



## Design Thinking

### Introduction

The Design Thinking methodology goes back to creativity studies undertaken in the 1940s and 50s by psychologists, who over time developed creativity techniques from their results (Gordon, 1961; Osborn, 1953). Originally, design thinking was picked up by designers, who incorporated it into their product design process focusing mainly on aesthetics. Gradually however, design thinking has become well established in a wider context such as product and business model innovation, entrepreneurial idea development, and even strategic management topics (Magistretti et al., 2021). As a human-centered, team-based, and iterative approach to innovation, design thinking is often chosen as the mentality to approach the grand or wicked challenges of our time, successfully unlocking collective creativity to its full potential. Its ability to bring together multidisciplinary teams and instill within them a mindset problem and solution-exploration, has proven itself time and again in successful results. Therefore, design thinking was identified as the methodology of choice for the 2022 ACE Hackathon.

As mentioned above, transdisciplinary skill development is key to addressing the challenges facing us today such as clean energy transitions, combating climate change effectively. Thus, the following learning goals based on the application of design thinking have been anticipated:

### **ENTREPRENEURIAL SKILLS**

- 1 Various studies have found design thinking to be effective in building entrepreneurship skills, which in turn have become more and more important in today's business worlds, where entrepreneurially minded people are needed to approach and solve wicked problems in innovative ways (Klenner, 2021).

### **COLLABORATION, INTERPERSONAL & PROJECT MANAGEMENT SKILLS**

- 2 As an inherently collaborative method, design thinking has further been found an excellent method to build both collaboration and interpersonal skills as well as project management skills (Lynch, 2021; Lahiri et al., 2021; Magistretti et al., 2021) due to teaching empathy and teamwork. Participants will have to both put themselves into the shoes of others and understand problems that may – on the micro-level – not be their own, while navigating both problem- and solution space with team members



through a multitude of perspectives. For these reasons, design thinking as a method has been used increasingly in higher education in recent years.

### PROBLEM SOLVING

3 As a third example, design thinking has been found to improve people's ability to solve problems across a range of domains (Luka, 2014). One reason might be that while working in multidisciplinary and multicultural teams, people might be confronted with more perspectives and are forced to explore many different opinions and direction in an iterative trial-and-error process, preparing them to take decisions based on a more solid knowledge base.

The hackathons first design thinking session introduced participants to the methodology and its broader understanding. Participants were being introduced to the importance of human-centered thinking and working as part of design thinking. Human-centered in today's digital world meaning the collection of data and knowledge about a certain stakeholder group, where organizations and institutions alike continuously attempt to improve themselves and the world, anticipating the future. Participants were also explained in detail about the significance of approaching the challenges presented as a team. Design thinkers often talk about the "myth of the creative genius" that supposes single individuals as big inventors through so called light-bulb moments, in which they single-mindedly develop the next big invention. This myth is revoked by the design thinking methodology and instead collaborative approaches are preferred, embracing broad views, transdisciplinary and transcultural perspectives mixed with local specifics creating a heterogeneous and holistic process - always both problem and solution-oriented. And lastly, participants were made familiar with the iterative nature of design thinking, which relies on going back and forth between the five steps (depicted in Fig.1 below) – fluidly moving between exploring problem- and solution spaces – to enable synergetic solutions that address the wicked challenges of our time.

### Five Phases of Design Thinking

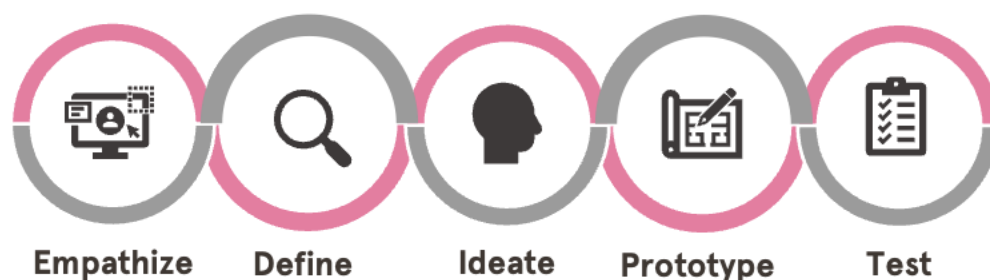


Fig. 1



Each of the five steps were subsequently explained to participants. For each a number of selected methods from the design thinking toolbox were selected and applied to the chosen challenges in 90-minute sessions over the three days of the hackathon. The following section will first outline and then reflect upon each of these sessions.

## Empathize

Beginning with the empathize step, participants were introduced to the importance of empathetic research to fully grasp and understand problems that are not their own. Empathetic research lays the base for any successful innovation based on design thinking. It is a process of going broad, in which one zooms-out, taking on a bird's perspective to demarcate the boundaries of a given problem-space at hand. The questions supposed to guide the empathy process are "who are the relevant stakeholders?" and "What are their perspectives and pain points?". The different methods of the empathy toolbox serve as prompts, enabling the answers to the above questions over time. Serving as a low-threshold entry point for participants, stakeholder mapping was applied to the challenges at hand. The method serves to identify all stakeholders involved in a certain problem-space and prompts participants to both think and research their perspective and pain points as well as identify potentially enabling or disabling relations between the many different stakeholders involved in clean energy transitions at the local level. Thus, the outcome of the empathy step is building a comprehensive mind map identifying, clustering, and analyzing the key stakeholders within a certain problem space.

Throughout the session, the teams used provided knowledge base and started collecting the stakeholders from (renewable) energy industry, politics, institutions, organizations, and private households. Thereafter, they analyzed stakeholder's motivations, interests and (financial) dependencies.



## Empathize

### Stakeholder Mapping – Who are the stakeholders?

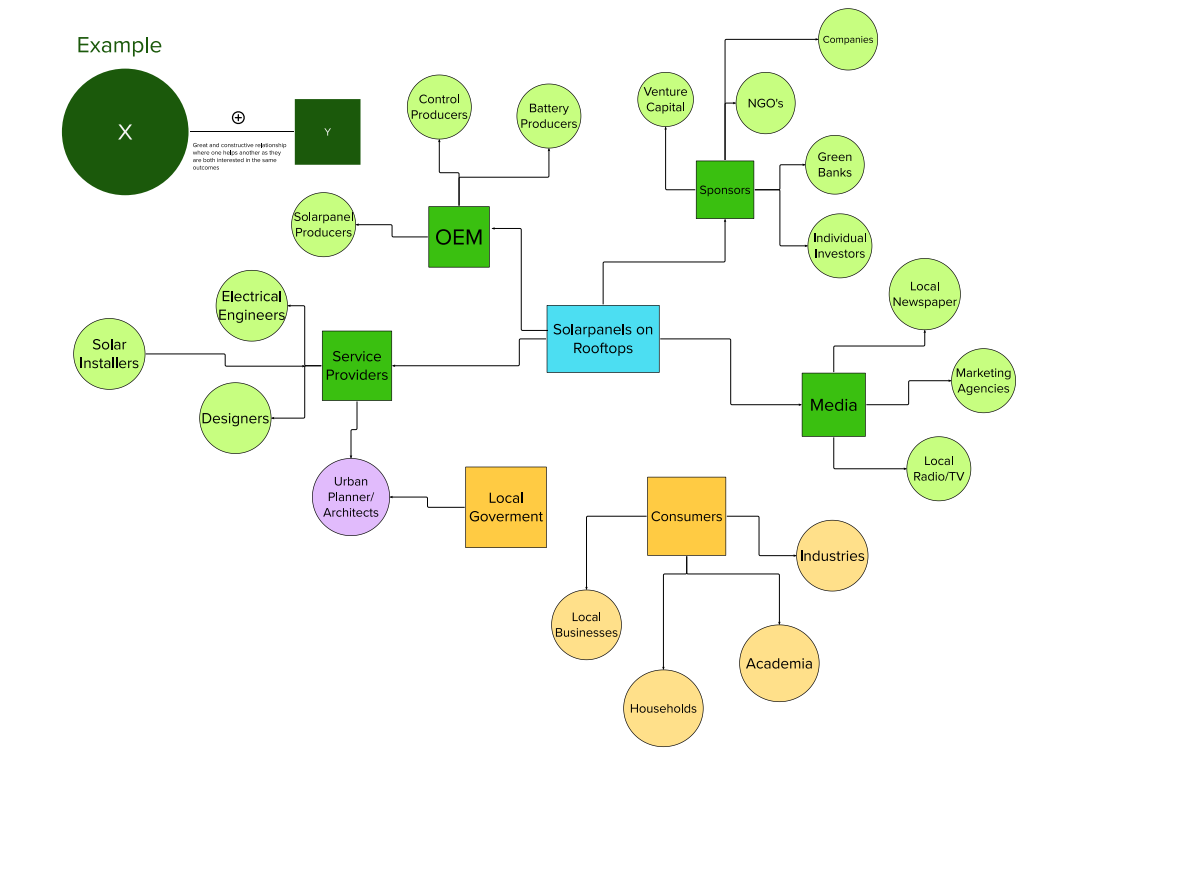


Fig.1 Example of a stakeholder map developed during the Hackathon.

To build a stakeholder map proper research is necessary for an in-depth analysis. The research time within the hackathon was limited, which led to a less comprehensive stakeholder map possible otherwise. However, the results of the session clearly showed that participants were able to develop a joint understanding of the chosen problem statement, acknowledged the central problems of different stakeholder groups and identified dependencies between individual stakeholder problems. Therefore, the teams established an excellent foundation for further elaboration. Considering the human-centered nature of design thinking, a notable limitation is the lack of field work undertaken to validate the research and assumptions about the different stakeholders. For future events of a similar kind, the provision of representatives of relevant stakeholder groups might be considered and arranged beforehand.



## Define

After identifying a problem-space and its key constituents a clear problem definition within the boundaries of this space needs to be generated. Thus, participants were asked to synthesize and redefine their findings from the empathy mode into an actionable problem statement. The define step is one of, if not the most difficult in the design process. Often, problems are not clearly understood and defined before solutions are being generated, leading to less-than-optimal results. The reason for avoiding the dealing and defining of problems is because it can be quite difficult to fully comprehend the complexities and intricacies of wicked problems. This means that an actionable problem statement needs to be narrow yet broad enough to create a broad enough solution-space to be explored. Thus, a clear problem statement provides guidance and direction throughout the innovation process, defining a solution-space that is broad enough to enable creative thinking. Therefore, multiple methods have been developed to help design thinkers reach that goal.

A method suitable to decrease the complexity of information and tangibly redefine the more abstract-level information from the empathy step are personas. Personas are an amazing prompt to enable deep understanding of human's thoughts, feelings, and actions. Personas are fictional and always representations of certain stakeholder groups. Through personification of abstract information, the human brain is aided in understanding each other's problems. Thus, teams were tasked to create personas representing different stakeholder groups, enabling a human-centered approach to exploring the problem space defined more in depth. Questions they were supposed to ask themselves throughout were "What could a persona representing a stakeholder look like?", "How do they live?", "What are their personal motivations, problems and intentions?". Based on three different building blocks derived through the application of the first two methods (i.e., stakeholder group...needs/problems...key insight/learning), actionable problems were defined, and the teams had to jointly agree on an actionable problem statement to further guide their innovation efforts. Based upon these statements, they then developed "how might we...?" questions such as:

"How might we incentivize private household to invest in solar panels more effectively?" "How might we overcome the common obstacles in the clean energy transition for companies?" for problem statement 1, and

"How might we establish a collaboration model which connects key stakeholders?"  
"How might we achieve an attractive collaboration model that encourages cities to work with municipalities?" for problem statement 2.



As expected, this step was quite challenging for participants as clean energy transitions on a local level present complex and intricate webs of issues and facets amounting to the bulk of a problem that is hard to grasp let alone define. We noticed that many teams aimed to find 'one stop shop' solutions, tackling all or multiple problems simultaneously and, therefore, came up with too broad problem statements, which may lead to more vague and less targeted solutions. Given the lack of in-depth analysis based on time pressures this was not surprising. All in all, and especially considering the timing issue, teams managed very well in identifying key problem. All problems were suitable to open a solutions-space for exploration.

#### Ideate

The definition of a problem opens a solution-space to be explored. Ideation as part of design thinking means the process of idea generation. Based on the previously defined problem statements, participants were now asked to switch from problems to solutions and develop ideas to solve the problems.

Considering the main critique of "group think" on the design thinking methodology, a combination of individual-level and collective-level methods was chosen for application: "Crazy 8", a core design sprint method and "visual brainstorming" to visualize ideas for collective ideation.

The crazy 8 method is based on the premise that the first ideas developed are most often the least inspiring or innovative ones, whereas further fast generation of ideas will unlock the crazy and truly innovative ones, which are often needed to release creativity to its full potential. The teams get eight minutes, to individually write down at least eight ideas. Hereby, the method encourages 'out-of-the-box thinking' by enabling every team member to be individually creative as it does not matter whether the developed ideas are practical, implementable, or realizable.

Depending on team size, each team ended up with 24 to 48 ideas following the crazy 8. They were now tasked to develop a mind map by visually brainstorming on their respective ideas, continuing the ideation process collectively. Thus, and comparable to stakeholder mapping, visual brainstorming makes use of visualization to capture ideas, organize information, and decrease complexity of information by using a sort of mind map. The teams were asked to write their problem statements in the middle of their mural boards and then collectively develop their ideas further. They revisited their ideas and wrote down thoughts that came up in relation to them as well as highlighted connections or correlations between them, and even elaborated further on particularly interesting ones. Using color, they were asked to finally highlight the ideas with the highest potential. In the final step the participants were supposed to reflect on these



preferred ideas by playing one of two scenarios: “How would you realize your idea with a budget of EUR 1,000?” and “How would you realize your idea look with a budget of EUR 1,000,000?”

In the ideate step of the workshop the overall goal is not only to come up with a broad variety of solutions but also to elaborate on them and connect them. By defining and then exploring solution-spaces for the respective two problem-statements, teams were able to permeate their complexities and intricacies, enabling them to move beyond the expected. This part is usually the most exciting for participants, since they finally get to “create” something new to solve a real problem. However, it is also challenging because using creativity to its full potential, requires design thinkers to stay open-minded. As mentioned above, it is common that once confronted with a problem, participants immediately focus on (im)possible solutions. Design thinking requires thinking about problems first and foremost to enable moving past the obvious solutions. Although the ideate step contains the application of multiple different methods, participants needed to constantly be reminded not to focus on one solution too early on to not limit their creative exploration of the defined solution-space. Accordingly, some of the teams were convinced of a particular idea at an early stage, which made it difficult for them to push their ideas as much as possible out of the box. However, all teams came up with viable ideas for possible concepts to be developed during prototyping.

### Prototype

After developing the first ideas to solve a defined problem, the fourth step of prototyping focuses on the development of the first rough prototypes. Since design thinking is based on prototyping and testing in rapid succession, it assists the design thinkers in subsequently deriving superior prototypes that can be successful in the market. Thus, prototyping is a process on a continuum from low- to high-fidelity prototypes, the levels of which can be described as conceptual, physical, and looks-like-works-like. While the solving of wicked problem entails positive change for societies and environment, businesses and product ideas must be economical as well as ecological. The rapid succession of prototyping and testing aims to ensure exactly that.

The method of parallel paper prototyping was used during the hackathon, using the creation of a high number of rough prototypes on paper individually and in parallel. The biggest critique on the design thinking methodology being loss of voices throughout the process due to group think developments, ensuring the working on an individual level will allow every participant ideas and voices to be heard.



Additionally, the exploration of multiple design alternatives simultaneously, will prevent the focus on only one too early in the process. Additionally, it will enable the evaluation and combination of multiple features or elements into a more superior prototype as each individually might have been.

The participants were asked to use the chosen ideas from the ideate step and individually put pen to paper, visualizing a conceptual prototype. The focus of this session was not on the creation of a perfect prototype but on making the developed ideas tangible. This task was challenging for participants as it depended on lifting an idea to the conceptual level, thus, working from the abstract to the concrete. Again, some teams were already committed to a specific solution prior to prototyping, and so not every team took the opportunity to think outside-the-box. However, even though prototypes were mostly going in similar directions, there were subtle but important nuances in different prototypes. As a result, teams came up with general directions such as specific cooperation models, digital platforms, or even educational programs to test in the following step.

### Test

To improve upon the developed concepts, they need to be tested. Testing is the process of putting the developed artifacts into the different relevant stakeholder's environments, real-world or fictional, to gather feedback and refine the developed concepts.

Considering the stage of the prototypes, a team internal method was chosen for application. The '4-Quadrant' method uses a feedback capture grid to identify remarkable, confusing, and negative things about a prototype as well as give room to just down new ideas that were sparked.

