Summer School 2021: Responsible Research, Innovation and Transformation in Food, Plant and Energy Sciences

Learning Journey and Reflection

Conference Proceedings

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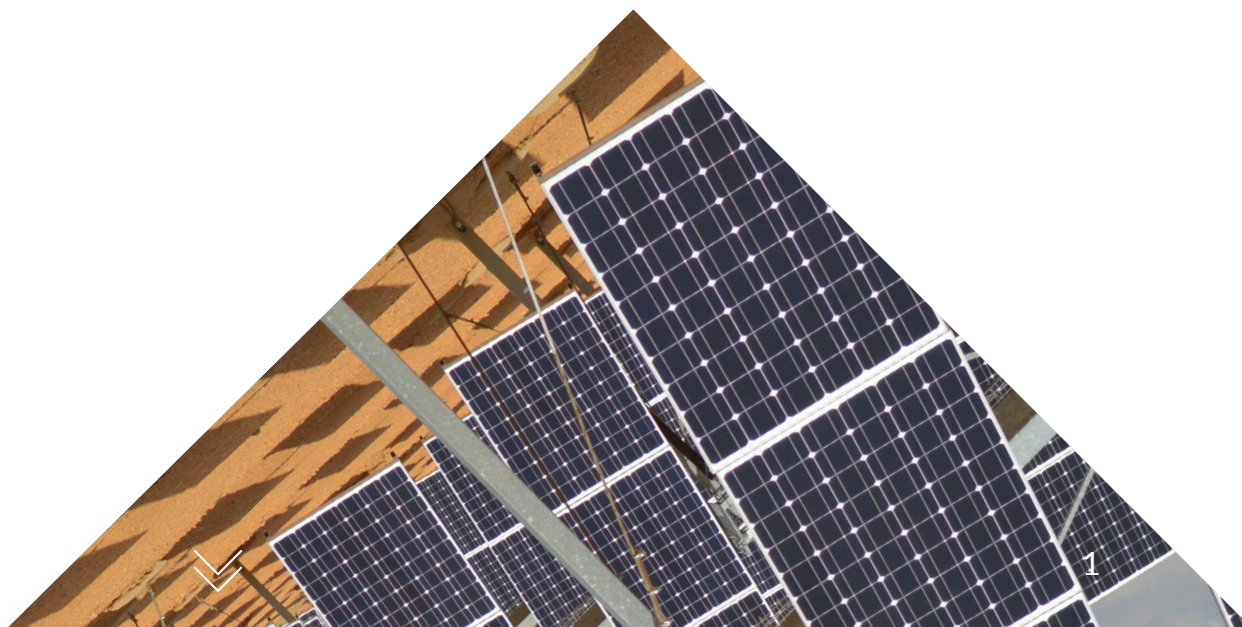
Summer School 2021

RESPONSE

Responsible Research, Innovation and Transformation in Food, Plant and Energy Sciences

Learning Journey and Reflection

Melanie Paschke (ed.)



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CONTENTS

INTRODUCTION

Food and energy are the great challenges for modern societies, both producing enough for the growing world population as well as producing and distributing them environmentally friendly, fair and equitable.

Their footprint on land, biodiversity, ecosystems, water, soil and their impact on climate is enormous. Establishing food and energy systems that support the Sustainable Development Goals (SDGs) is of uttermost importance to stay within the planetary boundaries.

Our need for energy and food has already made us overstep several of the boundaries for example in regard to climate change, biodiversity or nutrient supplies (Rockstroem et al., 2009). Systemic transformation and solutions through innovation and research involving all aspects of our society are key elements in the discussion how the global community could overcome its complex problems, related to environmental, social and economic constraints in a resource-limited world. Innovation conflicts arise when transformation is mainly technological driven and is not taking up the environmental, ethical, legal and social issues of society through expression, participation and deliberation (Felt et al., 2013).

Responsible Research and Innovation (RRI) is a current approach to mediating science/innovation-to-society boundaries through anticipation, reflection, deliberation, inclusion and responsiveness (Horizon, 2020). RRI seeks to move beyond reflection on consequences toward the societal uptake of innovation and technology (Von Schomberg, 2011). Rather than seeking to protect society against unwanted consequences, RRI aims, through the use of technologies, to produce innovations that address societal needs and values and can overcome the emergencies of our unsustainable way of living.

How the report is organized?

In the first part of the reflective report, you can explore the five case studies and follow the individual learning journey of the groups. In the second part the speakers abstracts are summarized.

CONCEPT

Holistic educational approaches needs to take into account the inter-relatedness between personal, political, technical and behavioural transformations (Leichenko & O'Brien, 2020; Pasarella, 2021).

Summer schools can especially foster skills as creativity, entrepreneurship (Junior et al., 2020) or ideation for possible solutions (Schaul & Bratrich, 2020), but also foster a strong sense of community along with individual empowerment (Pasarella, 2021).

Summer schools enrich the learning experience of participants.

How can we teach PhD student's ways to generate varieties of transformative solutions to these urgencies ahead?

The RESPONSE summer school of 5 days built an environment for participants to work through case studies and expand their scientific to a society-inclusive perspective. The participants had the opportunity to follow a structured process which guided them towards the development of a group project and to tackle one of the following problems: Digital technologies for urban micro farms, circular approaches in the food system, vertical farming, sustainable and resilient energy, food and biodiversity landscapes, stewardship of land use change – how can drones offer support?; and based on the following steps: Participants framed the problem and emphasized with stakeholders' perspectives, values and needs. They explored different methods for stakeholder engagement. They experimented with value-based and human-centred design thinking to ideate and prototype a variety of solutions. They reflected on the implementation of their prototypes in different social practices to anticipate questions and dilemmas, purposes, motivation, and potential impacts in society.

The summer school taught different tools for anticipation, reflection and deliberation (for example reflecting the intended and unintended impacts of their possible solutions on core values of the involved stakeholders and underlying value hierarchies) as required in the framework of responsible research and innovation. Every day was finished with a presentation to the sounding board of experts.Inputs were given to participants by scientific experts in the field of food, energy and land use. Innovators and researchers presented also best practice examples with social inquiry included in the research process.
Additionally, entrepreneurs and innovation labs in the field presented their ways of interacting with societal needs in co-designing technologies and innovation.

What the students mentioned as most important for them, was (see section 'Statements of participants'):

- Broadening the view on social relevance; thinking about the big context of own research.
- Reflecting on the impact and needs from stakeholders' perspectives.
- Understanding needs and concerns of those involved at the beginning of the process.
- Working in a case study with students from different backgrounds; experiencing how in the end the group came up with a solution together.

TOOLBOX

Figure 1. Toolbox of the summer school

Stakeholder Mapping

Stakeholders' Need Analysis

Creating a Persona

Value Analysis

Value-based Design

Design Thinking

Human-centred Design

Changing Social Practices

Figure 2. The structured process followed in 5 days. Details of the process in the working book template https://www.plantsciences.uzh.ch/en/teaching/summerschool.html.

DAY 1
FRAMING & REFLECTION

EMPHASIZING

- **Choose your case**
- **Understand the case study**
- **Understand stakeholders, their needs, expectations, concerns**
- **Explain your problem statement**

DAY 2
REFLECTION & EXPERIMENTING

VALUE-BASED DESIGN THINKING

Understand values of stakeholders, define their and your core values and carry out value-based design thinking and ethical risk assessment.

DAY 3
REFLECTION & EXPERIMENTING

HUMAN-CENTERED DESIGN THINKING

Carry out design thinking to create possible solution and prototypes to your problem.

Understand what your stakeholders really need (not what they think they need).

DAY 4
REFLECTION & EXPERIMENTING

SOCIAL PRACTICES

What are the social practices that link to your prototype? What does it need to make your prototype work in the social context? Define your change hypothesis.

How should your experimental innovation plan look like to test your change hypothesis?

What do you need to know to implement in the near future to evolve your prototype one step further?

DAY 5
CONSOLIDATING

Present your outcomes

STATEMENTS
OF PARTICIPANTS

I will try to leave my own perspective and look at a problem from the eyes of all stakeholders involved more often. For my project, as a first step, that means to go back to the very basic problem framing, to identify who are the ones involved and which values and assumptions are underlying. Then, I can start to understand their needs and concerns, and determine potential risks while finding a solution, not after. In general, I'll try to keep the bigger context of my research in mind more often, while solving very specific scientific purpose. It is not very easy to use the methods we learned in an on-going project, but they will become very handy once I start planning a new one or start integrating new ideas. – Katharina

In planning any project, it is important to consider the views and needs of all stakeholders involved. As a student of plant breeding, I am actively involved in the development of plant varieties that will be eventually used by farmers. Consulting and considering the needs of main stakeholders throughout the project would increase the rate of farmer-adoption of final products, thereby increasing the impact of my research. – Reah

Thanks to the RESPONSE summer school that exposes us to varied social, ethical, and design methods with relatable and interdisciplinary case studies. The most important take-home message for me is to not stick to our original idea before considering the actual needs and pain points of main stakeholders – this will elevate a good-on-paper project to a make-it-work one. To me, this human-based design thinking is also helpful when conducting energy systems modeling research. To make our energy scenarios more acceptable and influential, modelers shall not be satisfied with just a good “number-generator” but rather responsive to society. Reflecting on the impact and needs from stakeholders’ perspectives could be the missing gem of the truly good science we need nowadays. – Fei

As a student of energy engineering, I normally do not consider biodiversity and agriculture aspects to be amongst the main factors of interest when talking about renewable energy projects. This case study showed me that all these aspects can be combined, leading to a result which enables sustainability along several different dimensions. – Linda

Within my work on large scale ecological and environmental effects in land use, I sometimes lose the sense for specific implementation. Therefore, I hope to draw on the 'what and 'how' in stakeholder engagement and design thinking, when collaborating with my secondment partner. This again will help me re-focus my own research in the interest of others, while following scientific integrity. – Simon

STATEMENTS
OF PARTICIPANTS

I see an opportunity to integrate the RRI framework into my own research. In particular, I hope to inherently include in my research ethical issues and concerns as well as legal and social considerations pertinent to my project—not as an afterthought, but as a forethought. This is of course easier said than done, but I found the analogy of the image with the trailhead leading to the bridge and eventually to the distant mountains to help frame the scope. Employing RRI does not mean we have to reach for the mountains, necessarily, but rather focus first on looking ahead beyond the nail in the bridge. I often lose sight of this and found that the lessons learned from our first workshop can improve my research orientation/thinking when it comes to "larger" ethical considerations. – Bessie

I am going to use value-based design when planning my experiments (core values: research ethics, keeping things simple and efficient, potential use...), as it will help me not to lose focus trying to answer scientific questions. – Xeniya

In my research, I am going to use value-based design to revise the research project and use design thinking methods to broaden the social relevance in future public communication of my project. – Yuanyuan

The experience I have gained through participating in the RESPONSE summer school has helped me to think critically of how my research interacts with different stakeholders. In particular, it was especially helpful to learn about the Ethical Value Quality Requirement (EVQUR) framework that helps to ensure that the policies, products, technologies, etc. are underpinned by the core stakeholder values. Having learnt this and other valuable lessons during the summer school, I feel better equipped to contemplate possible applications of my research on novel methods in biodiversity monitoring in the wider socio-economic systems. – Monika

I found it very valuable to learn different approaches to include stakeholders in the research process. I will take this with me for my own research, for which I plan to engage different stakeholder groups as a first step in order to decide how to move forward. In addition, it was really interesting to work in a case study with students from different backgrounds and to experience how we in the end came up with a solution together. What I learned from this collaborative approach with people that have different knowledge and aims is also something that will be useful for my research, as I will involve experts in both agriculture and biodiversity in order to find ways to align these two. – Simone

Our projects are usually focused on a very specialized subject, so sometimes it is easy to get lost in its details for getting about the wider social scope. A way to avoid this can be carrying a careful value-based design of the project from the beginning, therefore, I will implement it in my own research. – Manuel

STATEMENTS
OF PARTICIPANTS

As I expected, choosing the project on drones for land use revealed to be the best choice for my PhD research. Carbon capture and storage is a technology still under development, as drones for land use. There have been several methods utilised in the Summer School that will be extremely useful for my own research, but primarily the ones used in the workshops of Michael Augsburger, Verena Lütschg and Anaïs Sägesser. These workshops helped me understand how to analyse different stakeholders needs, interests and values. The methods taught, such as the use of post-it, or thinking as a 4-years-old, or creating a table analysing the Core Value - Value Quality - Ethical Value Quality Requirement and Evaluation Criterion, helped me to develop different skills to approach my PhD research. I would like to apply different methods to my research on carbon capture and storage and, mostly, understand the core values needed to gain policy and social acceptance as well as drive forward this far-looking technology. – Linda

The specific methodology of the stakeholder involvement and the ethical risk assessment analysis will be very useful to enhance and deeply evaluate the quality of my research project for the scientific apple breeding community, Swiss farmers and ultimately the society in general. Using this qualitative approach in addition to my established quantitative design methodology will give me and above all to my research better tools to address a greater range of research outcomes, and to fill in the blind spots in the current scenario related to the apple breeding climate change resilient varieties. – Francesca

Considering all the tasks that I participated during the whole summer school. All tasks helped me think science from another aspect: value based. It clarifies my sphere of influence and responsibility as an ESR. I would like to use my stakeholder mapping to clarify their roles involving in my research. The process will be facilitated according to their interests and concerns during the meeting. – Danli

I found the idea of value-based design and comprehensive stakeholder engagement process very helpful in improving my research approach. With my research focusing on the impact of charcoal production on carbon emissions, biodiversity and land use, the practical lessons I learned during summer school are helping me to redesign my approach by including local communities and other stakeholders at an early stage of my work. With this collaboration with several stakeholders, I am confident that practical solutions that benefit local communities, improve biodiversity, and with reduced impact on the climate system will be possible.

– Dabwiso

Given that my research is highly multidisciplinary and thus involves a wide range of stakeholders from different spheres of society, I think that proper stakeholder mapping could prove very helpful for making sure that my research has the desired impact on society. By allowing for a better understanding of how apple growers, supply chain actors, apple breeders and consumers are interrelated in terms of stakes and influence they can have on adaptation to climate change, I am convinced that stakeholder mapping can help me properly translate the conclusions of my research into effective policy proposals. – Laurent

The possibility of introducing epigenetic variation into plant breeding programs is an interesting topic for many different groups of stakeholders. As a part of my project, it is envisioned to organize a public panel discussion on the potential of epigenetic variation for breeding involving stakeholders (breeders, companies, agricultural institutes). Implementing stakeholder analysis methods and the ethical risk assessment analysis will allow me to better understand all stakeholders' perspectives. – Dusan

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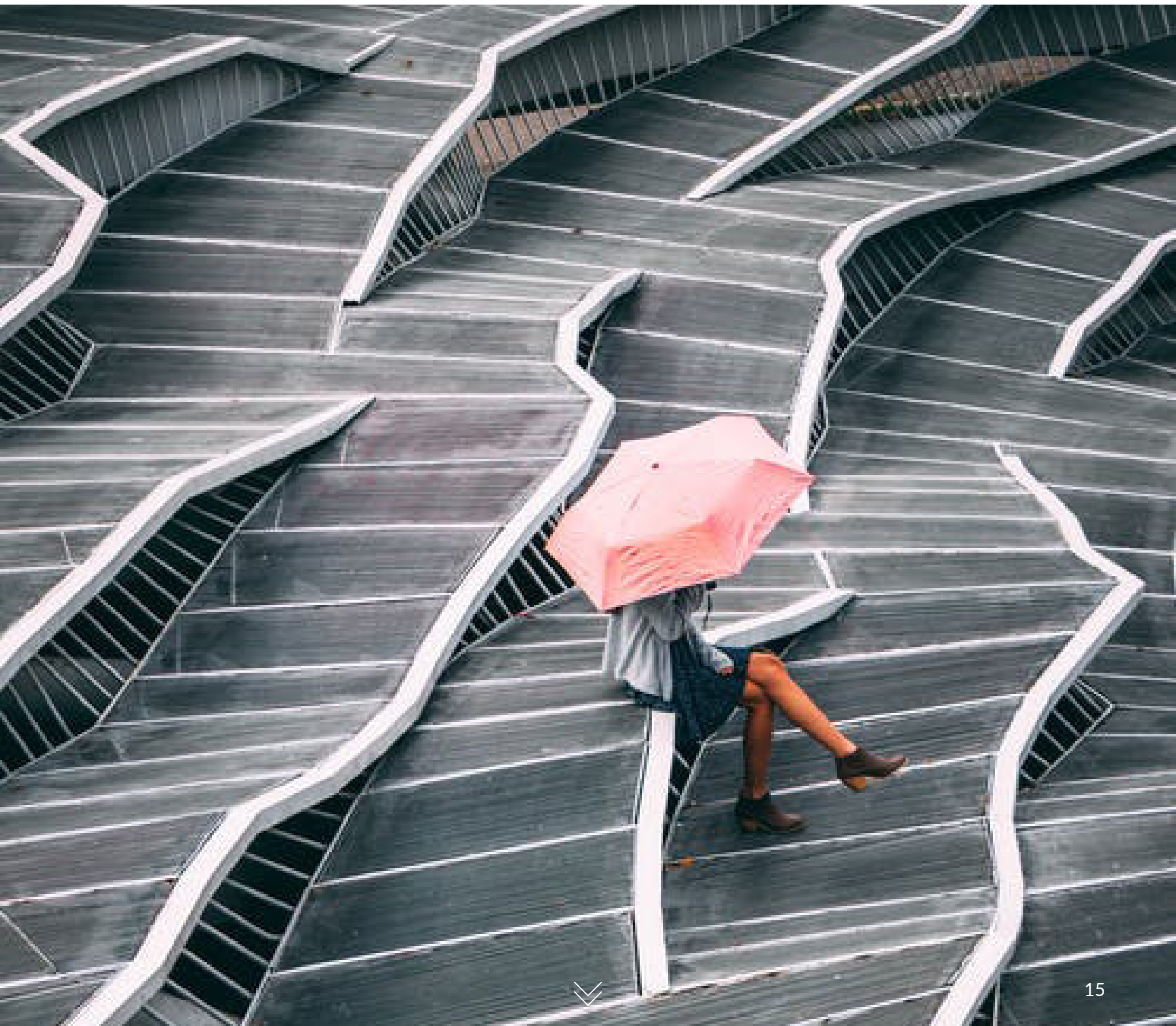
CASE STUDIES



Case study 1 – *DIGITAL TECHNOLOGIES IN MICRO FARMS: HOW CAN THEY LINK FARMERS AND (URBAN) COMMUNITIES?*

Digital technology in farming is coming with a lot of promises and positive expectations for a sustainable and more productive agriculture. However, digital farming developments also raise a bunch of societal-relevant questions.
Digital technology in farming (large or small-scale) is through data collection and precision equipment, on-time soil and plant measurements by new sensors and efficient computational power and modelling together with new devices as robots and drones. With this a sophisticated and integrated decision-making of farmers on the farm should be enabled. However, the data-intensive technologies are often framed for large-scale, conventional agricultural setting and are not enabling small-scale or agro-ecological practices, for example microfarms that build up on direct interaction between farmers and communities are left out in their needs.

This is due to several lock ins that these technologies and their development currently create, for example:

- Data management in closed, establishing proprietary systems in which the farmer is part of a highly integrated food supply chain
- Technology development that is framed solely within the efficiency narrative, therefore, not having in mind consistency (circular approaches and close loops) and sufficiency related priorities (e.g. avoidance of food waste or diversity approaches).

Without taking consistency and sufficiency approaches into account the technologies are on the risk of failing the SDGs despite large investments. Could a design process that will take into account values of micro-farmers, citizen and communities and a framing within the consistency and sufficiency boundary create a more social relevant and environmental friendly technology?

- What are the societal relevant questions linked to this case?
- What norms and values or interests are underlying the case? What ethical, legal or social benefits, challenges and conflicts do you when thinking about embedding technologies into the context of small-scale and microfarms?
- Could you translate identified values and needs into a new design of the technology?

Literature

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Please also have a look at the following section of the webinar: 30:46 – 45:51 by FabLab, IAAC, with their sequence on embedding robotics and environmental sensors for microfarmers: https://foodshift2030.eu/webinar-urban-and-peri-urban-agriculture/

Case study 2 – *HOW TO IMPLEMENT CIRCULAR APPROACHES IN URBAN FOOD SYSTEMS*

With the Milan Urban Food Policy Pact (2015) industrialized cities are seeking to re-envision their urban food systems and link it to the SDGs. Sustainable urban food production are taking several directions: from community gardens to community-assisted agriculture or towards innovative and technological-driven urban farming enterprises (e.g., indoor vertical farming, roof farming with greenhouse facilities or integrated aquaponic systems etc.).
While in principle most of us agree to support local sustainable food production systems, the framing of these systems is of uttermost importance. We need to embed the local food production within circular food systems. It is estimated that by 2050, there will be approximately 9 billion people living on Earth, with almost 70% of them projected to live in urban areas. This increase in the global population is projected to require three times more resources than we currently use. However, around 80% of all materials are directly discarded after usage, thus highlighting the need for circular alternatives to linear models.

- Gain through working on the case study increased knowledge about Circular Economy principles and concepts and measurements in the context of SDGs.
- Identify and assess challenges and opportunities when designing Circular Food Systems.
- Develop a Circular Product-Service Combination / Food Value Chain to achieve Food Circularity.

Literature

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The circular design toolkit for Arthur Mac Allen Foundation, see: https://www.ellenmacarthurfoundation.org/resources/learn/circular-design-toolkit

Case study 3 – *VERTICAL FARMING: FROM HYPE TO CONTRIBUTING TO A SUSTAINABLE LOCAL FOOD SYSTEM*

Greenhouse technologies, including hydroponics, aeroponics, and aquaponics enrich the vertical farming concept. Proponents argue that compact high-tech agriculture is not only applicable in dense urban areas but also in peri-urban areas. These new high-tech systems are thought to minimizing maintenance and maximizing yield of agricultural systems while being sustainable through reduced resource needs (pesticides, herbicides, water etc.), reducing food-miles (zero mile concept) and the need of less space. However, in the moment their carbon footprint due to their high energy consumption and due to their use of expensive drinking water is still high beside other socially and value-related questions as their potential to generate work places, their contribution to food sovereignty, the access to healthy food also for all social classes or questions related to animal welfare.

This case will (a) analyse the potential of vertical farms in the context of closed loop systems and potential hybrid systems (vertical farming combined with other low-tech approaches and in the local social context where they are happening for their sustainability in all three dimensions: environmental friendly, socially fair and generating livelihoods for many. You can also (b) design your vertical farming system for any local context that you want to apply using value-based and human-centred design approaches.

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Case study 4 — *HOW TO CREATE SUSTAINABLE AND RESILIENT ENERGY, FOOD AND BIODIVERSITY LANDSCAPES?*

Sustainable and resilient agricultural systems are needed to feed and fuel a growing human population. However, the current model of agricultural intensification which produces high yields has also resulted in a loss of biodiversity, ecological function, and critical ecosystem services in agricultural landscapes. If in this complex pattern we also need to integrate the demand for renewable energy both for biomass and also for technical approaches, e.g. photovoltaics the problem is even getting more complex. A key consequence of agricultural intensification or technological intensification for producing renewable energy is landscape simplification, where once heterogeneous landscapes contain increasingly fewer crop and non-crop habitats. Landscape simplification exacerbates biodiversity losses which leads to reductions in ecosystem services on which agriculture depends.
In recent decades, considerable research has focused on mitigating these negative impacts, primarily via management of habitats to promote biodiversity and enhance services at the local scale. While it is well known that local and landscape factors interact, modifying overall landscape structure is seldom considered due to logistical constraints. The loss of ecosystem services due to landscape simplification can only be addressed by a concerted effort to fundamentally redesign agricultural and energy landscapes. Designing landscapes that are sustainable and resilient will require that scientists work with stakeholders to determine the mix of desired ecosystem services, evaluate current landscape structure in light of those goals, and implement targeted modifications to achieve them.

In this case study the group of students from different disciplines need to work together to:

- Design a system that will produce food in a sustainable and resilient way, that produce renewable energy and where biodiversity is high.
- You choose the scale: will it be a farm or region that you will take as an example? What global region?
- Could necessary technical infrastructure and innovation be included in this landscape approach?
- Analyze feasibility and sustainability of your system assessing (on a theoretical base) key indicator for example for: food security factors, resilience factors etc.

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Case study 5 – *STEWARDSHIP OF LAND USE CHANGES: HOW CAN DRONES OFFER SUPPORT?*

Drones are mechanical devices that are, to varying degrees, mobile and can operate remotely from a human operator in aerial, terrestrial or water contexts. They can be used in varied ways to help protect the environment and can also facilitate or cause biodiversity harm. Drones / Unmanned Aerial Vehicles (UAVs) are a mix of technologies for locomotion, sensing and communication, to which other technologies can be added. Questions in this use case to work on are:

- How can they for example support communities, organisations, farmers, researchers or policymakers when managing conflicts and making decisions around land management?
- How can their developers merge processes, technology and skills from across multiple knowledge systems to create UAVs that serve needs of land stewards regarding ecosystem services?
- How can a group of people who will be using or benefitting from drone usage (a community) that are united by a common theme (domain) participate, propose, test, co-create and use technologies to best suit their needs (practice)?
- What are ethical implications that should be considered in the developing and using UAVs for environmental monitoring purposes? And why are they important?
- Do human values play a role in the development and use of UAVs? If so I what ways?

Literature

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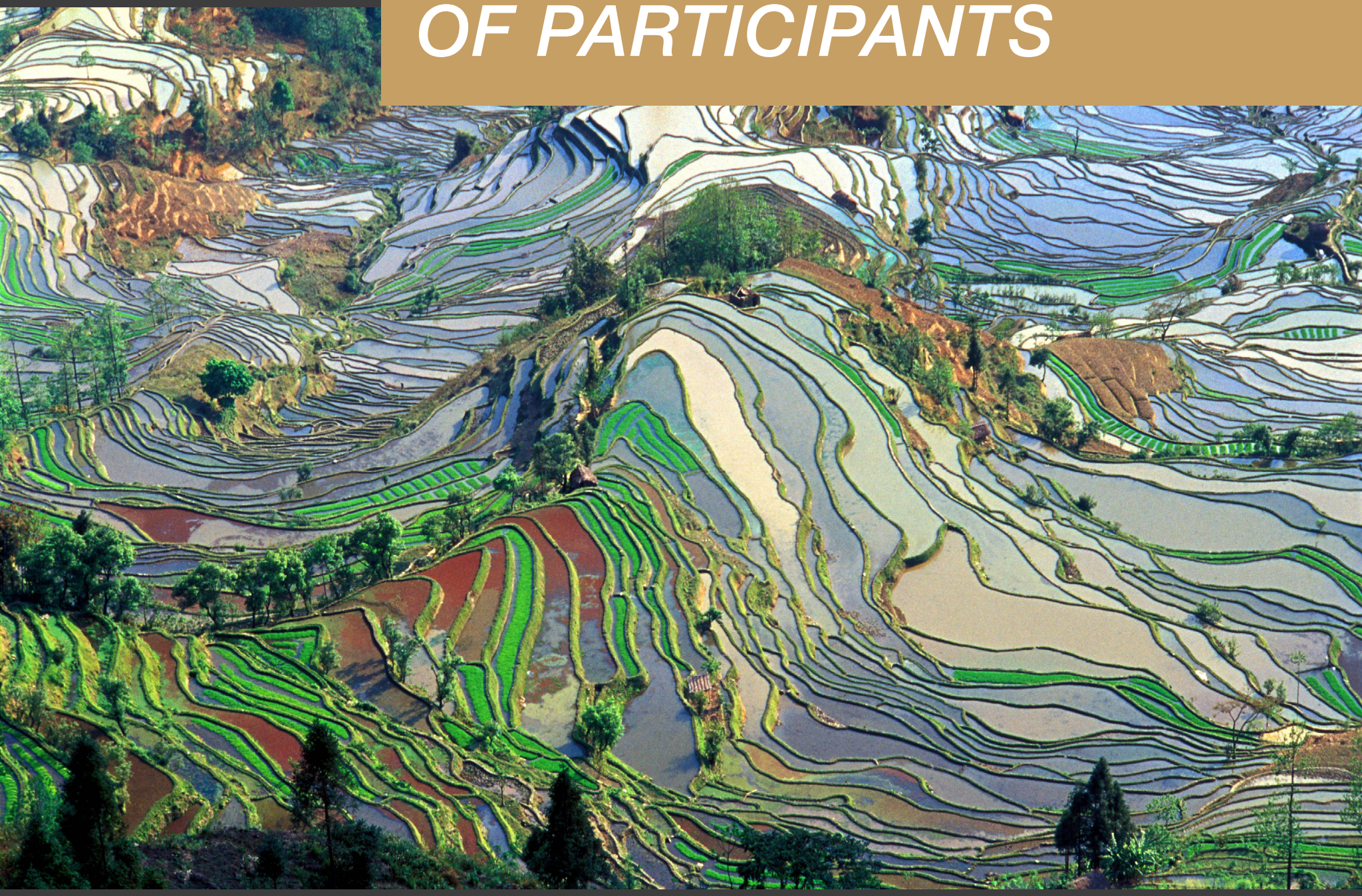
THE LEARNING JOURNEY OF PARTICIPANTS



1 DIGITAL TECHNOLOGIES IN MICRO FARMS: HOW CAN THEY LINK FARMERS AND (URBAN) COMMUNITIES?

Xeniya Kim, Yuanyuan Liang,
Manuel Belanche

Our solution: Digital Information bridGe

Where we started

In our project, we focus on micro farmers who have about 1 to 10 hectares of farm land located in an urban or suburban area. Due to limited scale and resources, micro farmers normally have limited access to customers. They usually sell their products through nearby local markets, which processes are normally time and effort consuming. At the same time, customers who enjoy buying local and organic products have limited information about the agriculture practices behind their food. Besides, buying vegetables from local markets is also time-consuming.

Considering all the listed pain points, we understand that there are communication gaps between micro farmers and customers. Thus, we aim to design an informative and interactive digital platform, which provides a bridge where micro farmers and customers can communicate directly.

What is your result?

Based on the concerns raised by stakeholders as well the research about the actual state of the micro farming markets, we came to the conclusion that what is missing is digital platform for farmers and consumers to connect and get to know each other.

The solution we proposed for this is Digital Information bridGe. It is a platform where both consumers and farmers can share all their day to day experiences and stories. This way, when consumers, who are usually interested in knowing the story behind what they buy and who they buy it to, and want to buy some products, can find which farmers are currently offering the products they need but also get to know about the farmer's personal life and the growth of the product. The sharing of experiences will build up closer relationships between farmers and clients.

Customers will be made and kept based on trust on farmer's practices. Moreover, we considered to provide delivery services to the micro farmer in order to increase their market reach at the same time that we alleviate the very time-consuming delivery tasks that micro farmers need to carry with the current system.

How did you arrive at the result?

We started from figuring out what digital technology can be implemented to make the life of local micro farmers easier. Having defined micro farmers and urban consumers of farm products as main stakeholders, we came up with a digital platform for selling and buying bio and local fruits and vegetables. The initial idea was to add more transparency and outsource delivery. Farmers would add information about watering, pesticide treatment and expected harvesting day for every product. This information would be available for consumers allowing them to be more aware of the background of purchased products. Buying process is simple: you choose what to buy and it will be delivered from the local farm to a pick-up point in the city.

Next, we got familiar with value-based design and set the core values: The first core value is related to our customers and the local micro- farmers: Our platform must be user-friendly, provide enough information about the products and help the micro farmers sell their products more easily and rapidly without concerns about delivery. The second core value is sustainability: allowing only chemical-free products on the platform, enabling short-distance delivery and reducing food waste for example through giving visibility to locally produced and conserved products. Defining values allowed us to see what must be considered first when developing the Digital Information bridGe platform.

Our project made a big step when we discovered the concept of human-centered design. We needed to understand the stakeholders' actual needs and, based on that, formulate the problem that we are going to solve. To do so, we interviewed Dr. Melanie Paschke who has a community garden as a hobby. We found out that local micro farmers do not have enough time to go from one market/ shop to another offering their products. And even if delivery is outsourced, how to convince people to buy local and bio using our platform? Many of us have seen vending machines in Zurich offering such great products, with quite little success though.

Because potential consumers do not know the story behind these fancy cheeses and honey pots.

They are used to buy in local supermarkets or from farmers they know thanks to word of mouth. Thus, we decided to add a “human face” to our platform. DIG will be more just an online marketplace of local and ecologically produced products. It will give to local micro farmers the opportunity to share the “behind the scenes” (or more precisely “behind the farm”) with their clients. Some sort of a farming blog or social network.
Instafarm, Farmbook, What’sFarm. Potential buyers can read farmers’ thoughts and not only learn about the farming process but get to know the producers closer. Pretty farmtastic, huh?

Finally, we learned more about social innovation. We thought about social practices associated with the process of buying fruit and vegetables: writing a grocery list, finding time to do groceries, going to the local market or supermarket, realizing that you forgot the grocery list at home, grumbling about that, choosing what to buy, paying, going home. Our platform will certainly change some of them: now people do not need to go somewhere and pay with cash, they can buy sitting on a sofa and receive the purchase the next day. And DIG’s “human face” will make the transition smoother, since consumers will want to support local micro farmers.

2 HOW TO IMPLEMENT CIRCULAR APPROACHES IN URBAN FOOD SYSTEMS

Alberto Linares, Fei Danli,
Katharina Jung

Our solution: Developing a circular Mensa

Where we started

To slow down climate change, many countries including Switzerland have pledged to reach the goal of net-zero carbon emissions by 2050. This needs to be addressed by all Swiss companies, and also institutions such as for example the ETH Zurich. Our circular Mensa should contribute to the reduction of CO_2 emissions at ETH Zurich.

At the same time, we want to tackle the problem of food waste: in Switzerland, almost three million tons of food are thrown away every year, coming mainly from private households and industry, but also from restaurants. With our project, we want to raise the awareness for this topic, and at the same time close the gap in the energy and nutrient cycle at the ETH Mensa.

What is your result?

The solution that we came up with during the summer school is what we call the “circular Mensa”. First, we will make the food waste more visible to the consumers, by installing posters with information at highly frequented spots in Mensa, and an additional display panel where the weight of food waste is summed up during the whole week. Next, all the food waste that is accumulated at Mensa will be collected, and sent to the company energie360°, where it will be converted into biogas. This biogas will be purchased to the existing biogas grid to supply Mensa with renewable energy, and in that way close the energy cycle. The organic matter will be distributed to the local farmers that supply the Mensa with agricultural goods. In the end, what was considered as waste in the beginning will be transformed into something valuable. Mensa is dependent on a constant energy supply, which might be fluctuating if we only rely on the food waste produced every day. Therefore, we decided to buy the additional required biogas from the same company and came up with a financing plan to be able to purchase the extra costs for the renewable and local energy.

The prices of the different meals should vary, based on their carbon footprint. A meal that only contains local and seasonal vegetables has a low carbon footprint and would therefore be relatively cheap. On the other hand, a meal that contains beef has a much higher carbon footprint and would be more expensive. The CO_2 emission of each meal will be calculated based on the ingredients, and transparently be presented on the daily menu. The data will help the consumers to draw a well-informed decision, and the higher prices will be used to buy more renewable biogas and therefore “compensate” the higher emissions.

How did you arrive at the result?

In our case study we needed to investigate how to implement circular approaches in urban food systems. In a preparation phase, we got familiar with circular economy principles, understanding that we need to progressively shift from conventional linear models to circular models. We came up with the conclusion that to transfer towards sustainability, many food system activities must be reconstructed, but we need to start acting locally. This is how we thought of introducing circular approaches in Mensa – the food service that we all use every day. Afterwards, in an exploration phase, we identified the possible stakeholders involved in our design. We also selected and prioritized the main values of our project, being sustainability our core value.

The most challenging process was to apply the human-centered design to reconsider or even reshape our original idea on day 3, when we were already quite satisfied with what we had by then. We started with depicting a key stakeholder persona – Determined Abbie – who is the Marketing Manager of Mensa company and determined to advocate circular economy in urban food systems. By putting ourselves in her shoes and brainstorming other viable approaches, we came up with another idea of internal carbon pricing that quantifies carbon footprints per meal. The tough moment was when we struggled to choose between two equally interesting ideas but did not want to leave either behind. Therefore, we turned back to find overlaps between the two ideas and utilized the second idea (carbon pricing) to close the financial loop of the first idea (compensating insufficient renewable energy supply).

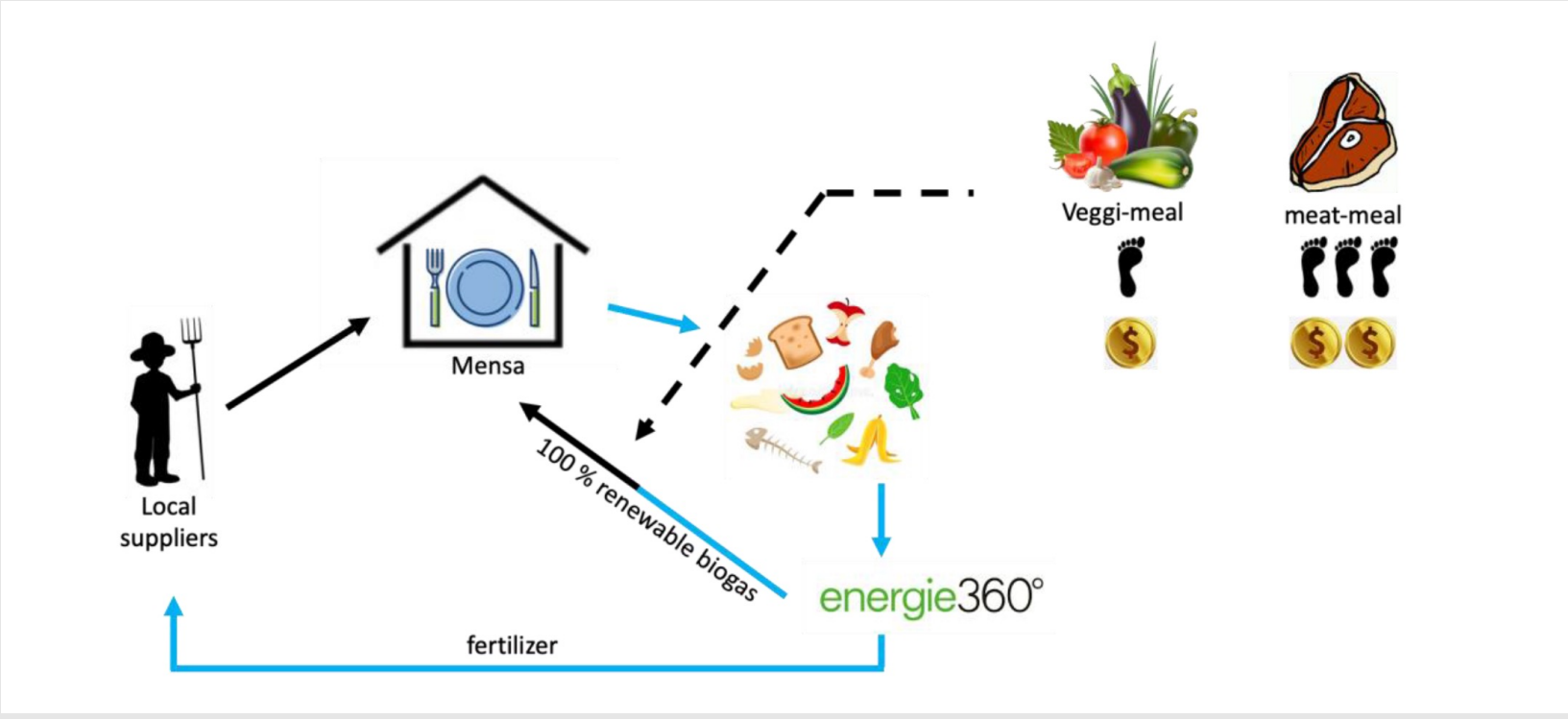


Figure 3. Circular Mensa

3 VERTICAL FARMING: FROM HYPE TO CONTRIBUTING TO A SUSTAINABLE LOCAL FOOD SYSTEM

Laurent Giguere, Francesca Zuffa,
Dusan Denic, Danli Fei

Our solution: VERDical

Introduction

The amount of arable land per person is decreasing worldwide as a direct consequence of rising population and urbanisation rates, a problem further exacerbated by decreasing water availability and climate change (Fedoroff N., 2015). Intensifying conventional agricultural practices may result in increased deforestation, soil degradation, depletion of natural resources, excessive use of chemical fertilizers and pesticides and elevated transportation costs from production to consumption sites. The forecasted increased demand for food supply worldwide requires that we find alternative economically viable production methods to increase yield per square meter while reducing potential negative environmental impacts (Beacham et al., 2019). A recent and innovative production technique is considered to be Vertical Farming (VF), which consists in a controlled- environment agriculture (CEA) practise of growing crops in vertically stacked layers that provide the optimal amount of light, ventilation, nutrients and water. The main advantage of producing crops in such a controlled environment system is that it is independent from external weather extremes and shelters crops from pathogens and pests. Thus, the use of pesticides and herbicides is completely eliminated. Furthermore, there is no seasonality-effect and the production can constantly fulfill the market demand for a specific crop all year round. One potential disadvantage of VF is represented by the highly selective crop species that can actually grow in such systems (mainly leafies) and the higher energy footprint compared to conventional agriculture due to the high demand of artificial lighting (Benke & Tomkins, 2017; Wong et al., 2020). Finally, VF may contribute to achieve the Sustainable Development Goals of the United Nations (UN General Assembly) by contributing to decrease the negative impacts of traditional agricultural practices, by providing large quantities of food in countries or areas with restricted land availability or hostile environmental conditions and by offering a complete independence from transport operations. Therefore, the goal of our case study project was to assess the potential of an indoor VF for creating a more sustainable food production system within urban communities. In order to make a comprehensive assessment, we divided our analysis into different parts, each one pursuing a distinct objective.

Analysis

In our case study project, we first analysed which sustainability aspects could be enhanced thanks to VF. To do so, we identified which specific improvements may be brought about by VF and whether these could potentially solve some of the biggest sustainability issues inherent with Swiss agriculture. Secondly, we determined who the potential stakeholders were, and how they may be involved in the building process of a new and innovative Swiss VF. We then created a stakeholder map by assessing both the degree of influence and the level of interest of each stakeholder. The goal of such an exercise was to understand how to approach and specifically involve each stakeholder in the decision-making process surrounding the building of the VF. Once we have completed this step, we performed an EVQUR (Ethical Value Quality Requirement) assessment, where we defined in depth the core values underpinning our project and the added values to the society and the environment of our VF, such as lower water consumption, avoidance of phytosanitary products as well as local production of food items. Finally, we increased the level of robustness of our case study by performing a risk factor analysis: we carefully identified each risk factor that could potentially jeopardise our vertical farm's capacity to meet the goals set in accordance with the project's core values. Among those risks was a reticence of some consumers to accept agricultural products stemming from artificial growing environments, a risk we then decided to mitigate through a counteracting strategy involving mostly vertical-farm producers and consumers directly.

What is your result?

According to the analysis methods we described above, we identified several groups of stakeholders: Farmers, Food retailers, Local authorities, Consumers and Seed Industry. Next, we analysed each stakeholder's interest and concerns regarding the food produced in VF systems. Farmers might be interested in VF because it allows them to produce the highest quality and safe food. Moreover, due to its high yield and all-year-round production, VF provides an excellent opportunity to earn extra profit. Food retailers would benefit by having a new high-quality product with a reliable supply. At the same time, the local authorities would improve the usage and optimization of

urban spaces and increase the city's eco-green outlook. The most significant identified concern was that consumers might be sceptical about the food produced in a vertical system since it is not being produced in traditional agricultural practice. To address this potential problem and reassure consumer's scepticism, we decided to promote VF by allowing consumers to visit vertical farms and provide consumers free samples.

Concerning the EVQUR analysis, we considered one of the core values of VF food production is sustainability. Some of the quality values that contribute to the sustainability of VF in comparison to conventional farming are zero-mile production, significantly smaller consumption of water and chemical inputs, and high yield production on a smaller surface.

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HOW TO CREATE SUSTAINABLE AND RESILIENT ENERGY, FOOD AND BIODIVERSITY LANDSCAPES?

4

Linda Brodnicke, Reah Gonzales,
Simon Landauer and Simone Markoff

Where we started

The Paris agreement became effective on the 1st November 2016, putting pressure on international governments to reduce CO_2 emissions. In turn, governments have enacted legislation to encourage private companies to move toward more sustainable energy sources without endangering food security and natural biodiversity. To this end, we propose the establishment of a system where sustainable, renewable energy is integrated with livestock grazing in a diverse landscape encouraging agro-biodiversity.

What is your result?

Our final proposal included a combination of PV panels producing solar power for the Mercedes Benz factory, whilst under the panels allowing for agricultural use by the community and farmers. The possible uses include for example grazing of livestock, bee keeping, gardening and other practices with a rotation to preserve biodiversity. By partly restoring naturally grazed meadows in the community area under the panels, surrounding lands can benefit from a higher biodiversity which may, for instance, foster pollination.

How did we arrive at the result?

First, we considered which company that would benefit from investing in renewable energy and identified the Mercedes Benz factory in Sindelfingen in Germany as a very promising candidate. Next, we selected a site for the project, based on proximity to the factory, distance to natural forests or conservation sites (German Naturpark distribution), the regions agricultural land use and the potential for renewable energy sources.
Using a photovoltaic potential map of Germany, we identified solar power generation as highly promising. Having decided on a site, we identified the central stakeholders (Table 1).
Considering the needs of each stakeholder identified we modified the project design. We added benefits for all members of the community, (allowing a reduced rate for charging personal electric vehicles for all non-employee members of the community), an education element (raising awareness for the benefits of renewable energy and biodiversity for environmental protection), and biodiversity protection (measures will be put in place to ensure wildlife populations are not affected by PV panels).

Table 1: Stakeholder needs

MERCEDES BENZ	Wants to move toward more renewable energy sources.
FARMERS (IN CLOSE PROXIMITY)	Future land use might have to be changed from cropland to pasture in some areas, noise pollution during the construction.
COMMUNITY (SINDELFINGEN RESIDENTS)	Concerned about altered landscape, agricultural land will be replaced with solar parks, and this will look very different.
UTILITY COMPANY	Interested to maintain the long-standing business relationship with Mercedes Benz, and to transform their business model in a way that they can profit from the project. Interested to use the project to demonstrate innovativeness and eco-friendliness. Offers to be involved in the design, construction, and operation phase of the PV panels.
GERMAN NATURE CONSERVATION ASSOCIATION	Concerned about the effect of PV panels on the wildlife population, specifically birds.

Figure A1: Designed logo for the project.

Figure A2: Overview of stakeholders and their respective interests, needs and limitations.

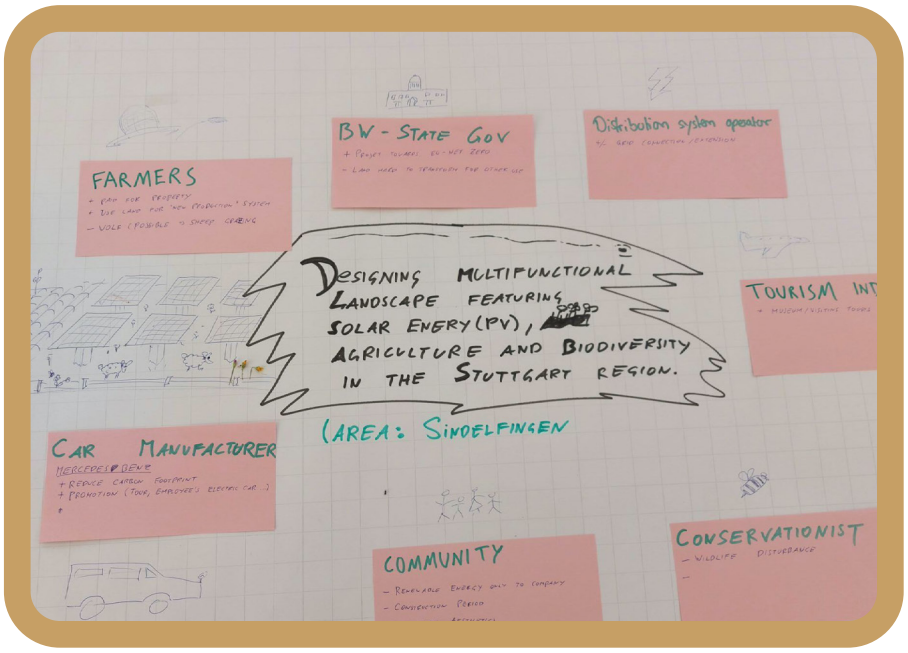
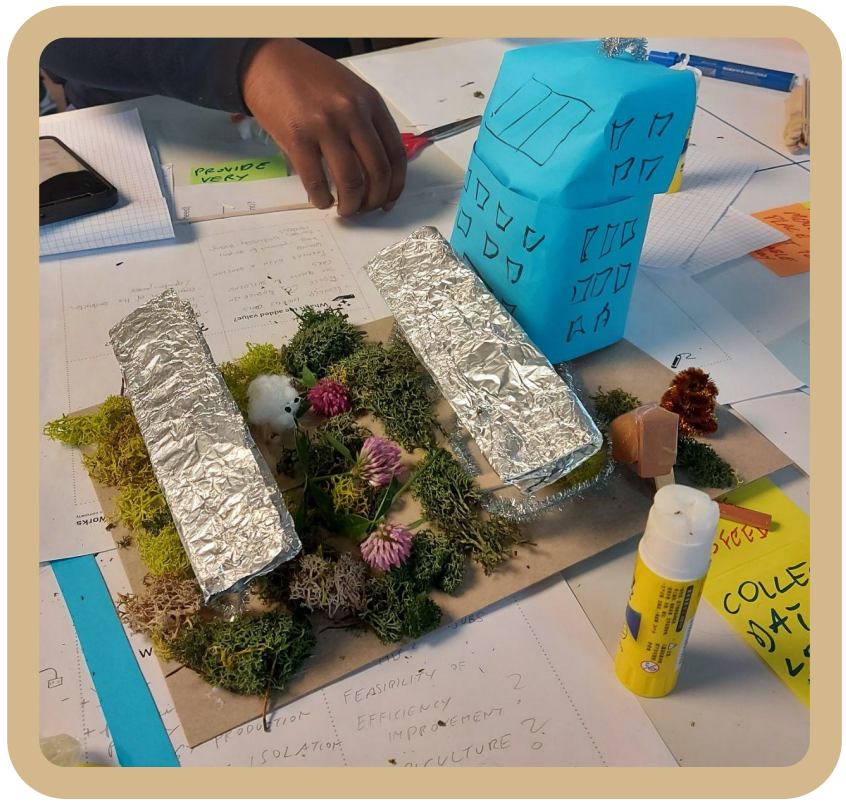


Figure A3: Gathering of ideas during design-thinking process.

Figure A4: Personification of one stakeholder, as manifestation of Mercedes Benz and community interests.

Figure A5: Evaluation of impact and effort for implementing potential solutions.

Figure A6: Prototype with PV panels, meadows, grazing sheep, beehives and Mercedes Benz factory in the back.



5 STEWARDSHIP OF LAND USE CHANGES – HOW CAN DRONES OFFER SUPPORT?

Linda Frattini, Monika Goralczyk,
Bessie Noll, Dabwiso Sakala

Our solution: Biodronic

Where we started

Our case study focused on the topic: 'stewardship of land-use changes: how can drones offer support?'. We imagined a landscape composed of different types of land uses (national park, organic farms in the buffer zone, nature tourism business) and chose to focus on a case study of an organic farmer who wants to maintain their farm while having a positive impact on the environment and local community.
The above-described package that Biodronic offers includes not only the multi-purpose, morphous drone itself, but also a platform with which local farmers or other interested stakeholders could share the cost and/or operational privileges of the drone. Biodronic's package also includes access to a database with which accumulated surveillance or measurement data collected from Biodronic drone users is centralized. Our decision to include the database in the package was motivated by stakeholders' needs to 1) access data collected by other users to understand a wider socio-ecological system, 2) ensure their personal data is securely stored and not shared outside of the group of approved users.

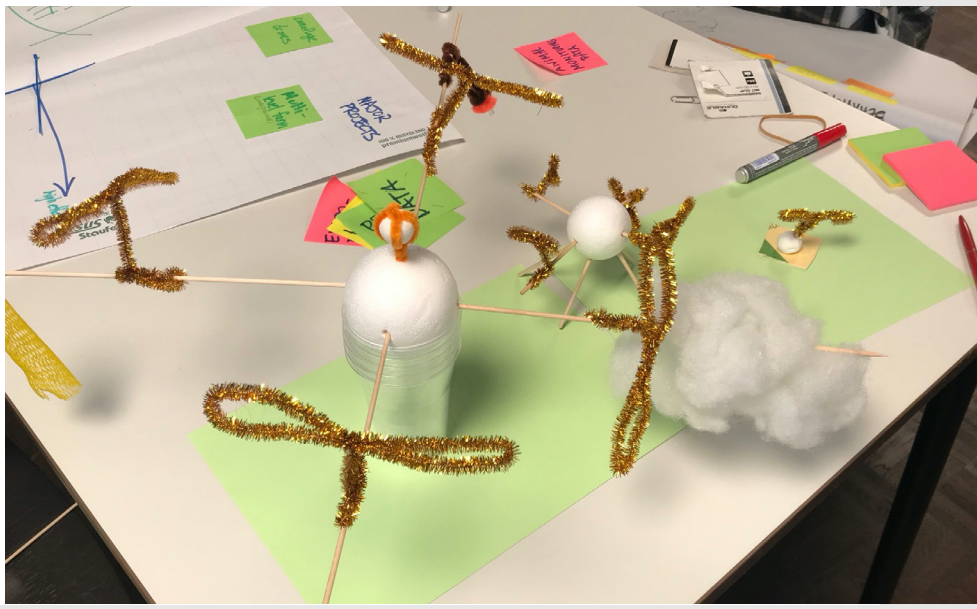
What is your result?

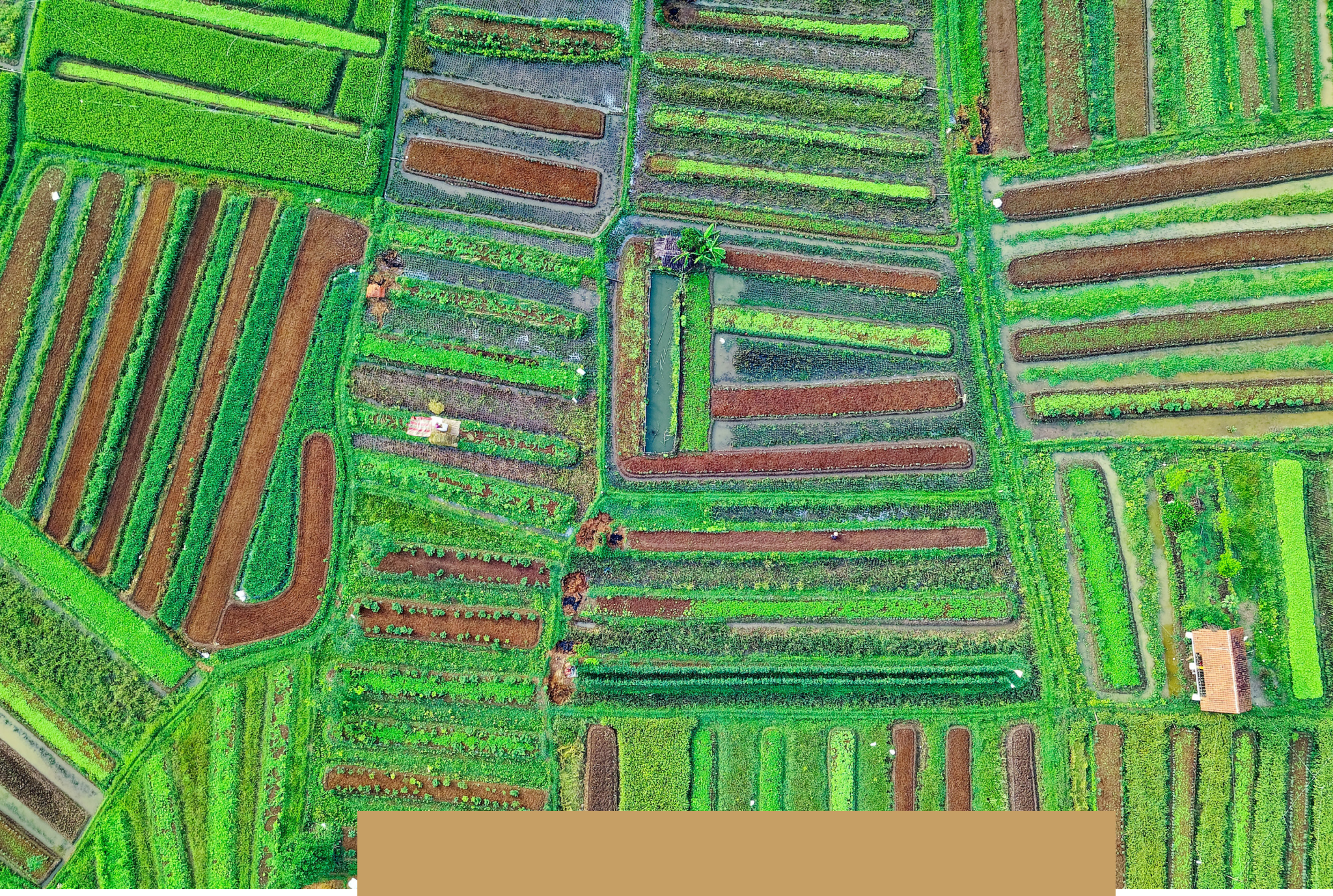
As a result, our final product is a package offered by Biodronic which includes a multi-purpose, morphous drone, as well as a platform with which local farmers or other interested stakeholders could share the cost and/or operational privileges of the drone. Biodronic's package also includes access to a database with which accumulated surveillance or measurement data collected from Biodronic drone users is centralized.

How did you arrive at the result?

In order to understand how drones could offer support as potential stewards of land use changes, our group first focused on defining the landscape itself. That is--what specific geographic environment could a drone be useful, what potential stakeholders would interact in said environment, how would these stakeholders benefit from a drone, and in which specific applications would the drone be useful. In the first two days of the summer school, a stakeholder-centric approach allowed us to hone potential drone users (i.e., local farmers, national park managers, nature reserve tourists, researchers, etc.) and define their needs from an ethical standpoint that considered both individual and societal consequences as well as a value-based standpoint. Initially, our group identified an important issue of sparse, inconsistent, or even non-existent legal frameworks regarding drone movement between both public and private lands and more importantly drone interaction with public and private individuals. To this end, we thought to place ourselves in a "policy-maker's" position to define and evaluate our problem statement, but this proved in the end difficult as the deliverable (which presumably would have been some sort of policy framework) was not straightforward.

Following an intense experience with the Design Thinking workshop on Wednesday, our group shifted the focus from policymakers to "entrepreneurs" (to an extent) in order to deliver our final product: Biodronic. This fundamental shift in design approach allowed us to focus on specific technical details that a drone (part of our final product) could offer our intended users/stakeholders. It also allowed us to include our earlier concerns related to the legalities of drone use in a multi-stakeholder environment by introducing the centralized database that would provide a safe place to store data. Importantly, the shift to a product-oriented deliverable forced our group to design for a specific stakeholder – Jamilla the organic farmer. This simplified the problem dramatically and enabled us to think about how our targeted stakeholder then interacted with other stakeholders.





ABSTRACTS

THE SDGs, THEIR LINK TO RESPONSIBLE RESEARCH AND INNOVATION (RRI)

Melanie Paschke, Zurich-Basel Plant Science Center, ETH Zurich

The 17 Sustainable Development Goals are an urgent call for action by all countries – developed and developing - in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and allow economic growth while accepting the global boundaries of our planet. RRI is an approach that anticipates and assesses potential implications and societal expectations with regard to technological innovation, with the aim to foster the design of inclusive and sustainable research and innovation (Horizon 2020, European Commission). In this introduction, we explore these concepts and their meaning for the research practice. Can we bring the two concepts together?

At the heart of the RRI process is deliberation: maximizing the decision-making power of all those included as well as on a high responsiveness and accountability of scientists towards needs, values and expectations of those targeted. The process of deliberation can lead to understanding, respect, empathy, and a balance of power. Deliberation in science is a yardstick for scientists in society in global governance.

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Melanie Paschke is heading the education and science-policy section at the Zurich-Basel Plant Science Center. She has a PhD in ecology and environmental sciences, has led and supervised the development of higher education programs for more than ten years. She has a record of accomplishment as educator in several areas of academic professional conduct and sustainable development. Her focus is on ethical inquiry in the plant sciences and on research integrity.

TRACKING SOCIO-ECOLOGICAL TRANSFORMATIONS BASED ON LAND COVER CHANGES

Fritz Kleinschroth, ETH Zurich

Land use is one of the most important factors contributing to and affected by global change. The way how humans produce food, manage forests, and organize their settlements has strong implications for the global carbon cycle, biodiversity conservation and many of the services provided by landscapes and ecosystems to people. Plans and policies have been developed on multiple scales, trying to restrict and influence how people use landscapes. Yet, it is frequently reported that policies are failing in the face of global economic, ecological and societal forces. To understand the effects and effectiveness of policies and societal transformations, it is crucial to keep track of changes in forests, settlements and croplands in a spatially explicit way over time and link them with decision-making on the ground.

In this talk, I will focus on infrastructure development, urbanization, and electrification processes in rural regions and link those with observable changes in land cover. Based on some of my past projects, I will provide examples of (avoided) deforestation along logging roads in managed and unmanaged forests of the Congo Basin, changing indigenous settlements in East African wetlands and proliferating floating vegetation invasions in rapidly urbanizing tropical regions. These examples all document profound landscape transformations that are detectable through remote sensing but are embedded in complex social-ecological systems. I will elaborate on the causes for these landscape transformations and the implications for ecosystems and livelihoods.

Linking observed landscape transformations to human decision-making provides an important base to assess how societal processes and policies produce intended and unintended environmental changes at different scales. Monitoring such changes is crucial for improving future policies, as I will show for the example of the FSC forest certification program. However, I will also discuss the limitations of earth observation in understanding socio-ecological transformations due to noise, strong natural vegetation dynamics and the simple (but important) truth that there is no remote sensing method to detect human needs and values.

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Fritz Kleinschroth is a senior scientist (Oberassistent) in the Ecosystem Management group at ETH Zurich, where he also previously worked as a Postdoc, coordinating the ecosystem component of an interdisciplinary project on the Water-Energy-Food nexus. He earned a dual PhD from AgroParisTech, France and Bangor University, UK as part of the “Forest and Nature for Society” Erasmus Mundus Joint Doctorate programme with a PhD thesis on “Roads in Rainforests”. Fritz holds a “Diplom-Ingenieur” degree in landscape planning from TU Berlin, Germany with an emphasis on urban ecology, vegetation science and GIS. He has practical experience in European conservation planning through three years of work as an ecological consultant and habitat mapper in Germany. Fritz’ interests in global socio-ecological systems place him in the interdisciplinary nexus of landscape ecology, urbanism and land system science. He is focusing on spatially explicit links between land cover changes and societal transitions over time. He has long-term experience in mapping effects of human interventions on ecosystem functioning from field-based and remotely sensed information in tropical and temperate regions. He is particularly interested in the importance of built infrastructures for sustainable development and conservation and he is engaged in science-policy interactions to make his work applicable for decision-making. He is first author of 13 peer-reviewed journal articles, published in high impact journals such as Nature Sustainability, Frontiers in Ecology and the Environment, Journal of Applied Ecology and Conservation Biology.

CAN WE GO NET-ZERO ANY TIME SOON, AND HOW?

Marco Mazzotti, ETH Zurich

Counteracting climate change and realizing a sustainable net-zero society, in harmony with the environment, require mitigating current CO_2 emissions as well as creating negative emissions to compensate for unavoidable emissions (from cement plants, chemical industry, agriculture, waste treatment plants…). CO_2 capture, transportation and storage systems (CCTS) and CO_2 capture, utilization and storage systems (CCUS) are going to play a major role. Point-source CO_2 capture is feasible across sectors, and we expect that permanent CO_2 storage will be accessible Europe-wide. CO_2 utilization is very energy-intensive (thus requiring clean energy and system level analysis), unless CO_2 is used in carbonate form for construction materials. Carbon Dioxide Removal can be accomplished via Direct Air Capture (direct air capture with carbon storage, DACCS) or by exploiting biomass (bio-energy with carbon storage, BECCS), but their potential is not clear. In certain sectors, such as chemicals and (aviation) fuels, there are different options to achieve carbon neutrality. Synthetic fuels (from recycled CO_2) however do not offer any “free lunch” in these sectors, while they might play an important role for the storage of intermittent renewable electricity. In any case, CO_2 management requires as a prerequisite a shared Europe-wide CO_2 network infrastructure, serving all CO_2 sources and CO_2 sinks.

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Marco Mazzotti is professor of process engineering at ETH Zurich. His research activities are in the area of development of carbon dioxide capture and storage systems. Marco Mazzotti has been coordinating lead author of the IPCC Special Report on Carbon Dioxide Capture and Storage (2002–2005).

THE RRI FRAMEWORK IN PRACTICE – INTEGRATING SOCIETAL CONSIDERATIONS IN YOUR RESEARCH

Daan Schuurbiers, De Proeffabriek, Arnhem, The Netherlands

WORKSHOP

As part of ongoing attempts to strengthen the responsiveness of research and innovation to societal needs and values – most recently within the framework of Responsible Research and Innovation – scientists are called upon to 'integrate broader societal considerations in their work'. But for all the compelling rhetoric, what does this actually mean at the level of day-to-day research? What sorts of consideration are we talking about? Whose consideration are they? And how could they be applied to research?
In this workshop, we will explore how to integrate societal considerations in our group cases. After a brief introduction to the notion of Responsible Research and Innovation and its implications for research practice, we will identify the questions, knowledge requirements and possible concerns that social actors might have. Subsequently, we will explore how you might incorporate these questions as part of your research.

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Daan Schuurbiers is director of DPF, a Dutch consultancy for responsible innovation in the Netherlands. Daan has encouraged early reflection on the possible social impacts of emerging technologies throughout his research and current advisory work. He designs training courses for researchers, builds novel interdisciplinary collaborations, advises on research policy and regularly speaks at conferences to raise awareness with researchers of the broader societal dimensions of their work.

FOOD CITIZENSHIP: CO-CREATION OF COMMUNITY-DRIVEN TECHNOLOGIES

Alessandra Schmidt, FabLab Barcelona

Alessandra Schmidt is a Brazilian born social scientist, with masters in Social Development Practice at University College London (UCL) and in Management Sciences at ESADE. At Fab Lab Barcelona, a department of the Institute of Advanced Architecture of Catalonia (IAAC), she oordinatinates EU research projects' operations, focused on supporting local communities' pathways for situated-innovation, pushing positive societal change and transformation outcomes one step forward across gloCal communities.

MEGATRENDS, RISKS AND RESEARCH CHALLENGES IN FOOD SYSTEM SCIENCE

Martijn Sonnevelt, WFSC, ETH Zurich

The way the world produces, consumes, and wastes food is far from sustainable. Producing, processing, and delivering food is resource- and energy-intensive, with the agricultural sector, together with forestry, actually accounting for 24% of yearly total greenhouse gas emissions. In addition, the UN estimates that each year, a third of the food produced worldwide worth US $1 trillion ends up rotting in waste bins or spoils because of poor transportation or harvesting practices. Fighting hunger was therefore included as a central element in the United Nations (UN) Sustainable Development Goals (SDGs). Clearly, if the world fails to increase efforts and to implement more targeted measures, we will fall far short of achieving the ambitious SDGs.

The challenge of food security is not only to produce enough food but to make it accessible and affordable to all. Food production is threatened by an overexploitation and depletion of resources, environmental degradation, climate change and poverty. Overweight and obesity are widespread while macro- and micronutrient deficiencies affect billions, creating a triple burden of malnutrition in many countries. So beyond food production, food systems must be assessed on their impact and role in creating jobs, stabilising livelihoods, reducing inequality between stakeholder and territories, and preserving and improving environmental integrity. The way the performance and efficiency of food systems are measured must be completely revised to allow to drastically reduce their impact on human and environmental health.

Literature

Overview report addressing important challenges and risks of food systems.

Dury, S., Bendjebbar, P., Hainzelin, E., Giordano, T. and Bricas, N., eds. 2019. Food Systems at risk: new trends and challenges. Rome, Montpellier, Brussels, FAO, CIRAD and European Commission. https://doi.org/10.19182/agritrop/00080

Martijn Sonnevelt is Executive Director of the World Food System Center. Martijn completed his bachelor, masters, and doctoral studies at ETH Zurich in Agricultural Economics. His doctoral thesis focused on understanding the actions and driving forces of smallholder farm households through an economic case study in the Sri Lankan hill country. He then worked as a Postdoctoral Researcher and Project Manager on a global grain value chains project, supported by a donation from Buhler, which included an expert advisory group from industry and government. Next, he coordinated a United Nations Food and Agricultural Organization program focused on incentives for ecosystem services in agriculture. Martijn was then the Deputy Head of International Affairs, Research, and Innovation at the Swiss Federal Office for Agriculture.

A PRACTICAL INSIGHT TO VALUE-BASED DESIGN

Melanie Paschke / Verena Lütschg, Tomorrow Consulting

WORKSHOP

Previous experiences and examples in several fields of technological innovation and sustainable development showed that behind deep and far-reaching societal concerns are often conflicts on overlooked or hidden values. An important idea of Responsible Research and Innovation is that engaging in ethical inquiry very up-stream in the research and innovation process, i.e. in pre-research or at the very start of a research project can resolve in more acceptance.
To get aware of core values and beliefs of stakeholders and the public related to the research area and your problem definition you will be introduced in the idea of considering values in technological innovation. You will assess through an ethical matrix if – from stakeholders' perspective – your research or innovation is in conflict or is supporting their ethical principles. Based on this, you will start a value-based design process: can you come up with a possible solution to your problem, an innovation that includes the results of your ethical inquiry?

In this workshop, participants will:

- Develop a deeper understanding of ethical implications and values in research and design.
- Learn how to conduct an ethical inquiry and develop an ethical matrix and value proposition.
- Learn how value-based reflection and value statements can provide guidance for future research/design decisions.
- Get familiar with the value-based design process.

Literature

Srivatsa, N., Kaliarnta, S., & Groot Kormelink, J. (eds.) (2017). Responsible innovation: From MOOC to book. Delft University of Technology. https://repository.tudelft.nl/islandora/object/uuid:2aad6105-4723-437e-9814-06a55054d986

Van de Poel, I (2013). Translating Values into Design Requirements. In: Philosophy and Engineering: Reflections on Practice, Principles and Process (pp.253–266). https://doi.org/10.1007/978-94-007-7762-0_20

VERTICAL FARMING: PROPHECIES, POTENTIALS AND PITFALLS OF A HIGH-TECH PROPOSITION FOR URBAN FOOD PRODUCTION

Mascha Gugganig, University of Ottawa; Technical University Munich

The indoor vertical farm industry has attracted considerable attraction in the last years, based on its capabilities to reduce water, apply no pesticides, be space-efficient (especially for cities), and independent of weather conditions, particularly in the face of the increasingly worsening state of this planet. Concurrent with this sense of urgency is the large amount of Silicon Valley venture capital, despite the unresolved issue of this proposed solution, and its high energy use. This raises the question who started this trend, how it continues to attract such large amounts of investments, and who does profit from vertical farms at the end of the day. In this talk, I invite workshop participants to think critically about the prophecies, potentials and pitfalls of vertical farming, starting with an introduction to Science & Technology Studies (STS). In this interdisciplinary field, scholars inquire in various ways how (western) society is not outside, but an integral part of science and technology, and vice versa. How we understand the world – e.g., framing social and environmental problems – is how we choose to live in that world – e.g., by finding high-tech solutions to solve those problems. This understanding of co-production will lead me to lay out how vertical farming proponents establish and align the dismal stage of the agricultural system as planetary-scale problem to then propose vertical farming as technological fix. In this dynamic are also internal disagreements of vertical farm advocates being both aware of the fact that it is not solving all problems, and believing that technology development will adequately respond to these problems. I will end the talk with a proposition to think of vertical farming as educational moment, to query what the actual operating problems are, and for public engagement to ask critical questions about current forms of agricultural and food production.

Mascha Gugganig is a socio-cultural anthropologist and science & technology studies (STS) scholar whose work looks at human-environment relations in agriculture and food production in light of contested novel technologies, attending to how actors constitute and trouble respective notions of ‘expertise.’ Her current work attends both to discursive authorities of policy and industry visions of ‘smart’ farming and AI applications in Canada, and the role of innovation and technology in agroecological practices. Based on two previous research projects, she continues to be interested in the European Union’s multifarious imaginaries of ‘sustainable’ agriculture and the hopes and hypes of indoor vertical farming as viable urban food production. Her doctoral research looked at the contested use of āina – ‘that which feeds’, or land – for agricultural biotechnology research and development on the settler colonial terrain of Kaua‘i. Critical public engagement with academic research, science and technology in museums and public spaces, as well as collaborative research through arts-based, multimodal methods form another core area of her scholarship. She is an Alex Trebek Postdoctoral Fellow in AI and Environment at the University of Ottawa, and Research Associate at the Munich Center for Technology in Society, Technical University Munich.

VERTICAL FARMING AND CLOSED LOOPS – THE EXAMPLE OF YASAI

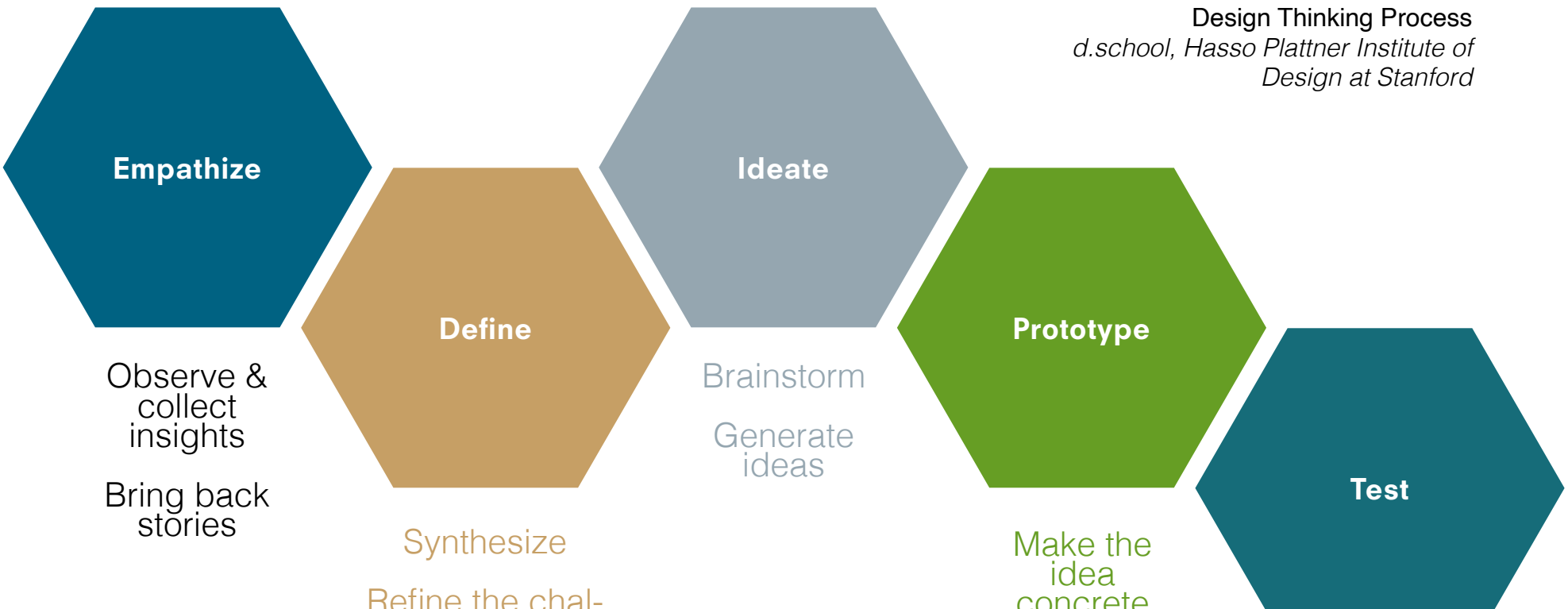
Philipp Bosshard, YASAI

Could vertical farming work through closed loops? YASAI is pioneering this new approach with its holistic circular concept for vertical farms. YASAI farms include integrated circular loops for nutrients and heat energy, as well as biowaste and CO_2. How do they work? How much input is needed and how much output is generated? Founded in January 2020, YASAI offers “Vertical Farming as a Service” – a new approach, where we not only build a turn-key vertical farm for our customers, but also offer the operation of the farm, as well as distribution, marketing and branding over our own sales channels. This approach allows everyone to enter the world of vertical farming, without the need of an extensive knowledge base and team. YASAIs goal is to empower its customers to grow more with less and the creation of circular food production systems all over the world, especially in cities and regions lacking sufficient agricultural resources such as fresh water or fertile arable land.

Philipp Bosshard, Co-Founder & CTO YASAI, BSc Ecological Engineering at Zurich University of Applied Sciences.

A PRACTICAL INTRODUCTION TO DESIGN THINKING

Michael Augsburger, Spark Works & ETH Zurich



Design Thinking Process
d.school, Hasso Plattner Institute of Design at Stanford

WORKSHOP

During this workshop, participants will discover Design Thinking — an innovative, human-centered approach to problem solving that starts with a specific challenge and goes through multiple stages of iteration: observation, interviews, brainstorming, and prototyping.
After an introduction of the tools and methods, participants will practice in groups on a real-life challenge, from reframing the challenge, generating and describing ideas, prototyping them and exposing them to external feedback.

Literature

It is recommended to watch the 8 minutes “ABC Nightlife” report about how the company IDEO works. This video can be found on Youtube, for example here: https://youtube/M66ZU2PCIcM

Michael Augsburger holds an M.Sc. in Environmental Systems and Policy at ETH Zurich. His research focuses on the use of human-centered innovation processes for policy design. Believing in the benefits of interdisciplinary work, he has experience in coaching student teams to develop and push forward their own innovation projects. At Spark Works, he supports our team in the execution of agile work sessions with our clients through workshop assistance and facilitation.

INTEGRATED AGRICULTURAL SECTORS AND FOOD SYSTEM FRAMEWORK: A HOLISTIC AND MULTI-STAKEHOLDER APPROACH GUIDING SECTORS IN THEIR CONTRIBUTIONS TO SOCIAL, FOOD SECURITY AND ENVIRONMENTAL OUTCOMES

Walter-de-Boef, Wageningen University & Research (WUR),

Wageningen Centre for Development Innovation (WCDI), The Netherlands

Producing food in uncertain times calls for inclusive and resilience agricultural food sectors. Through a process of transformation, i.e. system innovations, their contribution to defined food system outcomes is enhanced in a dynamic and structural manner. As such system innovation requires coordinating improvements and learning from and adapting to emerging and changing circumstances. As such, it is a case of system thinking at food system level is putting to practice at the level agricultural sectors, i.e., zoom in and zoom out. The best practices will share cases of rapid assessments responding short term to the impact of COVID-19 on food systems and sectors, as well as designing major multi-year and multi-stakeholder sector programmes by teams of Wageningen University & Research and its partners in various countries.

Literature

Rapid assessment: https://www.wur.nl/en/Research-Results/Research-Institutes/centre-for-development-innovation/Our-Value-Propositions/Guiding-Sector-Transformation/The-effects-of-COVID-19-on-food-systems-rapid-assessments.htm

De Boef et al., (2021). Rapid assessments of the impact of COVID-19 on the availability of quality seed to farmers: Advocating immediate practical, remedial and preventative action. Agricultural Systems, 188, 103037. https://doi.org/10.1016/j.agsy.2020.103037

Walter de Boef is Senior Advisor with the Wageningen Centre for Development Innovation (WCDI) part of Wageningen University & Research. Walter has more than 30 years of experience in smallholders' agricultural development. He has a MSc in Plant Breeding and PhD in Communication and Innovation Studies both from Wageningen University. At WCDI, Walter is co-leading the team working with transformation of agricultural sectors. Since joining 2020, the work has been targeted as placing this work within a food system framework. Walter manages and works in several country and multi-country collaborative programmes in the seed sector. Before, he was leading the seed system work at the Bill & Melinda Gates Foundation, was 10 year visiting professor with the Federal University of Santa Catarina in Brazil, consultant with various development organizations and worked for 10 years with the gene bank in the Netherlands. As scientist, Walter co-developed approaches that include the Integrated Sector and Food System Framework, Integrated Seed Sector Development and Community Biodiversity Management, on which he has been publishing several books and scientific papers. Walter has worked in more than 40 countries in Africa, Asia and Latin America.

SOCIAL INNOVATION – CHANGING SOCIAL PRACTICES

ANAÏS SÄGESSER, STRIDE - THE UNSCHOOL FOR COLLABORATIVE LEADERSHIP & SOCIAL INNOVATION

WORKSHOP

How can your innovation, solution, service, product or research efforts support the transformation of complex systems for a sustainable and equitable future? The societal challenges we face today ask for social innovation – innovation which emerges through participatory frames and seeks societal transformation. It can relate to different contexts and social practices, like transforming the ways we eat, work, do business, travel etc. In this workshop, you will understand the idea and the key elements of the social practice theory approach and how to put it into action. You will take a look at the social practices involved in your own approach and design an experimental innovation plan in order to test your change hypotheses.

With her passion for learning and care for humanity, **Anaïs Sägesser** just loves stepping on new pathways and exploring the unknown. With experience in many fields (hint: passion for learning) from business and economics (PhD at the HSG) to religious and Islamic studies, environmental sciences and yoga, she has worked in SMEs, large corporates, NGO, public sector and her own company. Having passionately built up the Swiss Climate-KIC office whilst journeying deeper in yoga, happiness research and coaching, Anaïs has become a sought-after mentor, business coach and expert on innovation and entrepreneurship. Acknowledging that many societal challenges of our time are merely symptoms of our values, belief systems and aspirations, it is now time to address personal transformation at scale to create a learning world that works for all. Next to STRIDE she is also a co-founder of scaling4good and MahaDevi Centre Switzerland associations, Chair of the Board of Trustees at MahaDevi Yoga Centre UK and member of the WeAct Advisory Board.

VALUE SENSITIVE INNOVATION IN THE HUMANITARIAN CONTEXT

Ning Wang, ETH Zurich

Emerging technologies are widely used in humanitarian, development and healthcare settings by aid agencies globally. Many of these solutions involve the use of digital technologies, such as geographic information systems, smartphone apps, predictive algorithms, blockchain, artificial intelligence, and unmanned aerial vehicles, also known as drones. The latter represents the first wave of robotic technology applied in the aid sector, demonstrating its remarkable capacity to speed up humanitarian responses and to optimize aid supply operations. However, along with enthusiasm comes uncertainty. Technological innovation intersects with values, norms, beliefs and various moral commitments. In the humanitarian sector, the use of novel technology may challenge the principle of 'Do No Harm', may raise questions related to sovereignty, and may negatively affect equality and access for at-risk populations in disaster zones and remote areas lacking sufficient healthcare services. Additionally, humanitarian innovation may also disrupt relationships between various actors including introducing new players (e.g., private for-profit companies and networks of digital volunteers), may widen inequality between those with access and those without, and may raise security and privacy risks disproportionately affecting the already vulnerable. This lecture focuses on the ethical considerations associated with the humanitarian use of drones. The findings are based on two recent field studies conducted in Nepal and Malawi, during 2019-2020, around two main applications – disaster mapping and medical supply delivery. The results are expected to inform the community on the gaps and needs with respect to the ethical challenges that humanitarian innovation may invoke in the case of the so-called "good" drones.

Literature

Wang, Ning; Christen, Markus; Hunt, Matthew; Biller-Andorno, N. (2022). Supporting value sensitivity in the humanitarian use of drones through an ethics assessment framework. International Review of the Red Cross: 1–32. https://doi.org/10.1017/S1816383121000989

Wang, Ning; Christen, Markus; Hunt, Matthew (2021). Ethical Considerations Associated with "Humanitarian Drones": A Scoping Literature Review. Science and Engineering Ethics, 27(4):51. https://doi.org/10.1007/s11948-021-00327-4

Ning Wang joined the Institute of Biomedical Ethics and History of Medicine (IBME) in February 2017. She acquired her Master's degrees in Applied Ethics (MA) and Political Science (MS) from Norway and Sweden respectively, during 2007-2011. From 2010 to 2013, Ning worked as an ethicist for a number of international organizations on policy development, in Geneva, Switzerland. From 2013 to 2016, Ning worked for a Swiss-based multinational company on business ethics, and subsequently a humanitarian NGO as an ethics policy advisor, in Geneva, Switzerland. In 2017, Ning returned to academia to pursue a PhD project at the Program of Biomedical Ethics and Law, University of Zurich.
In her current project, Ning works on value sensitive innovation, investigating how to integrate ethical values in the humanitarian use of drones, in collaboration with international organizations and academic institutions across Europe, North America and Asia-Pacific. Through empirical case studies, Ning intends to address the ethical, legal and regulatory challenges new technologies pose to society, propose appropriate and sensible analytical approaches in the understanding and evaluation of them, and outline feasible and pragmatic policy recommendations for the responsible development and deployment of them.

COOLING SINGAPORE: DESIGNING RESPONSIVE AND REGENERATIVE HUMAN SETTLEMENT SYSTEMS

Gerhard Schmitt, ETH Zurich and Founding Director, Singapore-ETH Centre

Human settlement systems face a new existential threat: The Urban Heat Island (UHI) effect. In combination with climate change, heat waves kill more people than any other extreme weather event: more than tornados, hurricanes, and even floods. This is why cities need to become more liveable, responsive and regenerative. Design, informed by science, site, and responsive citizens will be the enabler. Good governance, economic strength and sustainable resilience will be results. Design based on complexity science can mitigate the existential threat of climate change to citizens; and design can suggest settlement infrastructure, socio-economic and technological adjustments of settlements for inter-pandemic times. As real-time case study for this citizen-centric and science-based planning and managing approach we present the Cooling Singapore initiative.

Literature

Gerhard Schmitt, Estefania Tapias and Marta H. Wisniewska (2019). City in Your Hands. https://books.apple.com/us/book/city-in-your-hands/id1451584143?ls=1

Cooling Singapore
https://www.coolingsingapore.sg

How Singapore uses science to stay cool
https://www.youtube.com/watch?app=desktop&v=PM101DvvG4Q

Gerhard Schmitt, Professor Emeritus for Information Architecture, ETH Zurich, Switzerland; Founding Director, Singapore-ETH Centre; Lead Principal Investigator, Cooling Singapore. Since 2005, developed Information Architecture on the urban and the territorial scale at ETH Zurich and in Asia. Since 2006, co-developed the Future Cities Laboratory in Singapore. Studies in Munich, Los Angeles and Berkeley. Formerly: Associate Professor, Carnegie Mellon University; Visiting Professor, Harvard GSD; 1994-96, Dean of Architecture ETH Zurich; 1998-2008, ETH Zurich Vice-President for Planning and Logistics; 2000. Gerhard Schmitt initiated the virtual campus ETH World in 2000 and in 2003 the sustainable ETH Science City Campus in Zurich; he received for this work the 2010 European Culture of Science award.

SPEAKERS & CASE STUDY SUPERVISORS

Michael Augsburger, Spark Works, ETH Zurich
Philipp Bossard, YASAI, Zurich
Walter-de-Boef, WUR and WCDI, University of Wageningen, Netherlands
Mascha Gugganig, University of Ottawa, Canada & TU Munich, Germany
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Verena Lütschg, About Tomorrow Consulting, Zurich
Marco Mazzotti, ETH Zurich
Simon Meister, Low Impact Food
Sonja Meller, DigitalSoil
Melanie Paschke, Plant Science Center, ETH Zurich and Universities of Zurich and Basel
Christian Schaffner, Energy Science Center, ETH Zurich
Alessandra Schmidt, FabLab Barcelona
Gerhard Schmitt, ETH Zurich
Martijn Sonnevelt, World Food System Center, ETH Zurich
Daan Schuurbiers, De Prooffabrik, Netherlands
Dr. Anaïs Sägesser STRIDE - the UNSCHOOL, Zurich
Ning Wang, University of Zurich

Accommodation

We stayed at the former Monastery in Wislikofen. The hotel provides meals of well-balanced nutrition, and wherever possible using produce from the region. Breakfast is buffet continental style. The Propstei Wislikofen is a place with special charisma. Among other things, it is known for its historic ambience, tasteful rooms and excellent cuisine. There are lots of hiking tracks within the area of the hotel.

www.propstei.ch

IMPRINT

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The Jewel, Singapur Airport by Lynde – Pexels (page 2).

Energy systems, solar energy by Taryn Elliott – Pexels (page 15).

Terrace rice field in Yunnan Province, China. March 2003 by Jialiang Gao www.peace-on-earth.org (page 21).

Drone by Kira Hoffmann – Pixabay (page 22).

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Vertical Farming – FarmGRO (page 28).

Crops grow under PV arrays in a test plot at the UMass Crop Animal Research and Education Center in South Deerfield MA. The project is part of the DOE InSPIRE project seeking to improve the environmental compatibility and mutual benefits of solar development with agriculture and native landscapes – Flickr (page 31).

Conceptual view of the CYbER drones during flight and sampling inside tree canopies by Stefano Mintchev, ETH Zurich (page 34).

Cisauk, Indonesia by Tom Fisk – Pexels (page 36).

Electricity by Gordon Johnson (page 40).

Vertical farming – YASAI (page 45).

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