Final Project Report for the CERN Bootcamp 2022 - SDG11

Team Citizens of Babylon

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Introduction

The concept of Sustainable Development first received major attention in 1972 at the UN Conference on the Human Environment held in Stockholm. In 1979, the economist Rene Passet first introduced the classification of the term of sustainable development into three principles: the environment, the economy and the society. Ever since, sustainable development has often been defined as "the development that meets the need of present without compromising the ability of the future generations to meet their own", according to the Brundtland Report from 1987.
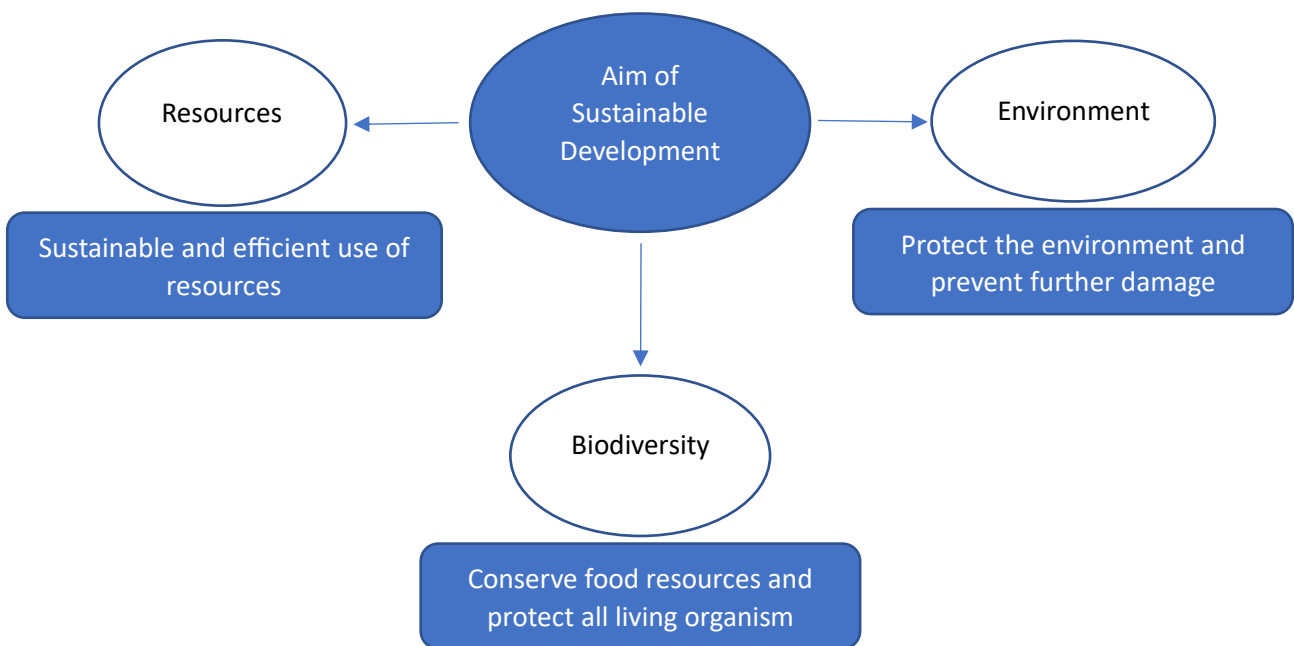
Figure 1. Map of the aims of sustainable development

The main objective of sustainable development is using renewable resources effectively while avoiding environmental damage in order to reach a state of society in which living circumstances and resources are utilized to suit human needs without jeopardizing the natural system's integrity and stability and considering future generations' needs in mind.

During the CERN Bootcamp 2022, our group's challenge and the problem we identified are linked to United Nations (UN) sustainable development goal 11 (SDG11): "Make cities and human settlements inclusive, safe, resilient and sustainable." SDG11 is a wide goal, including multiple challenges. As the world's population is constantly increasing, there is a need to build functional and sustainable cities. The conditions for the citizens and communities to live in, need to be resilient, safe, intelligent, green, inspiring, and urban. Changes are required for citizens to prosper within the limits of the planet (The Global Goals 2022).

The main message of the SDG11 is that everyone can contribute to reaching the goals within it. SDG11 is divided into 10 sub targets which are: Safe and affordable housing, safe and sustainable transport systems, inclusive and sustainable urbanization, protect the world's cultural and natural heritage, reduce the adverse effects of natural disasters, reduce the environmental impact of cities, provide access to safe and inclusive

green and public spaces, strong national and regional development planning, implement policies for inclusion, resource efficiency and disaster risk reduction, support least developed countries in sustainable and resilient building (The Global Goals 2022).

During our time in CERN, we set ourselves the following challenge: "How might we increase local engagement to make cities resilient?" We identified the focus of our challenge based on data gathering, expert interviews and ideation. These methods are explained in depth in this report. Our expert interviews and data gathering show that while environmental awareness has increased, this awareness has not yet been greatly reflected on the actions (Dufva, 2020). Sustainable solutions have been created, but they have not been communicated and shared as effectively as possible (Deda, 2022). Technologies that allow green growth already exist, but they are not utilized effectively. "How can you recognize the value of technology if we don't know this value" (Krause, 2022)? Affecting peoples' mindsets is one of the core elements we set ourselves in our challenge. Further key drivers of the challenge were sustainability, inclusiveness, and resilience. Sustainability and resilience are linked to each other. A city needs resilience to have sustainability and resilience requires sustainability. All the community members need to be involved to create sustainable and resilient cities. Thus, inclusiveness needs to be considered in the solution.

Today, smart city solutions are already part of our everyday life in developed counties. We are more and more interconnected via our smart phones, smart home solutions and cars, for example. The technologies that enable these developments hold a huge potential for energy-efficient city infrastructure, water, waste and energy systems, as well as for creating more convenient everyday life. However, alongside these possibilities, new challenges arise as well. Our team decided to focus on the challenge side of this development.

This report describes the development approaches used in the process as the evolution of the design. Throughout the ideation process, we were inspired by cutting-edge technologies developed in the ATTRACT program. The final solution to the identified challenge and problem is presented at the end of the report.

Development approach: Service design, design thinking and the Sprint

In society and the world of business, service design as a method to create new services and find new solutions has grown in popularity, and its importance has increased during recent years (Moritz, 2005, p. 39). According to Moritz (2005, pp. 25–27), in the world of business, four main drivers are responsible for the rise in need of service design: The service economy is booming, the product market is satisfied, technology enables service, and humans have individual needs. These developments have driven organisations in a situation where they need to find ways to differentiate from competition and create products and services that speak for individuals and cater for their needs (Moritz, 2005, p. 27). This is where service design and design thinking come into play in the business-to-business or business-to-consumer environment. However, as we have experienced during our Bootcamp, service design methods and ideology can also be applied outside of business to define challenges and find solutions to significant societal issues and questions.

Service design stems from the idea that the principles used in product design can be applied to services as well. According to Moritz (2005), the first time that service and design coincided was in 1984 in an article by Lynn Shostack. In 1991, service design was then introduced as a discipline in Köln International School of Design (Moritz, 2005, p. 66).

Although service design as a design methodology and discipline has existed more than 30 years, it is challenging to find an all-inclusive, common, and shared understanding of what service design is or how a service design project should be conducted. This becomes apparent when the current service design

literature is examined (see for example Design Council, 2022; Brown, 2008; Moritz, 2005; Saco & Goncalves, 2008; Stickdorn, Lawrence, Hormess & Schneider, 2018). However, common denominators, tools and thoughts can be identified from different scholars and their approaches, and it can be stated that all approaches share a common core (for example Moritz, 2005, p. 119; Stickdorn et al., 2018, p. 88).

The common denominator almost all service design literature refers to in some depth is the Double Diamond. It was created by the British Design Council in 2004 and it aims to create a clear process that both service design professionals and non-professionals can follow. The Double Diamond is formed by two diamonds where the left sides represent divergent thinking and the right sides convergent thinking. Divergent thinking refers to the actions during which the issue is explored more deeply and from all angles, and convergent thinking to taking a more focused action and narrow the question at hand. This way of studying a challenge is in the core of all service design approaches. The Double Diamond process has four iterative phases, which can also be identified from most other service design processes. The four Ds entail: Diverge to understand the problem; Defining to define the problem based on the insights gathered in the previous phase; Develop to answer the problem with multiple solutions in collaboration with different people or a team; and Deliver to test the chosen solutions and find the ones to develop further (Design Council, 2022).
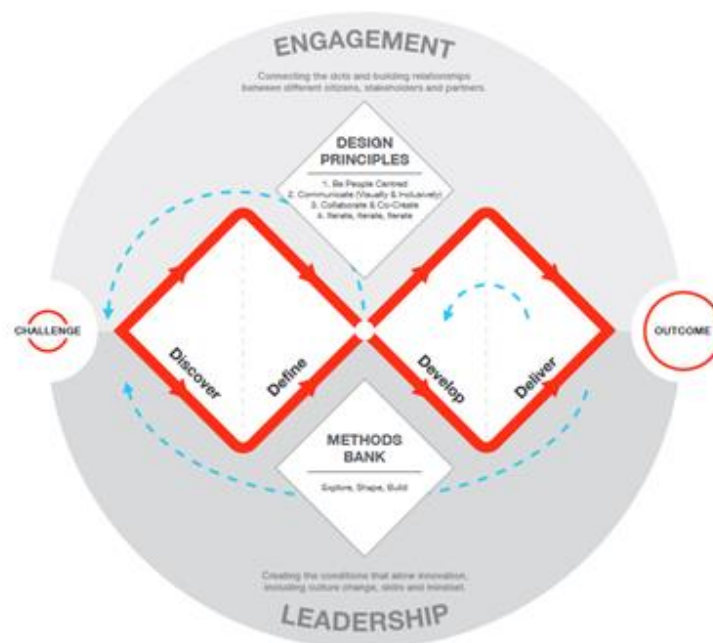
Figure 2. The Double Diamond of Design (The British Design Council, 2022)

In addition to the afore mentioned phases, there are multiple principles that are commonly shared between approaches.

Firstly, service design is a multidisciplinary system or process where tools and knowhow from, for example, strategy, marketing, change management, psychology, and design are combined (Moritz, 2005, p. 32; Saco & Goncalves, 2008, p. 10). Secondly, a service design process is iterative meaning that the different phases are be visited multiple times during a project to ensure the best possible outcome (The British Design Council, 2022; Moritz, 2005 pp. 39–40, 149; Stickdorn et al., 2018, p. 26). Thirdly, designing a service is a team effort, and it is vital to find the right people to the core design team. In addition to the core team, possible end-users, other employees, or complete outsiders can be involved in the design process as this helps to gain a

thorough understanding of the issue and pinpoint possible answers (Design Council, 2022; Knapp, Zeratsky & Kowitz, 2016, pp. 29–34; Moritz, 2005, pp. 55, 123).

Lastly, empathy, human-centricity and holistic thinking are in the core of service design: the process should start from understanding people's needs and aspirations, and every stakeholder that is affected by the service or solution ought to be considered in the design (Design Council, 2022; Moritz, 2005, pp. 39–40; Saco & Goncalves, 2008, p. 12; Stickdorn et al., 2018, pp. 26–27). In addition, service design processes share the same tools that are used to collect information, create and develop ideas, test them in real life and finally implement the solution. There are not a set of rules that define which tool to use in which phase of the service design process as many can be used in multiple phases. The collection of different tools is substantial, and a selection of tools can be found in every afore mentioned publication.

During our Bootcamp, we used the Sprint service design process by Knapp, Zeratsky and Kowitz (2016) as a base. The model was developed when the authors worked for Google Ventures, and during the years, they have implemented the method with hundreds of companies and applied it to different problems and ideas.

Knapp et al. (2016, p. 9) define the Sprint as way to answer critical questions through prototyping and testing ideas. It combines strategy, innovation, behavioural science, design and more, and packages them into a neat process that anyone can use. Their book is meant as a step-by-step guide for anyone who wants to try the method to test ideas and get quick feedback from potential users (Knapp et al., 2016).

The sprint is a comprehensive process that helps the sprint team to pinpoint on which part of the problem to focus, define the best possible solution, create a prototype and test it. The sprint method can help organisations to avoid spending significant amounts of money, time and other resources to ideas that will not work, or to pinpoint how to make their ideas even more appealing to their target segment. If the sprint is executed well and each step is followed, its key benefits are effectiveness and speed. However, if the sprint is not done according to the guidelines or the sprint team consists of the "wrong" people, its benefits can be close to none (Knapp et al., 2016).

The sprint consists of six parts: setting the stage and five working days from Monday to Friday (Knapp et al., 2016). Each step has clear guidelines, exercises, timetables, and goals to follow to reach the optimal outcome. Below, the steps are defined as they were portrayed in the book, and in the next chapter, the team's process is defined in detail since it varies from the original one quite significantly.
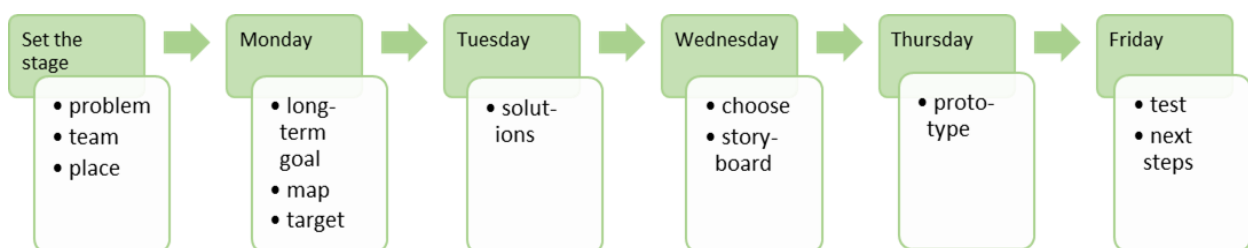

Figure 3. Plan of the traditional five-day Sprint week

Evolution of the Design

Data gathering

After two kick-off days in March where our team first met, we shared roles, so everyone could do their research and gather data from different kind of point of views. Some concentrated on ATTRACT technologies, some were searching for information of existing solutions, and some worked with nudges. Each member of the group had the opportunity to influence the angle from which they sought information.

One very important source was the UN's page for SDG 11, so the whole team could familiarize themselves with the challenge. Also, many videos regarding SDGs and topics like sustainable and smart cities, housing, transportation and environmental design were watched during the data gathering. The team also made themselves familiar with dozens of ATTRACT technologies. Even if at that point we had not yet had figured out what the actual challenge would be, some of the most potential technologies were tagged and sketched.

The search for information was also driven by the idea of finding ways to influence people's mindset. In addition to various rules and laws, taxation, penalties, and rewards, the possibility of successfully utilizing the effectiveness of softer interventions that do not limit decision-making or include financial incentives was explored.

The team also looked at Sitra's Megatrend report from 2020, to get a better understanding on the trends and megatrends that possibly could affect our challenge and solution. We found a few highly interesting and challenge-related megatrends, like "Tension between environmental awareness vs. environmental action" and "Is technology an opportunity or a threat"?

The concept of the city was also examined from different perspectives. The definition is not self-evident. We also looked at the concept of a 15-minute neighbourhood and the need to centralize or decentralize services. The community definition was also examined. Communities are today seen as major influences in issues of democratic development, urban planning and sustainability (Marsden & Hines, 2008, pp. 22–27).

This leads to a smooth transition to the concept of a sustainable community. However, as Blay-Palmer (2011, p. 747) argues, the term is still not codified, and due to this ambiguity, it is difficult to identify how sustainable communities look like in practice. Marsden (2008, p. 28) argues that community and sustainability need each other and that there is a two-way interaction between those two. Communities and their efforts to increase sustainability do not act in a vacuum but are affected by the world around. Marsden argues that the most important stakeholders are the state and firms since they define the available resources for action. Resources are defined in the broad sense of the word to include economical, ecological and social resources (Marsden, 2008, pp. 30–31).

We also examined the concept of Smart. The United Nations Economic Commission for Europe (UNECE) and the UN's International Telecommunication Union define smart cities as "A smart sustainable city is an innovative city that uses ICTs and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects". Smart cities are described as cities that use ICT to solve public issues and create better living conditions with different stakeholders such as non-profit organizations, residents and firms, and aim at increasing sustainability while doing this. Smart city solutions are almost always a combination of public and private effort since the technological solutions are often provided by private companies (for example, Moch & Wereda, 2020, p. 2; Vitunskaite, He, Brandstetter & Janicke, 2019, p. 314).

The security aspects of smart cities and the technologies attached to them have been widely discussed during the last decade. A common understanding is that there is still a significant lack of methods to ensure security and privacy when it comes to smart city solutions. Even if the methods exist, the know-how to use them correctly might not. The security concerns arise from many sources, for example, the highly complicated ecosystem of a smart city, unknowledgeable use of technology and devices, and lack of know-how (Elmaghraby, A. & Losavio, M., 2014, pp. 492–494; Vitunskaite et al., 2019, pp. 315–316; United Nations UN's International Telecommunication Union, 2020, pp. 3–8).

Although a lot of data had been collected from different sources and at different angles before the Bootcamp week, more data was collected during the sprint week, including the following interviews, which gave the team more insights from some point of views like security and smart cities. In addition, the data was further processed using various tools and functions. The team was sometimes divided into smaller groups to make the work more efficient and to give us more perspective on design, development and innovation. Our research wall – that helped us to organize a large amount of information and see the connections and forming patterns – played in big role in that. The team also used brainwriting – silent recording of observations – to share ideas more anonymously than with brainstorming. These issues are discussed in more detail in the sections dedicated to these themes.

Interview summaries

Mari Vaattovaara

Juniper and Matias interviewed **Mari Kaarina Vaattovaara**, a professor in urban geography at the University of Helsinki who leads the multidisciplinary Helsinki Institute of Urban and Regional Studies. Her research has primarily focused on housing policies, segregation, and migration. During the past five to seven years, she also established a multidisciplinary master's program on this topic.

Recently, her focus has been on reassessing what urban sustainability means at the neighbourhood or the city block level. In her view, the biggest challenge at the moment is the loss of understanding of sustainable growth in cities despite the increasing amounts of data available. Hence, she is currently preparing a research project to define sustainable development indicators for the community level that can be measured by looking out of the window. With these more targeted and focused indicators, she wants to reduce the wiggle room we have to simply call existing processes sustainable and rest on past successes.

She is also concerned that the absence of legislation on what a city in Finland is has allowed cities to grow beyond "the limits of municipalities, so the municipal capabilities of solving any sustainability problems are not as good as they used to be". Furthermore, she reminded us that the globalisation of cities means that they are today linked with actors worldwide and thus cannot be considered or made to change independently. In the future, she does not believe that cities will be split into fully decentralised units, e.g., with some of their own food production. Instead, she predicts that small-scale decentralisation will occur within a broadly "centralised urban fringe". The opportunities of remote working are certainly helping this development, as people who only have to physically commute to work a few times a week are now willing to live farther away from their jobs.

Importantly, in her experience the development to more sustainable cities where consumption starts to be decoupled from living in urban areas is already starting in detached houses. However, residents with the highest income continue to consume the most. In Mari's opinion, the best way to get towards sustainable cities is to define clear and ambitious goals but to then let the market economy and individuals free reign to

find the best ways to achieve them. She also does not think that publicly "pointing fingers" at fossil fuel companies who are investing in carbon bombs, projects that would on their own exceed humanity's carbon budget for 1.5 degrees of warming, will help this transition.

The full interview transcript can be found in Appendix A.

Ville Taajamaa

On 26th May Matias interviewed **Ville Taajamaa**, who works with VLR protocol & SDGs at the City of Espoo. She was recommended to us by Emmi Kauhanen from the City of Espoo, whom Paula had contacted first. After he agreed to an interview, Paula brought together Matias and Ville.

Ville Taajamaa has been involved in smart city projects widely. He has no problem admitting that most of the projects have failed at some level. In addition to achieving goals, learning plays a big role in what they do. What comes to sustainable city on a concept level, a committed community is his most important factor to mention, including companies, educational institutions and research institutes. The story of Espoo is concretized in Espoo. Even small children are involved in building the city along with businesses and others. Common will is an important thing, when creating a sustainable city.

He emphasizes the involvement of residents and cooperation with residents from a baby to a senior citizen. The views of professionals are not enough. In addition, he attaches importance to cooperation between cities. In addition to local influence, he believes it is extremely important to be involved with international community. Though there is a growing awareness that the resident is an actor, a subject, co-operation with other cities is important.

Ville recognizes the importance of education and the need to develop sustainable development goals for the future. What comes to the centralization and de-centralization of services, he favours the hybrid model. He believes that cities can and should be thought of as personalities as if they were people with their characteristics.

He enjoys the MyData application, which is a human-centric approach to personal data management, combining industry need for data with digital human rights. Espoo wants to be involved in building an ethically sustainable digital society and data economy. Ville is clearly data driven.

He says a strong silent signal on sustainable development is also that anyone who is committed to community sustainable thinking would be able to start growing towards goodness, towards light and hope. Regarding him, positive developments will take place through young people in any case. When asked who is worth targeting nudges or interventions, he mentions condominiums and businesses.

Ville seems optimistic about the future and the process. He believes that when there is a strong awareness of climate-related problems and needs, technologies will be developed to achieve this goal.

The full interview transcript can be found in Appendix B.

David Pollock

On May 23rd, Yousseif and Anni met **David Pollock**, a former professor and lecturer in sustainable engineering from Metropolia, to discuss his views on sustainability and sustainable cities. We received a first-hand description of a small-scale citizen-driven building project that aims for sustainability from David. He was involved in a project that aimed to build a more sustainable apartment building in Helsinki between 2008 and 2013. Their aim was to build a communal, sustainable and well-functioning building, and although they have

encountered some problems along the way, the group is happy with the outcome. This is a small-scale example of trying to influence an existing city's sustainability, which is the approach David prefers to constructing a new one. Also, it exemplifies the local action which David sees important as he thinks that the further the actions or decisions go from communities, the less they are trusted, and thus acted upon.

When discussing sustainability questions more broadly, David believed sustainability to start at the personal level: people need to feel that sustainable choices are the easy ones to make. This requires more training, incentives or mild sticks such as taxes, and examples that prove things can be done in a sustainable manner. However, he also referred to most people being comfort-loving and seeking to maintain the status quo, and therefore the society needs a crisis to move forward. Today, the war in Ukraine is such a crisis that has forced us to rethink the way we use energy and which energy sources are available to us.

In addition, he pointed out the multifaceted nature of sustainability. Although the solutions might be there, we also need to think about the effects the sustainable transition will have on jobs, people and the society. He also referred to the need to have a more heterogenic group involved in decision-making, such as people with disabilities and representatives from different groups, races and origins. This multifaceted nature also refers to the way sustainability can be measured. We can naturally measure the CO_2 emission but can also take a more human approach. David mentioned trust in the political system and neighbours, having a secure feeling about the future and seeing possibilities and goals for yourself and the society. The society can't move too fast since, then, David thinks that the average consumer is lost as people need to time adjust to the change. David sees the need to have both a short tern and long-term plan for sustainable development to ensure that we know to move forward.

The full interview notes can be found in Appendix C.

Paula Naukkarinen

On May 25th, Yousseif and Juniper interviewed **Dr Paula Naukkarinen**, PhD Senior Lecturer at the School of Real Estate and Construction, Metropolia University of Applied Sciences. She is a civil engineer consultant designing buildings and other concrete structures. For her PhD, she investigated how to make investments in energy efficiency financially attractive for hotels.

Paula reminded us that dealing with the existing building stock is crucial to developing a sustainable city. Therefore, she thinks that sustainability is not truly attainable for existing cities. Where developers do have the opportunity to start anew, she recommended optimising every component for sustainability. Importantly, the solutions always must be adapted to the environment and community where they are employed.

Transportation provides a good example of the complexities of sustainable cities. If a city can make public transport the most comfortable option, people will prefer it. However, a city needs to have a sufficient population for such public transport to be (financially) viable. Therefore, Paula recommends focusing on the lengths of journeys to reduce the need for longer-range motorised transport.

The interview questions focused on her experience in sustainability, defining what a sustainable city is, and how to measure sustainability, then taking her opinion in different application of new established suitable cities, and communities with local production. She also spoke about her PhD about making investments in energy efficiency financially attractive for hotels. The interview ended with a question on smart security, and the challenges that relying on smart technology will bring in the future.

In regards to smart cities, Paula believes that instead of relying on hackable and surveillant smart tech, we should instead raise awareness of each other at a neighbourhood level. When everyone is aware of the impact of their personal choices, governments can give incentives for sustainable actions without resorting to top-down control.

The full interview notes can be found in Appendix D.

Agata Krause

On Monday, June 6th, Juniper, Joni and Paula interviewed **Dr Agata Krause** from the Centre for Sustainable Development in Trondheim, where she is head of the 2030 Agenda. Previously, she worked for UNECE in Geneva and provided housing policy expertise for EUROCITIES and Housing Europe in Brussels.

For Agata, defining what sustainability is, is part of the problem of achieving it. It includes education, healthcare, water, sanitation, waste-management, environmental protection, climate mitigation, and being prepared for the future, of course. She is a proponent of strong sustainability, defined by synergies between environmental and economic prosperity, not trade-offs. Importantly, the problems and solutions we are facing are diverse and always dependent on the local context.

As a policy expert, Agata highlighted the importance of high-resolution data, which is needed for sustainable decision-making. In her opinion, this information should consist of both macroscopic data from international and governmental organisations, as well as data on the local level from small NGOs. Most importantly though, Agata stressed that numbers are never enough to describe a ciy. For that, they need to be contextualised with on-the-ground lived experience of the community.

Agata sees future opportunities in using smart technology to measure and monitor our sustainability and provide information for decision-making. For her, the most important issue is that technologies must be adapted to their communities, and that they functionality, benefits, and risks have to be communicated to the people who will be affected: "How can you recognize the value of technology if we don't know its value"? This is especially important to test new technologies before developing communities make investments into them. Finally, Agata stressed that technology is never *the* solution for *all* challenges, but part of a bigger system of engaged citizens, decision-makers, and international agreements.

Finally, Agata reminded us to not only consult experts on sustainability issues but talk with regular citizens.

The full interview transcript notes can be found in Appendix E.

Paola Deda

On June 7th, Anni, Julia, and Juniper interviewed **Dr Paola Deda**, the director of the Forests, Land and Housing Division at UNECE, who had previously worked for the UN Environment Programme. She has a PhD in environmental and urban planning and has worked on sustainable development at the UN for 24 years. During her time in this field, responsibility and leadership have slowly shifted towards cities, who have had a growing importance in tackling climate change and other crises such as Covid-19.

Paola is a realist and hopes for feasible solutions such as urban greening to be implemented quickly and extensively. While she hopes for more structural change to occur in cities, e.g., to transform them towards having multiple smaller centres with limited access for private cars, little progress has happened on this so far issue. Paola stressed that many decision-makers hide behind the supposed cost or difficulty of implementing solutions such as green planning. However, the need for green spaces during the pandemic has changed this and convinced people that creating green spaces is not as complicated as they feared.

People are at the centre of sustainable and smart cities for Paola. In particular, she wants cities and technology that are in the service of the city and its citizens, not the other way around. Therefore, Paola believes that smart cities should not be about technology, but about helping citizens independent of whether it is done with technology or a simpler and manual solution. She also reminded us that not all services can be made smart, but pointed out areas such as access to healthcare where technology can be very helpful.

Paola is sceptical that the security of smart cities will create substantially new issues, but instead exacerbate existing ones. Hence, she argues for keeping around manual fall-back solutions that cannot be hacked, and to educate children in both 'dumb' and 'smart' solutions for different problems.

Last but not least, Paola highlighted the need for good communication between cities and their citizens. She noted that while decision-makers are aware of sustainability issues and goals, they are limited their need for re-election as long as the public remains insufficiently aware of the consequences of its actions. Therefore, Paola stressed that communication of sustainable actions and effects should be clear and visual, which works best on a local level where voters can observe the actions of their representatives directly.

The full interview notes can be found in Appendix F.

Stefan Lueders

On June 7th, Paula, Matias and Yousseif interviewed **Dr Stefan Lueders**, Head of Computer Security Team in CERN. He has a strong background in computer security and is doing everything related to digital security and securing everything related to laptops, smart phones, streams, printers and computer centres inside CERN. The interview questions focused on his experience, in security and in sustainability, defining what security means on an individual and city level, and which are the most vulnerable areas when attacked for example. He said CERN is under constant attack but had not noticed a significant difference in the number or quality of attacks since the start of the war in Ukraine. Technically they are doing the 4 aspects of security: Prevention, Protection like CERN firewalls, Detection, and Incidence response when something happens.

In his answers, Stefan emphasized the need to increase security awareness, the use of backups and the importance of computer centres. What comes to backups, the importance will only increase in the future as the use of technology increases. We also had the opportunity to hear about different utopias and dystopias. We had received responses from Stefan on a quick schedule in advance, as well as links to interesting safety articles. Sustainability could be considered more, but the fact is that security has its price what comes to sustainability.

He sees machines not so secure, at least when human makes mistakes. He thinks that designers are not thinking of security enough. He tells that raising awareness and educating people is crucial in preventing attacks. In his opinion smart cities should be robust, resilient and sustainable. Connecting everything online and together creates a risk that you can kill all the smart metres and stop whole countries for example.

Stefan mentions that greatest cybersecurity risk could soon be non-secure gear in markets - like smart phones. Threats are getting more sophisticated. Threats are constant and growing linear. Even exponentially if smart things are growing exponentially.

The full interview notes can be found in Appendix G.

Kaisa Sibelius

On May 31st, Anni and Teija interviewed **Kaisa Sibelius** from Forum Virium. Forum Virium Helsinki is an innovation company of the City of Helsinki. They develop future urban solutions in cooperation with companies, the scientific community and city residents. In smart city projects, they pilot and co-create digital and carbon-neutral services to improve the quality of life of Helsinki residents.

Kaisa Sibelius is a project Manager and a Coordinator of AI4Cities PCP. AI4Cities brings together the leading European cities in the intersection of smart cities and GHG emissions reduction, in order to speed up and steer the creation of new breakthrough solutions in how AI will support cities' climate action commitments.

The interview questions focused on her knowledge of city of Helsinki and Forum Virium supporting the product development that serves the needs of Helsinki by using AI.

We asked Kaisa how she defines a city in general and wanted to know more about Smart City projects and examples of potential use of AI for sustainable cities. Kaisa told her most interesting solutions to be ones from p2p and all in all she gets excited to see innovative proposals and thinking outside of the box. Key points from the interview were that technology and that AI aren't always the best solutions. All in all, it is challenging to find new innovations that are feasible, and she mentioned the importance of GDPR.

Something to consider, standardised data is needed, and data should be commensurate with AI. It also takes a lot of time to clean up the data and there also needs to be a lot of teaching data - so that the AI/system can learn and be able to work in the future. The city needs expertise for procurement department and bidding to be able to buy AI services and technology better and know what to do with it.

The full interview notes can be found in Appendix H.

Note: *The full interview notes have only been shared with the teachers of the CERN Bootcamp course. They are not made publicly available to respect the wishes of our interviewees.*

Problem identification – Monday

On Monday, after the introduction to IdeaSquare and going through some practicalities, the teams were driven into design sprinting mood through various exercises and lectures. It was relieving to find out that the coffee machine is close to our work areas, the coffee is great, there are many variants available, and that there is enough coffee for the needs of the whole design sprint week. Our group spirit was strengthened through mental and physical activities that we participated in to get to know strangers with the help of group dancing and a game called "Two Truths One Lie". We also learnt to hum like bees, which can be useful for cross-pollinating ideas. The point was to create together, not having leaders and followers. We believe that exercises like this really work and, when done correctly, will create a favourable mindset for finding solutions.

The challenge was still open on this first sprint day. The team wanted to wait until all the interviews on Monday and Tuesday would be completed, to get more data and new valuable points of view, before narrowing down our challenge. On Monday, however, the possibility of including certain themes, such as security and artificial intelligence, as well as certain interesting ATTRACT technologies, was already being considered. We were also already convinced that our challenge, that is, the problem we were to solve, would be related to changing mindsets. It was also quite clear that our team would focus on the challenge from the perspectives of sustainability, safety and security, and technology, since all these thematic areas contribute to resilience at both the individual and the community/city level.

We had a brief presentation regarding our team and our challenge on Monday, even though the challenge was still widely open. During Monday we also analysed the data collected so far, and planned data gathering further. After data gathering and an interview script lesson, we also took some time to write more interview questions and prepare ourselves for Tuesday's two interviews.

On Monday, it also began to become clear that our problem would also be related to communication, where there is a lot to improve. Throughout several interviews a pattern of needing to develop communication in order to generate engagement for a more sustainable city and community had already been observed. We also discussed that sustainability is getting boring and the term is losing its meaning, partly because of the

greenwashing that corporations are practising. Therefore, we want to make sustainability fun and interesting again. It was also agreed that cities should be supported with sustainable actions, and to co-operate and share ideas together.

We also agreed on some roles for the spring week. We decided for changing facilitators over the coming sprint days and sharing some other important tasks. Crucially, every deliverable task, the video, poster, final report, and prototype, all received their own decider who would be responsible for that task. Since Paula became the decider for the crucial prototype, we also elected her as our overall decider. When sharing tasks, we utilized the strengths and special areas of expertise of our team members.

We also interviewed Dr Agata Krause from the Centre of Sustainable Development in Trondheim on Monday afternoon. She provided comprehensive information and insight on sustainable and smart cities, their development and the challenges they face.

On Monday evening, some of the team members already had time to get to know what the city center of Geneva has to offer, while others rested and stayed at CERN.

Data Analysis – Tuesday

On Tuesday, the team had a lot of time to concentrate on data gathering, sorting it and trying to find the most relevant topics out of all our research. In contrast to the busier Monday, the work towards finding the solution to our sustainable development goal really started on Tuesday. We had earlier decided on some of the sprint design roles for the week, and Julia acted as a Facilitator for Tuesday.

Three people of our team (Anni, Julia and Juniper) had agreed to interview Paola Deda at the Palace of Nations in the morning. Unfortunately, the interview had to be moved online. This, however, gave us more time to take notes based on our earlier research and write many post-its. These were put up on the research wall, read out together, and later sorted into different groups.

In the afternoon, Matias, Paula and Yousseif interviewed CERN's Head of Computer Security Team, Stefan Lueders. Both interviews on Tuesday gave a lot of valuable insights and deeper understanding about the subject which helped to narrow down the challenge and find the most important themes.

With six people doing the interviews, Joni and Teija were able to focus on arranging our research wall, combining similar findings together from the team's earlier research and to create a stakeholder map. With these two last interviews out of the total number of eight, and work for the research wall happening at the same time, Tuesday afternoon was the time when the bootcamp really kickstarted in regard to shifting the mindset to actually looking for the answers out of the all data. There wasn't too much time left anymore and the team wanted to reach a point that it was possible to start trying out for the ideation, prototypes and solution during the next days. While our goal was to decide on the challenge before end of Tuesday, that didn't happen due to the late-afternoon interviews. Therefore, the team agreed to decide on the challenge the next day. That was a good decision because it gave time to reflect about everything so far and to crystalize the main focus later. If it had been done on Tuesday after a long day in a rush, the outcome might not have been as well-reflected.

In the evening there was some time to relax in Geneva and go for a dinner with students from ESADE who were at CERN IdeaSquare with us. It was nice to spend some quality time there together and cool down during a busy week. Having those little breaks was important and helped the cohesion of our team.

Generating Insights and Ideation – Wednesday

On Wednesday morning, we continued generating insights by reviewing the How Might We questions which we had formulated earlier. Each team member received five stickers to vote on which questions we thought were most important and exciting. We extracted the following six questions:

- "HMW get rid of tensions around sustainability?" (5 votes)
- "HMW support cities to do sustainable actions?" (5 votes)
- "HMW help cities cooperate with different stakeholders for a sustainable future?" (4 votes)
- "HMW be more resilient to now increasingly common crises?" (3 votes)
- "HMW facilitate city-citizen communication?" (3 votes)
- "HMW affect mindsets and actions/choices without financial incentives?" (2 votes)

From these questions, we identified that we wanted to work on the interaction and communication between cities and their citizens, change mindsets, make sustainable actions more visible, and improve our resilience towards future crises. While this focus was still quite broad, this vote clarified that we would not be working on smart city security as we had previously planned.

In the late morning, we participated in the scientific walk across the CERN campus, which allowed us to clear our minds and gain fresh perspectives. Crucially, hearing the origin stories of the web and seeing a small accelerator reminded us that we had a license to dream big at Idea Square. After a refreshing lunch, we returned and worked on expressing our challenge more concisely. We used the "Me, We, Us" method, first writing down how we saw the challenge individually, then forming pairs and later groups of four to bring our ideas together before we finally discussed our combined vision with the entire team. There were two possible directions that we came up with. While one focused on improving the resilience of cities, the other proposed to enhance the communication between local government action-takers and citizens. In the end, we decided to put the communication idea to the back of our minds and focus instead on:

How Might We increase local engagement to make cities resilient?

This question captured our desire to build on the increasing awareness for sustainability, which has not yet been sufficiently translated into action. Throughout our iterative process of agreeing on a challenge statement, we found that first agreeing on which keywords we wanted to include provided us with a good baseline to develop more detailed statements afterwards. For these decisions, we used quick thumbs-up-/-down voting where a keyword could either be resoundingly approved, cautiously approved, ignored, or vetoed.

In the afternoon, we finally started our ideation to devise a solution for our challenge. We started with the brainwriting technique to get the ideas we already had out of our brains and onto sticky notes. As expected, most notes contained obvious or vague statements. However, at this stage, we also developed some new concepts, including a festival and a locally held resilience challenge. To iterate on these ideas, we employed the Seven Thinking Hats method. Every team member except our facilitator was assigned a hat/perspective with which to look at the existing ideas, pick the three best ones, and create a new one. In addition to the traditional six hats of "big picture/management", "facts and information", "feelings and emotions", "risks", "gains", and "creativity", we also added a hat for outrageous ideas. This exercise proved very fruitful and entertaining as we introduced each other to our new ideas. In particular, one new idea was found and

developed as our final solution. Therefore, we ended the day by agreeing to work on this sustainable community contest solution.

Prototyping – Thursday

Thursday was the most tiring and stressful day of the whole five days as there were many tasks for the whole team, these tasks needed to be accomplished by the end of that day. The day started with a visit to CMS where the team witnessed the accelerators and had a lesson on the mechanism and the concept of the accelerator and other projects in CERN. Afterwards, the team returned to IdeaSquare to review the solution agreed on Wednesday, refine it, and come up with a prototype to test the idea later in the day.

So, the team used the sticky note process, as follows:

1. Art Museum	2. Heat Map	3. Speed Critique
Putting all the Solutions on the wall with masking tape.	Silently looking at the Solutions and use dot Stickers to mark interesting parts.	Quickly Discuss highlights of each solution with time limit, and a volunteer will use sticky notes to capture big ideas.
4. Straw Poll	5. Super vote	
Each person chooses one solution and vote for it with dot stickers	The decider makes the final decision by using special dot stickers.	

Table 1. Sticky note process

Next, each team member created a storyboard to visualise how they though the Sustainable City Contest would work. The main purpose is to turn the storyboard into a realistic phototype in just seven hours, based on the prototype mindset philosophy which is based on four main principles:

- You can Prototype anything
- Prototypes are Disposable
- Build just enough to learn, but not more
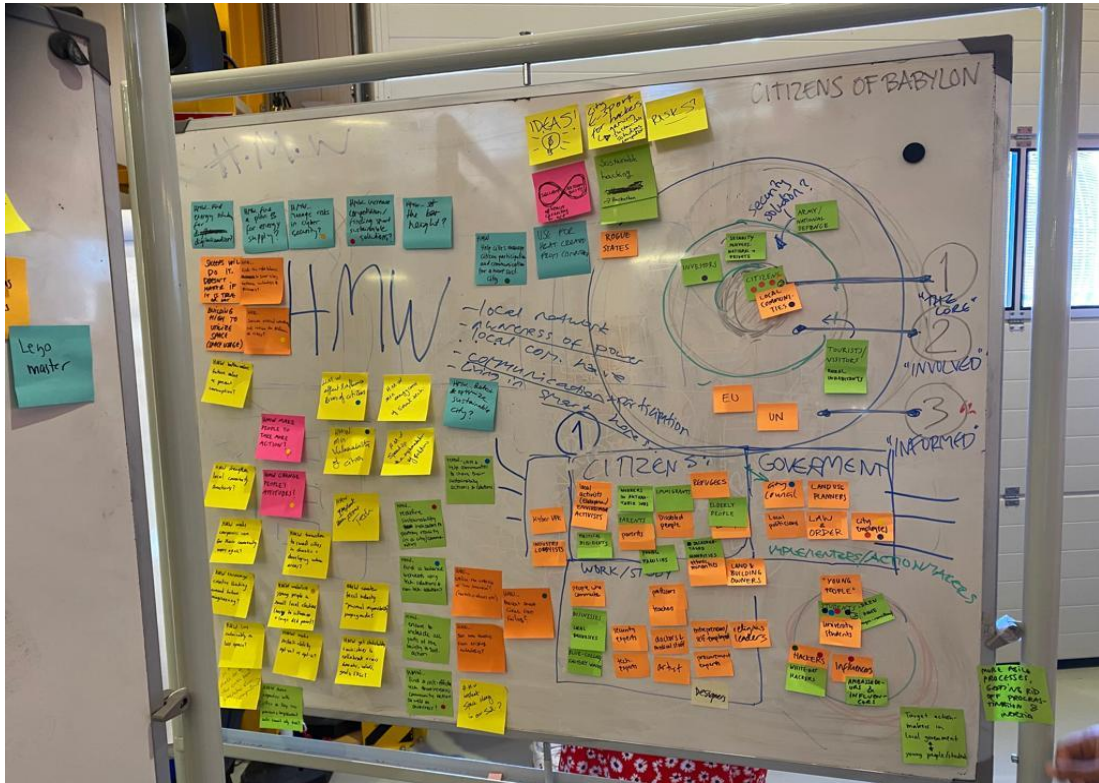- The Prototype must Appear Real

Figure 4. Stakeholder map and How-Might-We Questions

Figure 5. Storyboards of The Sustainability Contest ideas

Next, the group gathered brainstorming to form the name, scenario, outcome, script and actors for the prototype based on the various storyboards. After that, everyone on the team was assigned a specific task to complete, such as quickly making props for the contest jury and special effects.

While most of the team were working on the larger prototype, we also talked about our solution with other groups to get their feedback on the process. We used the customer journey design tool to find the points that we could improve to make our prototype better. Importantly, our assumptions were checked through questions such as:

- Who are the applicants?
- What are they performing?
- What is the impact in the long and the short terms?
- Will it be interesting for the public?
- Why would anyone apply or register?
- Who can apply and register?
- Will the members of the society benefit from this solution?

For our main prototype, we wanted to act through one part of the storyboard and perform and test it in front of some teachers and mentors at IdeaSquare. Our entire team of eight participated in the prototyping. Three represented the expert jury, two competed on stage as the representatives of a competing city, one created special-effects (the flood or wildfire endangering the city), and one hosted the show. The last team member took notes and made observations. Our testing audience was two IdeaSquare representatives and four supervisors.

Figure 6. The Prototype - The Sustainability Contest in action

The prototyped scene started with the host's monologue: "Welcome back to The Sustainable City Contest, where we celebrate sustainability and test the resilience of your cities!... ". After this initial speech the audience and the people watching the TV broadcast at home were able to vote between two resilience challenges – a wildfire or a flood. Based on the votes a flood challenge was chosen. While the team was competing on stage, the scenery shown on the background screen indicated how well the jury thought the team was doing. If the screen turned green and luscious, the team was doing well. If, on the other hand, the screen was brown and dry, the team was struggling. After the challenge was completed, an expert jury from the UN, EU and WWF submitted their votes and commented on the team's action on stage. In the first prototype the team also still received "ATTRACT points" – these were later removed. Last but not least, the audience gave their applause and the scene ended.

The aim of the prototype was to test what a sustainability contest could look like. It was particularly important to validate if such a sustainability contest could be fun and engaging. The audience's initial reactions to the prototype indicated both amusement, interest, engagement, but on the other hand also confusion. The audience pointed out that as the name of the competition was not displayed anywhere, the concept was initially difficult to understand. There were also questions about who the competitors in the teams were – professional emergency service workers, city officials, or ordinary citizens – and how they had been selected. The use of ATTRACT technologies both on stage and as an element in the team's own sustainability projects, was seen as unlikely or unbelievable. We also received the feedback that the background screen indicator distracted from the action on stage. The expert jury was seen as a good element that could be given even more time to educate the audience through their comments. There were also questions about the actual resilience challenge and if it would be possible for all cities to compete in the same challenges, as the challenges each city will face in the future vary, e.g., depending on their geography.

Crucially, the prototype validated that there is a need for making sustainability more engaging and fun, and that an entertaining and community focused contest of this style is welcomed. However, the audience also stressed that it is important to include the educational part in a smart and compelling way. Therefore, we further developed our initial concept to also include other events surrounding the contest that could involve explicit knowledge-transfer and cross-pollination of ideas. Experiences gained in the ATTRACT program, which we see as proof that exposing people with little background in a specific technology still allows them to innovate new applications towards a sustainable future, could be utilized both as a benchmark and a foundation to build on. Finally, our prototype testers also agreed that getting communities together to learn from each other is an effective way of not only spreading awareness, but also encouraging them to implement sustainable actions in their neighborhoods. Therefore, our prototype showed that a sustainability contest would have the potential to support the transition to a more sustainable world.

After a long day at IdeaSquare, we had dinner, and then gathered to start preparing our presentation for the shark tank in the next morning.

Refining and Presenting – Friday

On the last day of the sprint, we had to answer why the contest would work and what we needed to still figure out and fix to get there. The day started in the early morning with a shark tank exercise. We presented a prototype version of our final presentation to see if we were able to communicate our idea and why we were so excited by it. Unfortunately, we were clearly not there yet. However, the shark tank format provided us with valuable feedback from the audience about what we still needed to improve until the afternoon:

- The information sources from the data gathering process incl. Interviews should be added

- The contest procedures were still unclear
- The main idea was lost some-how, and the audience was confused
- We had failed to communicate how we wanted to integrate ATTRACT technologies
- The presentation was lacking some of the high energy from our prototype

After the shark tank, the group gathering, discussed the comments and weakness points in our presentation and how to solve them. Since we had little time left but were asked to implement the large range improvements, we had to work extremely hard to rework every part of the presentation, creating on up to four new versions of some slides before we settled on the final ones. While one team member continued her work on the teaser video, the other team members were split into groups of two that tackled a set of slides that had to be rewritten or added. Julia and Juniper also worked to update the style and feel of the slides. Afterwards, each sub team presented their changed slides, and they were merged back into the presentation. Anni, Julia, and Teija also came up with the idea to integrate the beginning and end of the prototype into our presentation. In particular, we would start as in the prototype with the "welcome back" speech by the host, but the contestants from Helsinki would now be our presenter team showing off their sustainability solution, the contest itself. This framing allowed us to add more energy to the presentation including music and dance, demonstrated part of our solution to the audience, and framed the audience as people who we aimed to convince to participate in our solution. After some final rehearsal, we gave the final presentation to the now increased audience. Thankfully, it was well received, and we were praised in particular for addressing all points of criticism that our prototype in the shark tank had raised. The shark tank session and the presentation were also filmed by one of our team members.

Integrating the ATTRACT program

Our team familiarized themselves with the ATTRACT technologies. They are very technical and advanced products that can be quite difficult to understand. We still found a few technologies that we initially planned to use in the final solution. Depending on our solution, some of those technologies (such as HERO, SMART, EU-RainS and DetectION) might have been beneficial to create a more sustainable and safer city.

We reviewed and evaluated a few potential ATTRACT-technologies which could be applied in the development of the solution. Those ATTRACT-technologies upper-level topics include Environment, IoT, Communications, Security, Electronics, Software, Energy, and Robotics.

Our team looked at a lot of technologies and saw many of them as fascinating and that they could be potential technologies in the case. Many of those are interesting because they are highly advanced modern technologies related to energy, environment and safety, and that is why some of them could be utilized in a solution fighting the climate change and creating better cities (ATTRACT Showroom, 2020). The following paragraphs introduce a couple of ATTRACT technologies in a more specific way.

HERO
Hero is a novel holistic approach for hardware trojan detection that is powered by deep learning. So far it is in use in Estonia and Greece (ATTRACT Showroom, 2020). Deep learning is using a complex structure of algorithms, deep neural networks, which were originally loosely modelled after the human brain. This method enables the processing of unstructured data like text, documents, and images (Wolfewicz, 2022).

Deep learning allows computational models consisting of multiple layers of processing to learn a data representation at multiple levels of abstraction. These methods have dramatically improved state-of-the-art technology in speech recognition, visual object recognition, object detection, and many other fields such as

drug development/discovery and genomics. Deep learning finds a complex structure in large data sets using a backpropagation algorithm to tune its internal parameters to optimise its data representation (LeCun, Bengio & Hinton, 2015, pp. 436-444).

HERO is a major step forward in identifying and combating hardware Trojans by developing an artificial intelligence multi-step approach capable of identifying vulnerabilities in IC models and performing post-silicon validation with a combination of logic and side channel testing methods covering a variety of Trojans, types and sizes with large parameter variations. The implementation of HERO technology is expected to bring breakthroughs in several IC fields, including mobile phones, tablets, digital cameras, microelectromechanical systems (DLP projectors, inkjet printers and accelerometers, and MEMS gyroscopes), photonics, and sensor applications in medical implants. This also applies to other electronic devices (ATTRACT Showroom, 2020; Moustakidis etc., 2019). HERO as a technology seems very potential and scalable. It can be connected to various systems, such as electricity and water systems, and can also be used in the field of IoT. HERO can save lives.

SMART

Smart ("Supersensitive Multipurpose Advanced Radiation Technology") is a complex integrated system which consists of multiple sensors assembled in 1 device to monitor indoor and outdoor environmental conditions. This system is prepared to send early warning and alerts in case of sensing any abnormal or unusual behaviour such as flames, sparks, smoke, dangerous gases and radioactivity. It also has low energy consumption so that it can be operated using clean solar cells generated energy. This system could be employed in sustainable cities to lower the vulnerability of cities towards environmental hazards and not only save human health but property, industrial and agriculture infrastructure, and the environment.

EU-RainS

Heavy rainfall is considered as a huge threat in some places, making massive destructions which have increased recently because of climate change. This project aim is to prepare cities and make cities more adaptable to this kind of risks by enhancing the quality of the rainfall sensed at street resolution. This technology should be implemented in sustainable cities making them more resilient to climate change.

CHEDDAR ("Chip-less RFID radiation detector")

The aim of this project is to develop a new low-power and low-cost chip-less RFID technology to realize sensors for ionizing radiation. These sensors are very cheap because they have no electronics in the tag and also are suitable for wireless detections and harsh environments. The sensor concept is relatively simple where the sensing tag is composed of a sensitive layer on a thin metallic structure that resonate in the microwave range, the resonating frequency of the tag is dependent on the dielectric properties of the layer, which is sensitive to ionizing radiation. This technology has already been demonstrated and employed for several detections like temperature, humidity, proximity and structural health sensors.

This technology is predicted to help to monitor and control contaminated areas which will impact the human health, it is also improve a secure, clean and efficient source of energy when employed in nuclear power plants and it will contribute to controlling the nuclear waste minimizing the environmental impact.

DetectION ("Rapid detection of high value pollutant ions")

This project will make a tremendous impact in the nature of water security globally through identifying and removing ionic pollution at the same process. The technology is depending on water pollution sensors and purification technologies.

During the bootcamp, our team was testing to implement two different ATTRACT technologies to testing the prototype. These two technologies were SMART and EU-RainS. During our prototype, we acted out a scenario that was, depending on audience's choice, either a city facing a wildfire or a flood. In the wildfire scenario, SMART would have helped the contestants detect the wildfire. As the audience chose flooding, the team used EU-RainS to detect the flood early. However, the test audience commented that the way the team implemented ATTRACT technologies to the scene was not believable given their high complexity.

When our solution started to find its final form, we discussed how the ATTRACT technologies could be part of it in a more natural way. It was decided that when cities or individual competitors are applying for the Sustainable City Contest, they could get mentoring and help about ATTRACT technologies, so they would better know how those work, and how they might be a part of some great sustainability solution.

ATTRACT could also be a sponsor or maybe one of the organizers, so they would be a visible partner of the event, and local communities and audiences worldwide could be coached and consulted with possibilities of various ATTRACT technologies. One example could be that after the next year's Preparedness Challenge is announced, all the participating countries/cities can get coaching from ATTRACT experts on which technologies could be used in a certain challenge and how.

Most importantly, we decided to use ATTRACT as inspiration of how knowledge transfer can be implemented. ATTRACT has already shown that students with little technical background are able to innovate based on a low-readiness technology and find new applications for it to advance sustainable goals. Similarly, our Sustainable City Contest will expose ordinary citizens worldwide to sustainability solutions and technologies from around the world to spark idea cross-pollination and grassroots sustainability innovation.

Final solution

System-level description

Our solution is a "Sustainability/Preparedness 'Eurovision-like' Contest between local communities". It not only combined ideas of competition, festivals, and resilience that we had already thought of but also provided citizens and local governments a platform to visibly celebrate and spread successful sustainability solutions.

It was born as a result of all the ideating and the dialog described above, particularly the ideas of engaging communities, having an international level contest, and encouraging knowledge transfer. These foundations made it easy and fun to come up with details and a prototype for our solution.

How to change mindsets, how to use nudges and how to make a difference on a systematic level? Who should we be talking to? We saw it to be important to tackle change fatigue by taking a positive approach and making the solution and sustainability fun and interesting **for communities**. Living in this time with TikTok's and reality TV shows, we understood the power of influencers, tribes and togetherness. As there are several stakeholders involved, we decided to create a stakeholder map and visualize the bigger picture and its dependencies. As a result, we noticed how our solution can work with all the stakeholders and most of all, to engage them in different levels. Citizens can create ideas and vote, a city itself can gain good reputation and advertise itself by being successful in sustainable development and challenges. Going with an internationally broadcast Eurovision-type event with sponsors means a great visibility and big games. Importantly, we took full advantage of our licences to dream big.

Overall, our aim is to make a change in the world on a systematic level, to change negative attitudes into hope, decrease change fatigue, and most of all to help the people to share and communicate their sustainable solutions across the borders or silos by action. After a lecture on value proposition, we tested our idea by comparing it to a value pyramid and seeing its potential on all levels of the pyramid - coming from bottom down and functional level to all the way to the top to a social impact -level.

The Elements of Value Pyramid

Products and services deliver fundamental elements of value that address four kinds of needs: functional, emotional, life changing, and social impact. In general, the more elements provided, the greater customers' loyalty and the higher the company's sustained revenue growth.

SOCIAL IMPACT

Self-transcendence

LIFE CHANGING

Provides hope · Self-actualization

Motivation · Heirloom · Affiliation/belonging

EMOTIONAL

Reduces anxiety · Rewards me · Nostalgia · Design/aesthetics · Badge value

Wellness · Therapeutic value · Fun/entertainment · Attractiveness · Provides access

FUNCTIONAL

Saves time · Simplifies · Makes money · Reduces risk · Organizes · Integrates · Connects

Reduces effort · Avoids hassles · Reduces cost · Quality · Variety · Sensory appeal · Informs

SOURCE © 2015 BAIN & COMPANY, INC. ICONS BY NIK SCHULZ.
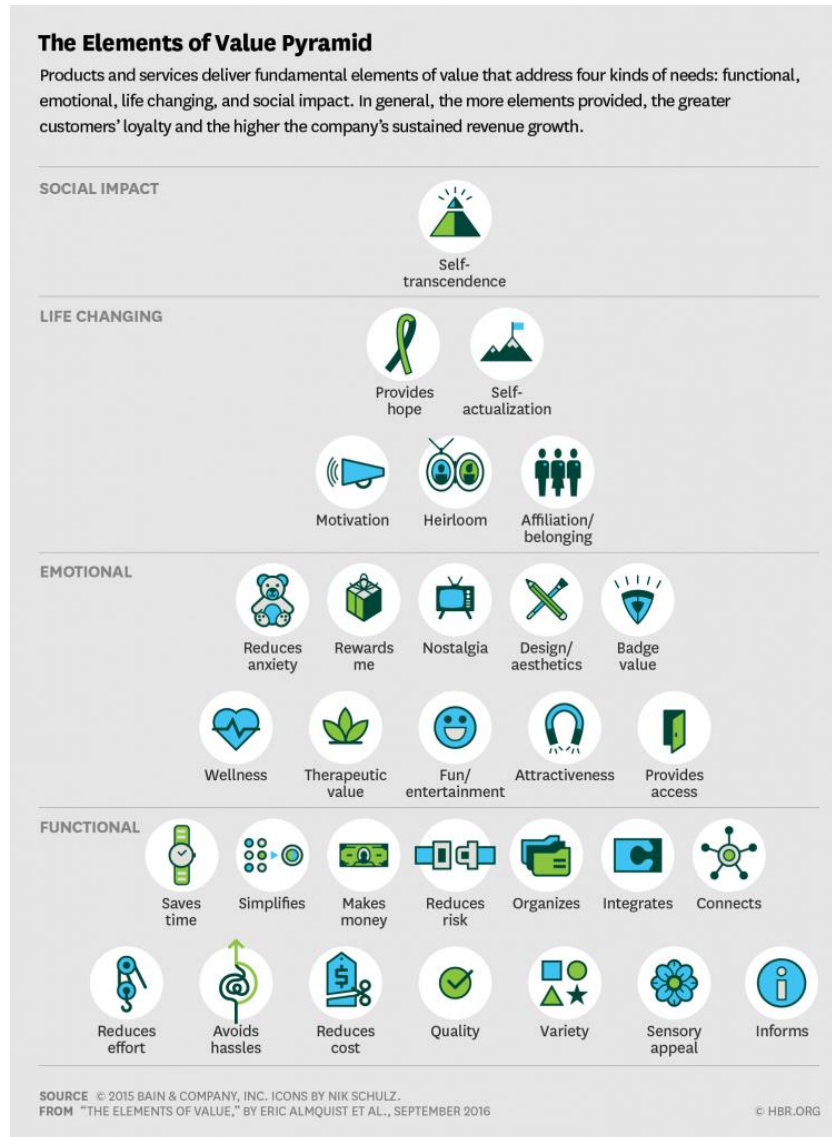FROM "THE ELEMENTS OF VALUE," BY ERIC ALMQUIST ET AL., SEPTEMBER 2016   © HBR.ORG

Figure 7: The Elements of Value Pyramid (Almquist, Senior and Block, 2016)

Functional-level description

Our final solution, The Sustainable City Contest, has two main parts: The Battle of ideas and The Preparedness Challenge. The contest is easy to either scale down to only a local contest or up to a global contest, according to the available resources. The Battle of Ideas is an opportunity for different kinds of communities; student groups, activists, associations, or neighborhoods to connect and share their successful sustainable accomplishments. This could be anything from a local waste reducing initiative to innovation regarding water or energy saving. The most important thing is that inspired people in local communities inspire others and

share ideas that could be applied also elsewhere. The participating ideas in The Battle of Ideas can be an initiative from the local community or from the city government. The ideas then compete in a local selection, where the citizens vote and choose their representatives for the city. The winner then advances to the national semi-finals and further to the global final, which is broadcasted worldwide. The local ideas and initiatives competing are presented in a compelling way through video postcards, as also seen in the Eurovision Song Contest. This is also an unique opportunity for the cities to promote themselves globally.
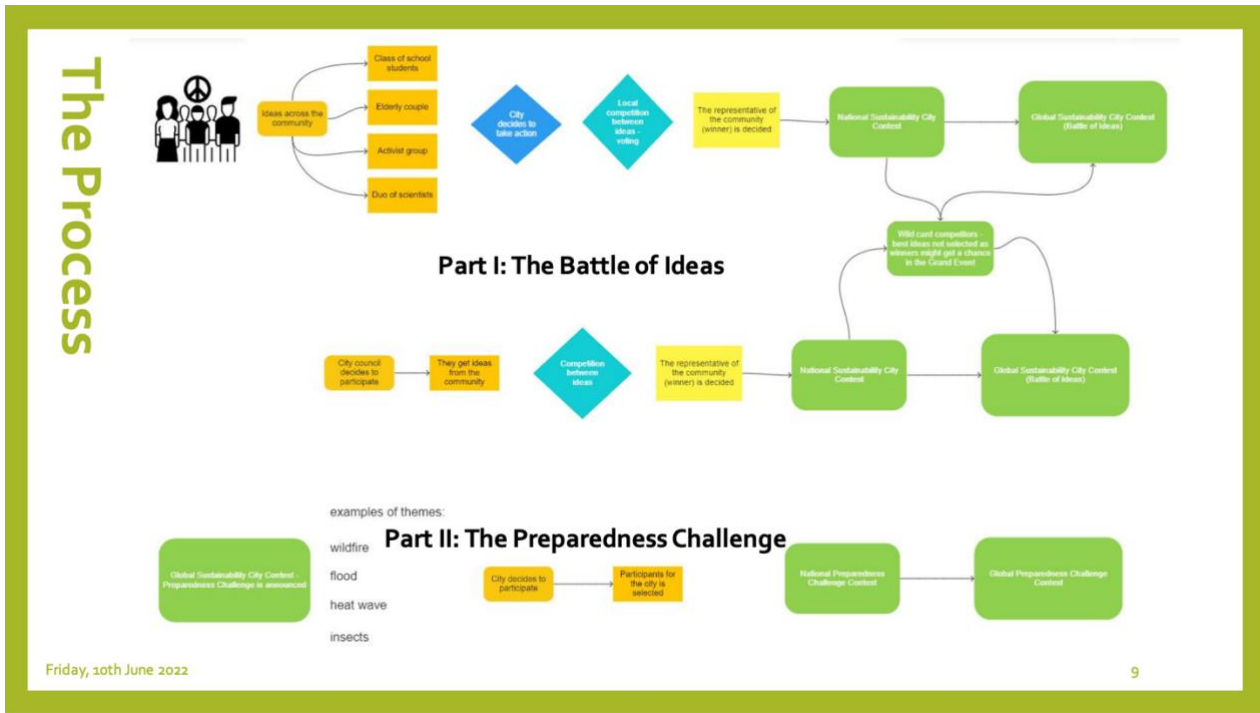

Figure 8: The process of the two main parts of the Sustainable City Contest and the overall process

Figure 9: The process in short

The preparedness challenge is what creates the show at the night of the contest. This challenge tests the cities resilience to different kinds of crisis. In this case the cities decide their team of participants who then compete in the national semi-finals and the global broadcasted final. The main idea is that the audience on site and online vote for a preparedness challenge that the competing teams then will need to face and manage on stage. A jury of officials from the UN, EU and WWF (or other global institutions depending on the scope of the contest) then evaluates their performance and comment on ways to improve. In this way the show is both entertaining but also educational.

As presented in our initial prototype ATTRACT technologies could be used both on stage and as an element in the team's own sustainability projects. However, this was seen by the test audience as unlikely or unbelievable. Therefore, we further developed our initial concept to also include other events surrounding the contest that could involve explicit knowledge-transfer and cross-pollination of ideas. Experiences gained in the ATTRACT program, which we see as proof that exposing people with little background in a specific technology still allows them to innovate new applications towards a sustainable future, could be utilized both as a benchmark and a foundation to build on. In other words, the ATTRACT technologies were implemented as a model for how knowledge-transfer, innovation and inspiration could be achieved.

Figure 10: Using the ATTRACT program as a model

ATTRACT enables funding for low-readiness technology research. In the same way the Sustainable City contest could in different ways promote local ideas and solutions for sustainability. In ATTRACT a catalogue of technologies were created to gather and communicate about the technologies. In the contest a catalogue of local solutions could help gather and share great ideas from and to local communities. In the ATTRACT program student projects help innovate new applications of the researched technologies. In the same way that the contest could become a platform to inspire citizens and communities to innovate and adapt solutions in their own neighborhood.

Potential Commercial Applications

Since our team's ultimate solution is a wide-spread, huge event that takes place locally and globally and hopefully attracts a big audience, its commercial potential is also quite big. In events like that, there are always sponsoring and partnering possibilities and a chance to sell commercial advertisement slots.

Even if the event would be the biggest ever, it must stay true to its meaning and original goal. The event couldn't sell, for example, main sponsorship or huge visibility to the highest bidder, if it was a brand that does

not act in a very sustainable way. Crucially, the Sustainable City Contest cannot become a platform for companies to greenwash. Instead, it would partner with organizations with a mission towards global collaboration and sustainability.

This contest could be a platform for new, innovative, green products that the competitors might present to the world in this event. Some of the funding to organize the event could come from big, global organizations like the UN, participating cities and governments, and some media companies which would get the rights to televise and stream the event to the public. The event could be a mixture of Eurovision's celebratory community-spirit and Slush's innovation-based hype. It could attract many kinds of people who like to see the world moving towards more sustainable direction and therefore offer many opportunities to investors and entrepreneurs. And the same thing can happen in smaller scale, at local level events, when the competitors are trying to make their way to the big finals eventually.

Societal impact

Although the organization of an event such as the one described requires a lot of planning, groundwork, partnerships and investment, it has a positive total societal impact, when properly implemented. Our solution impacts the resilience of smart cities, as with improved security cities' infrastructure is less vulnerable to attacks, does not matter whether it is a natural phenomenon, such as a flood or a wildfire, or an attack from outside by people online or offline. Our solution – the event – also affects the mindset of city officials to understand the vulnerable nature of their infrastructure, they will be more prepared to crises that can affect and change the needs to create a sustainable city. Improved communication and increased awareness will also increase awareness, capacity and resilience at the grassroots level, among ordinary citizens.

The contest itself works as a strong motivation factor. Sustainability, safety and resilience are attractions for cities. Individuals and human-made cities strive for good results when the measurement of things and the level of sustainability is public. Making things public in such a case can have a huge nudge effect. Who wouldn't want to look good from a sustainability perspective either, when there is also an existing strong economic incentive to do with attractiveness, partnership opportunities and good reputation. However, a competition itself prevents the exploitation of things like greenwashing, making measurement results and visibility into the degree of sustainability of cities more realistic and trustworthy. The competition also attracts funding from parties that benefit from this kind of visibility and cooperation, for example through sponsorship. Virtue signalling is a strong trend, which is not a bad thing in the sense that people, companies and institutions like cities are really doing good. However, there should be strict criteria for what kind of company or institution can become a partner or sponsor. This requires quantitative data on the sustainability of the target operator. It is also a question of the reputation of the event and the organizer, so there is no room for neglect in this regard.

Demonstrating ATTRACT technologies in the context of an event and making them work will also increase scalability and global implementation of technologies, with positive societal impacts through increased sustainability, resilience and security. Similarly, the competition will show people what doesn't work so well. The desire to innovate new and test new technologies will also increase with the high-profile event, which will indirectly increase the sustainability of cities and other important features around the world. An event such as the one described is apt to increase cooperation between the various levels of society, which is very important for the creation and maintenance of sustainable and prosperous cities. Likewise, cooperation between cities, so called intermunicipal co-operation, is highly important (Alcantara & Nelles, 2009). Also accession to the international community is very important, what comes to technological development too

(Maisonobe, Eckert, Grossetti, Jégou & Milard, 2016). Events like this have the potential to increase collaboration, learn from others, and create multi-level synergy benefits as well as scalability.

Positive societal impacts may also include information sharing on new ideas and technologies, implementing new sustainable technologies and ideas, scalability of technologies, increased attractiveness of cities, increased awareness, Inclusive and sustainable organisations, more productive community with less stress, happier lives and better health, strengthening national and regional development planning and risk management, making sustainability fun, engaging and attractive, and long term engagement to sustainability. In the middle of this as a result, is increased resilience, that has mostly positive impacts in many areas of life on individual level and thus cumulatively on community level also. Those benefits include physical and mental health, improved self-esteem, increased sense of control over life events, greater satisfaction, better success and performance, and a general protective effect (Herrman, Stewart, Diaz-Granados, Berger, Jackson, & Yuen, 2011, pp. 258–265). Improved relationships, and better problem-solving skills are something that increased resilience provides as well (Santos & Soares, 2018, pp.265–276). Also, longevity and successful aging are impacts of resilience (Zeng & Shen, 2010).

The division between the short- and long-term societal impacts is often a line drawn in the water, and there are overlapping in many cases, since processes, changes and impacts rarely progress incrementally, making it even more difficult to divide into short- and long-term impacts.

Of course, the event itself has a carbon footprint. Therefore, the event must be well planned in order for its environmental payback period to be reasonable. This is an investment whose payback period is to be assessed in advance before implementation.

Conclusion and reflection

This part is a summary of the report. It is divided in two sections: conclusions and reflection. The first part includes summary of the conducted project (challenge and the solution). The second part includes reflection of the students' learning process during the bootcamp.

The objective of the bootcamp was to develop solution to global challenge related to SDG11. Service design approach and basic tools to design sustainable innovations were used in the project. ATTRACT technologies were investigated and applied during the process.

After data gathering and expert interviews the challenge was narrowed down into "How might we increase local engagement to make cities more resilient"? The desired impacts of the solution are to affect the mindsets of the citizens, increase the preparedness level of cities, improve cooperation and communication between cities (for example regarding smart city technologies) and to increase awareness and resilience (also to decrease vulnerabilities of critical infrastructure).

During the data gathering it was discovered that the level of environmental awareness is in relatively high level, but action is lacking. Therefore, the focus of the challenge was in affecting the mindsets rather than only increasing awareness.

The group's solution to the challenge was The Sustainable City Contest. The contest is for celebrating sustainability and testing resilience of the cities. The solution was created to respond to the challenges presented above. As sustainability has recently become self-evident and boring, the solution aims to make it fun and engaging. To implement the solution in practice, the group hopes to get international organizations, such as UN, as sponsors for the event.

The overall feeling of the group after the bootcamp was positive. Our group had managed to finalize the required tasks and create a solution for the problem within the time limits. We were pleased with the arrangement of the bootcamp on site at CERN as it was inspiring environment and the team had better possibilities to focus on the challenge in question. Also, the team spirit within the group was good and no bigger adversities were confronted.

The service design process used in the camp includes five working days from Monday to Friday. During the bootcamp week at CERN the group had also other activities such as visit to CMS and thus didn't have the full time to work on the project. The group felt that there wasn't enough time to do all the phases of the sprint properly (for example prototyping). In addition, the team didn't have enough time to do through benchmarking of the solution.

Another challenge that the team faced was working in a team of eight people. In the sprint book (Knapp et al. (2016) it is stated that no more than seven people should be included in the team. On the other hand, the diverse team was seen as richness and opportunity for the team. The diverse backgrounds of the team created various ideas and were beneficial in the sprint process.

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