○ ○ ○ ○
Is there a long bonding relationship to the costumer (touch points, brand perception,...)?	○ ○ ○ ○
Can the product be used by several users (sharing)?	○ ○ ○ ○

Use check list
Life cycle stage 5

LERNFABRIK ECODESIGN

EcoDesign strategies	
Reduction of impact in the use phase	Optimization of initial lifetime
• Low energy consumption • Clean energy source • Few consumables needed • Clean consumables • No wastage of energy or consumables	• Reliability and durability of the product • Easy maintenance and repair • Modular product structure • Classic (timeless) design • Strong product-user relation

ANNEX V

End of life check list – Life cycle stage 6 (part 1)

End of life check list
Life cycle stage 6

LERNFABRIK ECODESIGN

Waste recovery and disposal I	fair, neutral, good or excellent
What do you have to consider to close the material loops?	**Degree of consideration**
Did you consider what is the highest and best use for the product at the end of its life (e. g. used as a resource for your company or for another industry)?	○ ○ ○ ○
Is it possible to get the product back in a way that facilitates your business model?	○ ○ ○ ○
Can a method for product collection be implemented?	○ ○ ○ ○
Does the product still have a value once the costumer wants to get rid of it?	○ ○ ○ ○

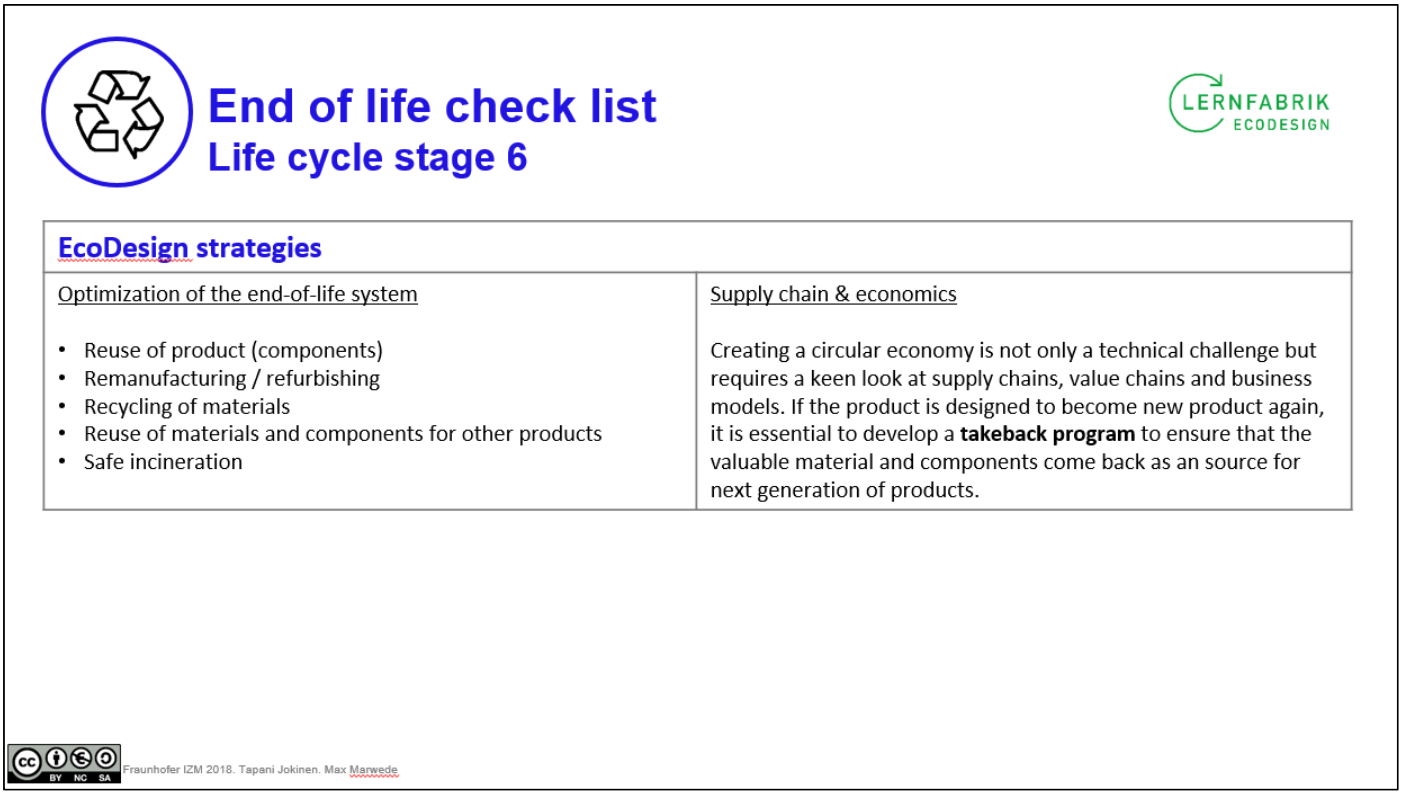
End of life check list
Life cycle stage 6

LERNFABRIK ECODESIGN

Waste recovery and disposal II	fair, neutral, good or excellent
What problems arise in the recovery and disposal of the product?	**Degree of consideration**
Do you know how the product is currently disposed of?	○ ○ ○ ○
Is it possible to reuse components or materials?	○ ○ ○ ○
Are recyclable materials identifiable?	○ ○ ○ ○
Can they be detached quickly?	○ ○ ○ ○
Are any hazardous components easily detachable?	○ ○ ○ ○
Do problems occur while incinerating non-reusable product parts?	○ ○ ○ ○

ANNEX V

End of life check list – Life cycle stage 6 (part 2)



End of life check list
Life cycle stage 6

LERNFABRIK ECODESIGN

EcoDesign strategies	
Optimization of the end-of-life system • Reuse of product (components) • Remanufacturing / refurbishing • Recycling of materials • Reuse of materials and components for other products • Safe incineration	Supply chain & economics Creating a circular economy is not only a technical challenge but requires a keen look at supply chains, value chains and business models. If the product is designed to become new product again, it is essential to develop a **takeback program** to ensure that the valuable material and components come back as an source for next generation of products.

ANNEX VI “Feedback Form”

Feedback questionnaire at www.umbuzoo.de

[page 1 & 2]

Feedback Learning Factory EcoDesign

Thank you for participating the Learning Factory EcoDesign. We hope you enjoyed the training and learned a lot. We constantly try to improve the training, so your feedback is very welcome. If you like to help us, please take **5 minutes** of your time to fill out this short survey. Thank you.

Für die deutsche Version, bitte hier klicken.

Next page

---

0 %

How would you rate the workshop overall (flow, timing, content,...)?

	1	2	3	4	
Very good	○	○	○	○	Dissatisfying

How did you like the moderation and presentation?

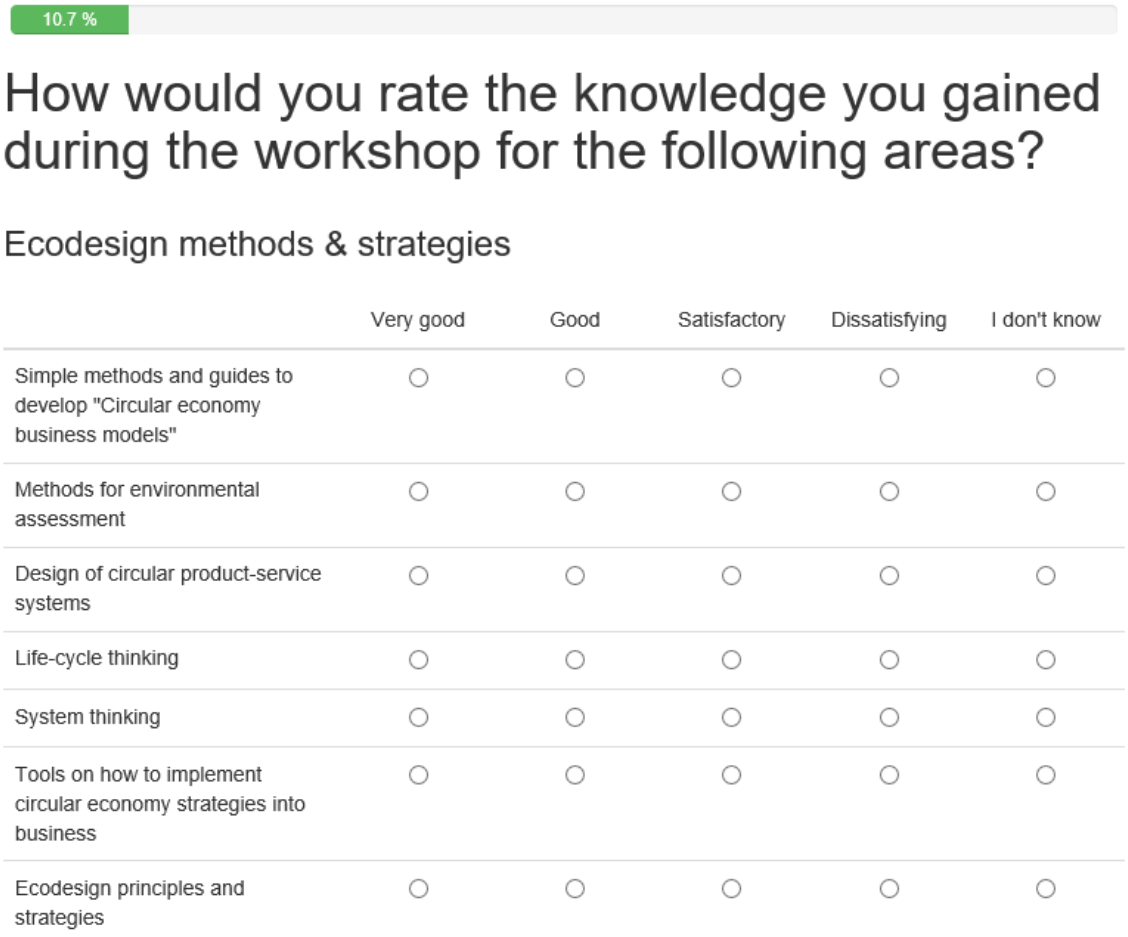
	1	2	3	4	
Very good	○	○	○	○	Dissatisfying

Any comments?

Back Next page

ANNEX VI

[page 3 – first part]



10.7 %

How would you rate the knowledge you gained during the workshop for the following areas?

Ecodesign methods & strategies

	Very good	Good	Satisfactory	Dissatisfying	I don't know
Simple methods and guides to develop "Circular economy business models"	○	○	○	○	○
Methods for environmental assessment	○	○	○	○	○
Design of circular product-service systems	○	○	○	○	○
Life-cycle thinking	○	○	○	○	○
System thinking	○	○	○	○	○
Tools on how to implement circular economy strategies into business	○	○	○	○	○
Ecodesign principles and strategies	○	○	○	○	○

ANNEX VI

[page 3 – second part]

Economic & business aspects

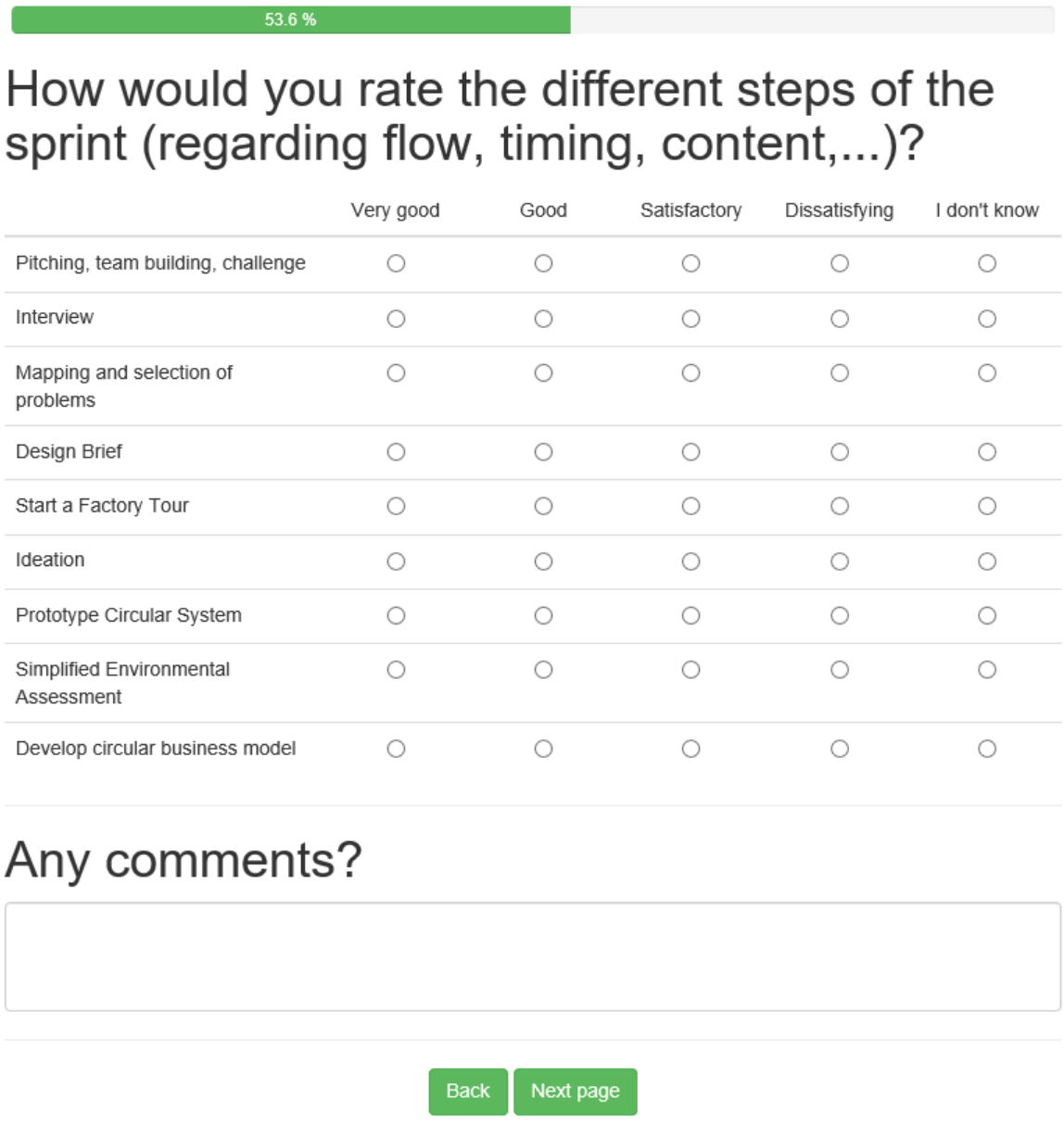
	Very good	Good	Satisfactory	Dissatisfying	I don't know
Arguments and information regarding which (economic) benefits emerge from ecodesign	○	○	○	○	○
Good examples of economic viable business models and "sustainable" products and services	○	○	○	○	○
Approaches to allign the business strategy to circular economy	○	○	○	○	○
Understanding of positive effects from ecodesign for people, planet and business	○	○	○	○	○

Any comments?

Back Next page

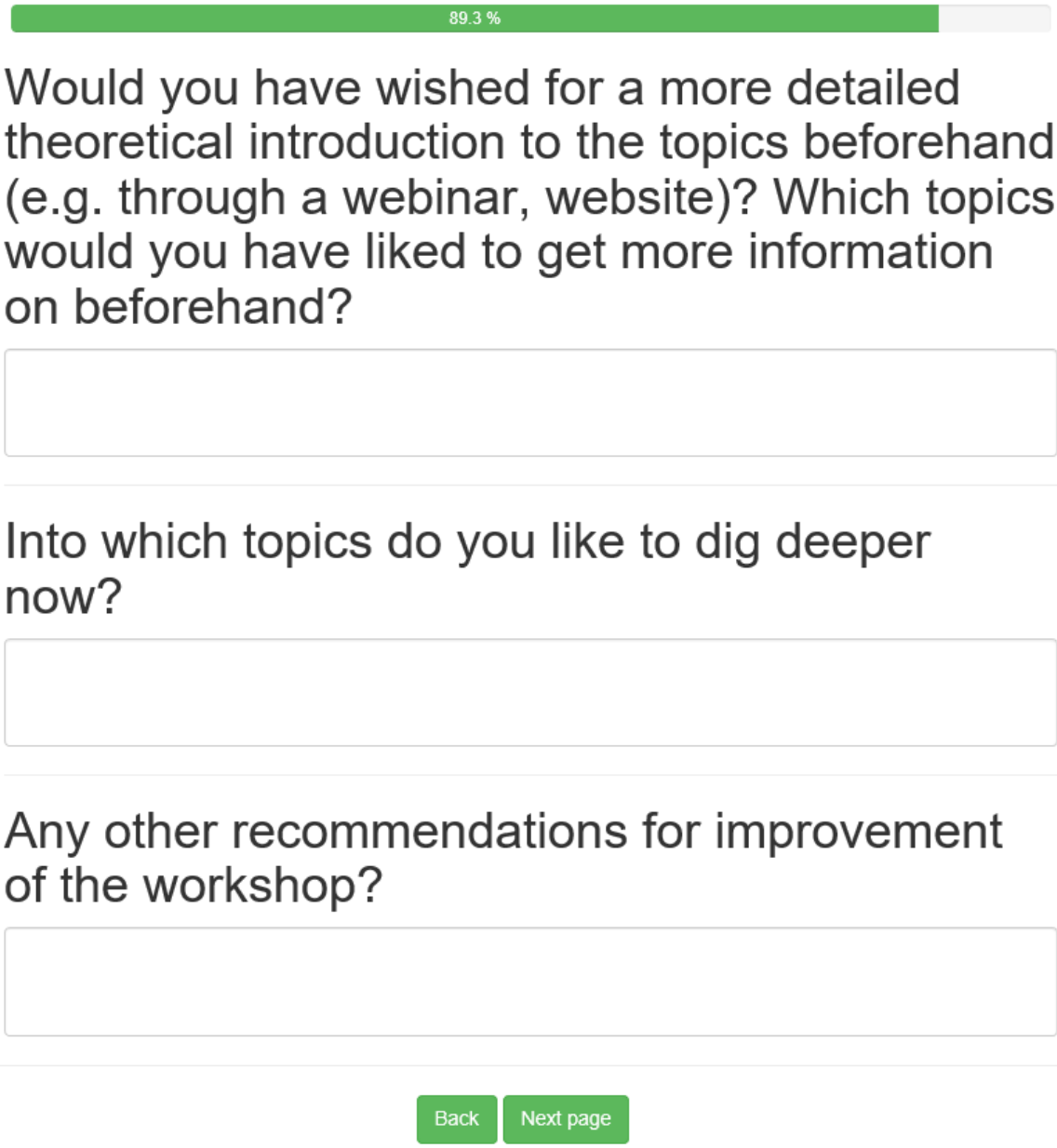
ANNEX VI

[page 4]



ANNEX VI

[page 5]



ANNEX VI

[page 6]