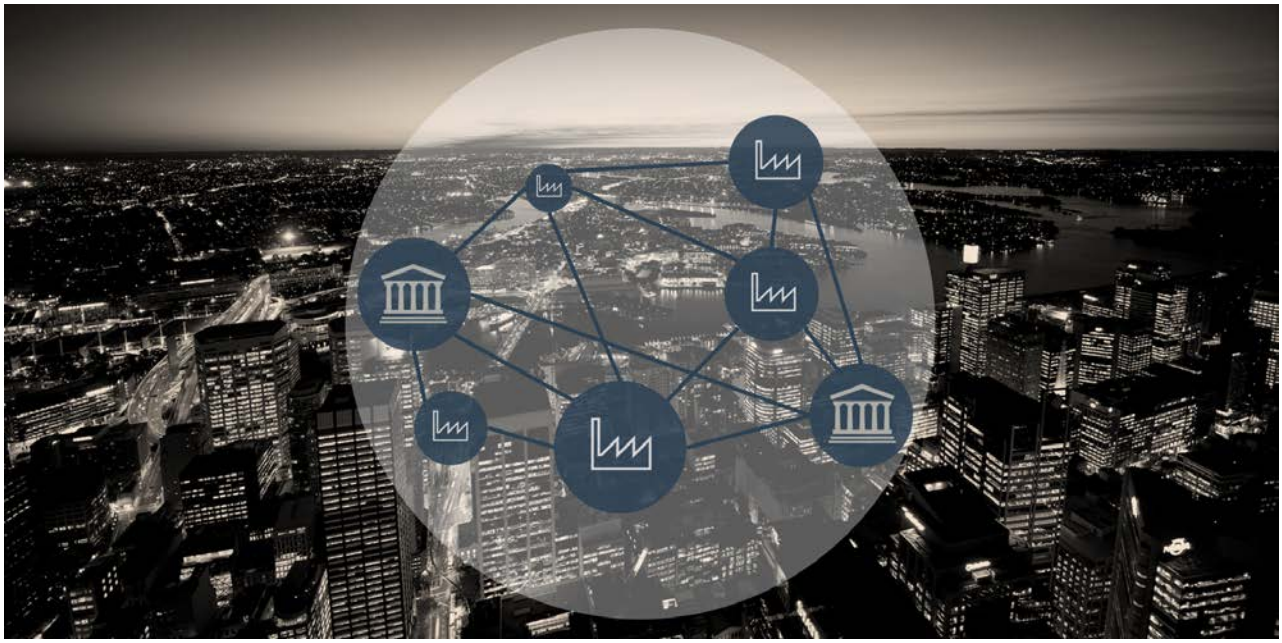
CHALMERS
UNIVERSITY OF TECHNOLOGY



Interorganizational collaboration in a living lab
HSB Living Lab as a case study

Challenge Lab 2015: Sustainable Urban Development

Master's Thesis in the Master's Programme: Management and Economics of Innovation

PANUWAT CHAYABUNJONGLERD
SAEID TORKABADI

Department of Technology Management and Economics
Division of Management of Organizational Renewal and Entrepreneurship – MORE
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2015
Report No. E 2015:090

MASTER'S THESIS E 2015:090

Interorganizational collaboration in a living lab
HSB Living Lab as a case study

Challenge Lab 2015: Sustainable Urban Development

PANUWAT CHAYABUNJONGLERD
SAEID TORKABADI

Department of Technology Management & Economics
Division of Management of Organizational Renewal and Entrepreneurship – MORE
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2015

Interorganizational collaboration in a living lab, HSB Living Lab as a case study
Challenge Lab 2015: Sustainable Urban Development
PANUWAT CHAYABUNJONGLERD
SAEID TORKABADI

Master's Thesis E 2015: 090

Department of Technology Management & Economics
Chalmers University of Technology
SE–412 96 Gothenburg
Sweden
Telephone +46 (0)31–772 1000

Cover:
An illustration of interorganizational collaboration among multiple organizations in a living lab for sustainable urban development

Reproservice, Chalmers
Göteborg, Sweden 2015

Interorganizational collaboration in a living lab, HSB Living Lab as a case study

Challenge Lab 2015: Sustainable Urban Development

PANUWAT CHAYABUNJONGLERD
SAEID TORKABADI

Department of Technology Management & Economics
Chalmers University of Technology

Abstract

This thesis includes two phases. The Phase I is about the Challenge Lab process, which is applied to identify a research topic as a leverage point for moving towards sustainable urban development. Since overcoming sustainability challenges needs interorganizational collaboration and user involvement, the Phase II focuses on these issues.

In the Phase II, HSB Living Lab was selected as a case study for investigating collaboration in the living lab context. In order to effectively manage the collaboration, a structural process, which could be influenced by interests of partners, is needed. Moreover, a shared understanding of the context is important for collective actions. Therefore, the aims of the thesis are to investigate why the partners are collaborating in the HSB living lab project (considering both organizational and interorganizational level) and how they understand the living lab approach as an open innovation collaboration setting. As the main research method, semi-structured interviews were conducted with representatives of the partner organizations in the HSB Living Lab. Based on the findings, firstly, it can be concluded that each partner concerns itself with fulfillment of self-interests as a reason for collaborating. Nevertheless, partners share their self-interests in three areas: brand awareness, relationship with partners, and access to external knowledge for learning. In the level of interorganizational domain, the sustainability issue has high potential to be considered as the problem that has gathered all them together, but it is not well formulated. Furthermore, the common goal of collaboration is not clarified. Secondly, the partners have a basic shared understanding of living lab as a platform for testing solutions, and getting ideas from partners and users. However, the processes of working with partners and involving users are not clear for them. Finally, the importance of acknowledging self-interests, identifying common problem, and clarifying collective goals should not be underestimated since these issues can influence on structuring the processes in the living lab. Meanwhile, structuring the processes could enable partners to have a better understanding of the collaboration context.

Keyword: interorganizational collaboration, domain, living lab, user involvement, self-interests, collective goals, context.

Acknowledgement

Being in the Challenge lab 2015 is an exciting transformative journey for developing skills and confidence to act as agents of change toward sustainability. This transformation would not have been possible without tremendous support we have received from people both inside and outside the lab.

First, we would like to thank you, John Holmberg for believing in us, students, that we can become change agents and for being spearhead to offer the Challenge lab platform for us to show that we can. Also, we would like to express our gratitude to our supervisor, Kamilla Kohn Rådberg, who is always supportive as a guide and an advisor with very interesting perspectives.

One of the most important people we would also like to say thank you is David Andersson. Without him, we would not have had this great opportunity. Thank you for your supports, energies, and guidance.

We would not have been able to conduct this research project without the support of Shea Hagy who is the project coordinator of the HSB Living Lab. We thank you for your time and your assistance.

At the beginning of this journey, we both obtained guidance and support from Ingo Rauth and Sara Fallahi. We would like to thank both of you.

Thank you all the Challenge Lab participants for giving us unforgettable experience, friendship, and amazing memories we have made together during the C-lab 2015. You are all fantastic.

Finally, we would like to thank our families, friends and dear ones.

PANUWAT CHAYABUNJONGLERD
SAEID TORKABADI

Contents

Table of figures

List of Table

Introduction

Since this thesis was developed in the Challenge Lab, readers who are not familiar with the Challenge Lab might be curious to understand what it is and how it works. Therefore these two issues are going to be introduced in the following parts. Firstly the basic idea behind the Challenge Lab would be described briefly. Secondly, the theoretical concepts, which support the Challenge Lab's process, are going to be explained.

What the Challenge Lab is

The Challenge Lab (C-Lab) as Holmberg (2014) has suggested is a student-driven arena in which students would act as change agents to address sustainability challenges. Since students are perceived as neutral and non-threatening actors in society they can play an important role in developing trust among different sectors. At the same time, students have the required knowledge in their field of studies to challenge current situations by conducting research studies to investigate trigger points for driving a transition. Moreover, the C-Lab provides the opportunity for students to develop their personal skills in order to act as change agents.

As one of its missions, the C-Lab is designed to be a place that different actors from industry, academia and public sector (or normally defined as a triple helix) can be invited by students to discuss about transition toward sustainability. This role of C-Lab could potentially influence positively on the triple helix innovation process, which is usually initiated by forming a social mission and developed by close interaction among triple helix actors(Jeromen.d.).

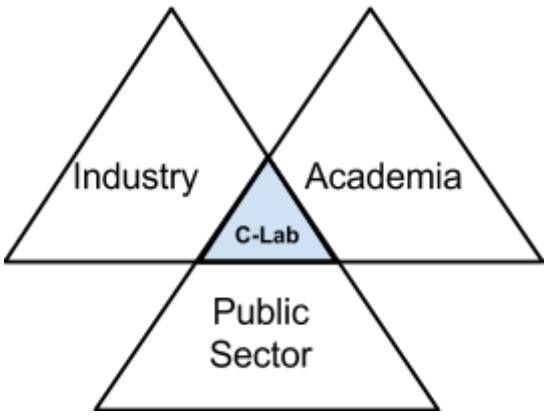


Figure 1: The Challenge Lab's position in the triple helix (Holmberg 2014)

In the second generation of the C-Lab, thirteen students had the chance to be part of the C-Lab to write their master theses during spring semester 2015. These students have different educational and cultural backgrounds. The group consists of students from nine countries and seven master programs. The diversity among group members enables them to have various viewpoints leading to more dynamic discussions and creative solutions (Paulus and Nijstad 2006). In addition, the C-Lab has a defined theme for each year to guide the focus of all students in the lab. For this year, 2015, the theme is "Sustainable Urban Development".

How the C-Lab works

The C-Lab methodology, which uses the backcasting approach as a centric approach, consists of two phases. Phase I mainly focuses on identifying potential leverage points for driving sustainability transition toward the defined vision by considering both “outside-in and inside-out” perspectives, while Phase II emphasizes more on research studies and particular projects considered as selected potential leverage points.

Briefly, in phase I, students are supposed to develop a better understanding of their personal values and sustainability challenges. After this phase students are able to use the outcomes and develop their own research topics under the focused theme of the C-Lab while having the opportunity to pair up with other students and continue the process into the phase II, which would be started by focusing on a specific project related to the research topic.

In the following part, authors elaborate on theoretical background of the methodologies and tools that are used particularly during the first phase.

Theoretical background

This section starts by explaining backcasting methodology as foundation of the C-Lab methodology, combining with outside-in and inside-out perspectives, and introducing important tools that are applied along the process in the C-Lab.

Backcasting

In order to explain backcasting, it would be beneficial to briefly discuss about forecasting, which is used more commonly as a tool for facing future uncertainties. In forecasting methodology, decision makers mainly use mathematical algorithms and information generated from past experiences, current situations and dominant trends to project that information into future (Dreborg 1996). However, Höjer and Mattsson (2000) argue that backcasting and forecasting are complementary approaches since forecasting approaches inform decision makers that by following dominant trends the designed vision would not be reached. Accordingly, using forecasting would not be a practical methodology when ongoing trends and past experiences are part of problems and the nature of problems is complex (Dreborg 1996). Under these circumstances, scholars (Holmberg and Robert 2000; Dreborg 1996) suggest applying backcasting methodology, which “...is a method in, which the future desired conditions are envisioned and steps are then defined to attain those conditions, rather than to take steps that are merely a continuum of present methods extrapolated into the future.” (Holmberg and Robert 2000, p.294)

Backcasting was introduced as a methodology for the first time by Robinson (1982), and was developed by other scholars. However the model developed by Holmberg (1989) would be used as the main basis of this thesis. In his model he divides the backcasting to four following steps:

1. Defining criteria for sustainability
2. Describing the current situation in relation to the criteria
3. Envisioning future solutions
4. Finding strategies toward sustainability

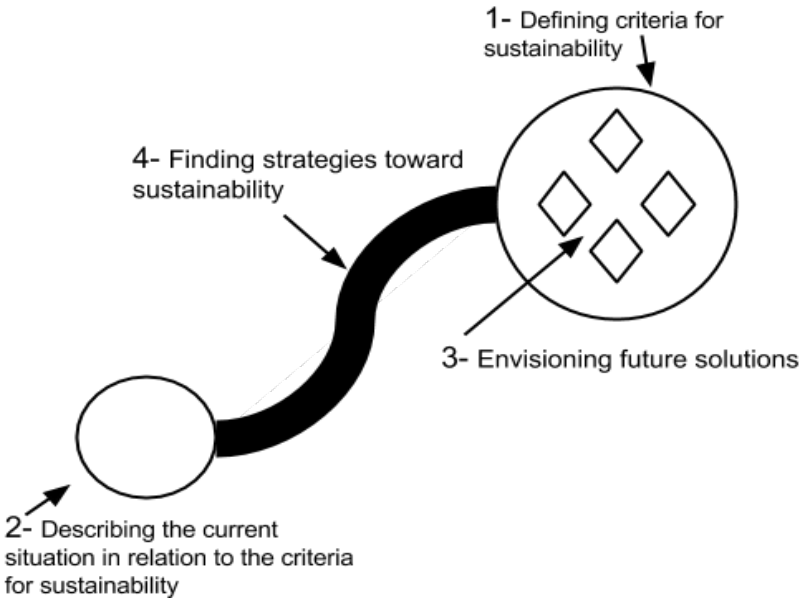


Figure 2: Backcasting model (Holmberg 1989)

Step 1: Defining criteria for sustainability

As it is mentioned in the definition of backcasting the first step starts from defining conditions of desired future. Atkisson and Hatcher (2001) believe that there is no precise definition for sustainability, but all definitions should at least consider issues related to nature, economy, society and well-being. Therefore, they suggest using "compass index of sustainability" as a simple framework, which is attractive and useful for decision makers. The compass is divided to four categories of nature, economy, society and well-being to cover the main sustainability issues.

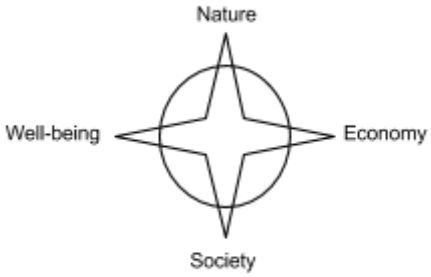


Figure 3: Sustainability compass (Atkisson and Hatcher 2001)

Based on this framework, criteria for sustainability could be discussed and mapped in four categories, which are more clear and understandable than discussing sustainability issues generally. After setting the criteria, a vision should be developed based on them to picture the sustainable future.

Step 2: Describe the current situation in relation to the criteria for sustainability

In the second step of backcasting, current activities, trends, and systems are analyzed to have a better understanding of current situations on different levels. By having this understanding, it is possible to identify activities, trends and systems, which are not following the criteria defined in previous step.

Step 3: Envision future solutions

As Holmberg (1998) argues, step three is about envisioning future solutions based on analyzing current situations (step 2) and considering defined criteria as the future framework (step 1). The aim of this step is not to come up with exact and detailed solutions; instead it should enable students to open their mind to new possibilities. Moreover, identifying the core needs, which the solutions are going to satisfy, is crucial.

Step 4: Finding strategies toward sustainability

After having the criteria for desired future, understanding the current situation and envisioning the future solutions, the next step is to develop strategies for moving toward the vision by bridging the gap, and to take actions according to these strategies. When the strategies are identified, Holmberg (1998) recommend considering following points:

- Will each measure bring us closer to sustainability?
- Is each measure a flexible platform for the next step towards sustainability?
- Will each measure pay off soon enough?
- Will the measures taken together help society to make changes at a sufficient speed and scale to achieve sustainability without too many losses for humans and other species during the transition?

Inside-out and outside-in perspectives

Inside-out perspective

Inside-out approach focuses on the fact that students are perceived as change agents in the C-Lab process. In order to prepare students for being change-agents and interacting with stakeholders it would be crucial for them to understand their driving forces, values, strengths, weaknesses and improve their communication skills. Therefore, two workshops are conducted regarding self-leadership and dialogue improvement.

- *Self-leadership*

During the process of self-leadership people would be able to find self-direction and self-motivation (Neck and Houghton 2006). Regarding motivation, Ryan and Deci (2000) elaborate on intrinsic and extrinsic motivation. They argue that there are some activities that people are intrinsically motivated to do based on their intrinsic interests, but it should be mentioned that not all activities could be part of intrinsic interest of individuals. Therefore, extrinsic motivation could explain how people could be motivated to do non-intrinsically motivated activities. They divide the extrinsic motivation to four levels, and the highest level would be achieved when there is a match between activities and individuals' values, and needs. Thus, it is important for students to be aware of their internal values and needs.

- *Dialogue*

In this part, the work of Isaacs (1993) would be reviewed to explain the dialogue approach. A dialogue can be seen as an effective tool for generating free flow of thoughts that allows new possibilities to emerge. Based on its fundamental concept, it can be found that when people are rewarded for forming implicit assumptions and materializing their beliefs together with others, common strengths and capabilities among the group of people can be developed. Instead of finding only one thing that is logically acceptable for most people in the group by limiting number of potential alternatives (consensus

approach), a dialogue approach can stimulate people to learn how to think collectively through exploring underneath assumption and obtaining insights why the problems arise.

Additionally, when using the dialogue approach, people tend to gradually perceive their relationship to a larger pattern of collective experience. With this approach, it does not only help stakeholders to be able to understand and change the underlying theories of their actions (double-loop learning), but also provide an opportunity for people to discuss further about supporting reason or purpose of these actions (triple-loop learning) (Isaacs 1993).

- *Stakeholder dialogues*

The aim of these meetings is to invite different stakeholders from various projects to discuss about their obstacles and share the status of their projects with students. For achieving sustainability, Quist and Vergragt (2006) emphasis on the role of stakeholder involvement in different phases of problem defining, solution searching and vision development. In addition, when several stakeholders are invited to the sessions, it is an opportunity for them to meet and expand their networks. Therefore, these meetings could be considered as dynamic social systems in which organizational values are created and relations which are not defined in organizational charts are developed (Sandow and Allen 2005).

Outside-in perspective

As Holmberg (2014) explains about these two approaches, the outside-in approach enables students to develop a deeper understanding of sustainability challenges in different levels of society from global to local issues by having systemic view and multilevel perspectives. Based on this approach they are able to grasp the general picture of ongoing systems and analyze them to find leverage points. Thus, several tools such as the funnel and system thinking are introduced to support outside-in perspective.

- *The funnel*

In order to discuss the trends of supply and demand on global level, the resource funnel would be a proper tool to categorize several trends in one model.

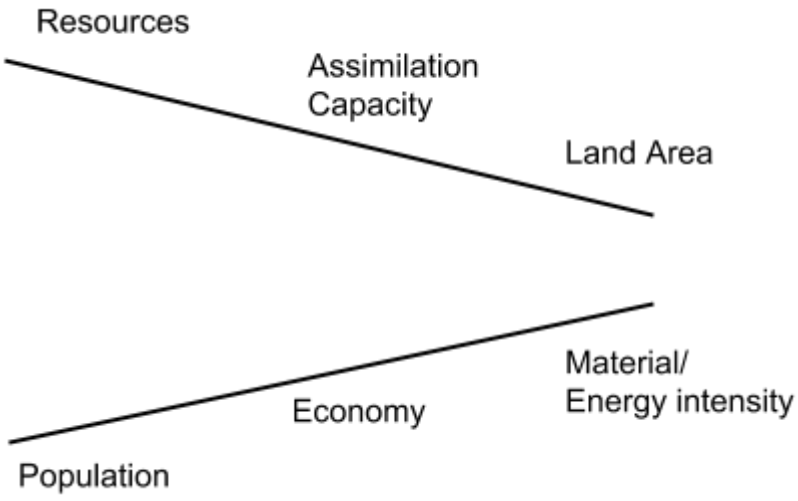


Figure 4: Resource funnel (Holmberg, 1998)

The funnel shows two major global trends in present situation. The upper edge of the funnel shows the decreasing capacity of the natural resources and the lower edge represents the increasing demand side (Holmberg 1998).

- *Systemic thinking*

Having a systemic perspective is crucial for reaching sustainable development because it enables us to understand complex systems (Seiffert and Loch 2005). Boardman and Sauser (2013, p.5) define the systemic thinking as "a way of thinking that emphasis connectedness and enables people to see the bigger picture; one in, which owners, solvers, solutions, problem solving methods and problem descriptions are portrayed as a whole system."

Systemic thinking does not focus on one problem, instead the unit of analysis is system of problems, therefore the goal is not finding a solution, but having a better understanding of complex problems (Hester and Adams 2013). By having the understanding it would be possible to identify leverage points, which are parts of a complex system where a small change can influence on whole system (Meadows 1997).

To summarize this part, the readers have been introduced to the concept of the C-lab and theoretical background of the backcasting methodology as the main basis of the whole process. In addition, the inside-out and outside-in perspectives and several tools are described to present how students work specially during the phase I of their master thesis development. In order to understand how these theories were applied by students, the following chapter is going to elaborate upon that in more detailed level.

Phase I

The C-Lab process in Phase I

In this chapter the process and results of the first phase in the C-Lab process would be explained in more detailed to clarify how change agents have developed their understanding the sustainability challenges, analyzed the system, and defined potential leverage points during this phase. At the end of this part it would be possible to understand how and why the specific project and research topic were selected for going to the second phase. In order for readers to see what happened during the first phase, Appendix A shows the schedule of first month.

Understanding self-values via Self-leadership workshop

Self-leadership workshop
Development of change agents started from identifying individual's values. The C-Lab process started by the self-leadership workshop held by Dominic von Martens from "Self-Leaders" company. The aim of this session was to show students what their values, strengths and characteristics are. Besides, students had the opportunity to share the outcomes together and know each other in a better way, which helps increasing trust among them. In order to achieve this goal the following tools were used.

- *Value map*: Before the workshop students were supposed to fill out a survey, which was about prioritizing different types of internal values. The outcome of the survey was a table, which categorizes those values. After discussing about the table, students should have shared their values with other students in form of active listening activity.
- *Active listening:* For this activity, students were divided to several groups consisted of three students. In each group, three roles (Facilitator, focus person and observer) were defined. Based on this design, students had opportunity to discuss their values and experience acting in those three different roles. The process of active listening could be considered as a practice for improving communicative skills needed for dialogue sessions and stakeholder meetings.
- *Strengths Diamond:*Strengths diamond was the other survey, which was sent before the workshop. In the survey, students were supposed to prioritize their own strengths on different levels. During the workshop the results were used as input of activities, which were designed to help students to understand their own and others roles and characteristics in a group level. In these activities, students were divided to different groups based on their strengths and they could discuss about their characteristics both as an individual and a team player. These activities were beneficial for second phase of the C-Lab process when students would pair up as a team and work on their own projects.

After preparing the students to understand themselves, they are well equipped to go through the backcasting steps.As mentioned in the previous chapter, backcasting methodology is a backbone of the C-Lab process. Therefore, activities carried out during the first phase in the C-Lab are going to be explainedbased on the four steps of the backcasting methodology.

Backcasting step 1: Defining criteria and vision for sustainable future

In order for students to be able to define criteria and vision for sustainable future, they have to develop their knowledge in this area. Therefore, at the beginning of the C-lab a short introduction about sustainability challenges and role of students was given by John Holmberg. In addition, students were meeting every day to share their knowledge and discuss various topics in the group. To organize the meetings in a structured manner, students followed the sustainability compass framework as the guideline and made one group for each area (Nature, Economy, Society and Well-being) to do research and find out what issues should be considered in the each part. After reviewing different sources such as literatures, web pages, and UN planning students could plan in a self-organized way to present the results for whole the group. Having diverse, open minded, knowledgeable and passionate students allowed us to have dynamic dialogues about various subjects. This process was completed after four weeks, however it should be mentioned that other steps of the backcasting were started simultaneously.

The results of these researches, presentations, and dialogues are several criteria in each area and a vision, which are summarized in the following table. It should be taken into account that the vision and criteria are defined in the global level, despite of the fact that the theme of the C-lab 2015 was sustainable urban development. The decision was made after a long discussion about the level of visioning and setting criteria. Finally, students came to the conclusion that the global level would cover urban level and it would provide a more complete picture.

Table 1: Vision and criteria for sustainability (Developed in the C-Lab 2015)

Vision
"A sustainable future where we (~10 billion people) are able to meet our own needs within the planetary boundaries without compromising the ability of our future generations to meet theirs" Developed based on Brundtland (1987)
Nature
• Not to increase the concentration of substances from the lithosphere in the ecosphere. • Not to increase concentration of human made substances in the ecosphere. • Not systematically deteriorate the resource base; such as fresh water, fertile land, and biodiversity through manipulation, mismanagement, or over-exploitation.
References: (Holmberg et al 1996), (Holmberg and Robert 2000)
Economy
• The economic system enables us to meet the other criteria efficiently and effectively. The economic system should be influenced by the other dimensions (society, well-being, nature) and not the other way around. • The economic system is resilient in a way that it functions as a buffer against destructive

disturbances, such as environmental catastrophes or economic mismanagement.
- Enable further use of resources and avoid dissipative use of materials.
- The economic system has an inherent mechanism of maintaining and serving societal infrastructure and institutions that permits human well-being to be met over time.

References: (Sen 1999); (Anand and Sen 2000); (Simmie and Martin 2010); (Pisano 2012)

Society

- Societal institutions are built on transparency, accountability, and mutual trust. They enable the well-being of the individuals in society.
- The societal system is an instrument for individuals to live together within the other criteria.

References: (DESA 2009); (OWG 2014)

Well-being

- Everyone has basic needs fulfilled such as food, water, health, energy, shelter, and safety.
- Human life includes affection, understanding, morality, participation, leisure, empowerment, creation, identity, and knowledge.
- Each person has an equal right to the most extensive basic freedom compatible with a similar freedom for others. This includes freedom of opinion and assembly, expression, conscience, and choice - without deliberately harming others.
- Social and economic inequalities are not justified unless they are to the greatest benefit of the least-advantaged members of society.

References: (Raworth 2008); (UN 1948); (International Wellbeing Group 2013); (OECD 2013), (Max-Neef 1993)

Backcasting step 2: Understanding current situation

The purpose of the step 2 is to develop a better understanding of current situation in relation with the defined vision and criteria. During the first phase of the C-lab process, three main activities (using resource funnel, reviewing projects, and stakeholder meetings) enabled us to grasp the picture of current situation.

Understanding global trends regarding sustainability through the funnel

The first activity was guided by using the resource funnel as a tool to find out what the ongoing trends in global level are. As mentioned in the C-lab methodology, the funnel is divided to six different subjects that are as follows: resources, assimilation capacity, land area, population, economy and material/energy intensity.

In order to cover all these subjects, students were divided to six groups to investigate global trends in each topic by reviewing different types of sources. When data were gathered by all groups, students organized a session to present their results for other groups and share their knowledge with other students. The presentations made by students developed the general picture of the global trends, but the authors reviewed the trends in more detailed level. The following table includes the summary of the results; however the elaborated version of each trend is available in Appendix B.

Table 2: Summary of global trends

Dimension	Key issues
Population	● Growing population to 10 billion people in 2050 but growth rate is declining due to a drop in fertility rate ● Shifting to ageing population society, less labor forces ● Large portion of global population will be absorbed by urban areas
Economy	● Growth of Industrialized economy and increasing natural resource consumption ● Economic growth and migration to urban areas for better employment opportunity ● Inequality in distribution of resources due to return of capital and economic growth ● Trend in collaborative economy
Material and Energy intensity	● Considered as an indicator for sustainable development; the less intensity is, the more efficient consumption is. ● Reducing material intensity in ante-industrialized countries such as US, due to efficient production technologies and moving toward service-based industry ● Growing material intensity in Asia caused by relocation of production base ● The world average hardly decreases ● Impacts of urbanization on material and energy intensity can reduce the intensity but need supported policy
Resource availability	● Threats of resources exhaustion ● Population growth has significantly increased the consumption of natural resources ● World Commodity prices have increased dramatically ● Urban agglomeration economy has stronger effect in resource allocation
Land use	● Over a half of land have been used for human activities ● Maximize the utilization of urban spaces
Assimilative capacity	● Defined as the ability to carry waste materials without negative environmental effects ● Pollution only assimilative capacity is exceeded ● CO2 and GHG emission trends seem to be results from urbanization rather than population ● Climate change caused by high GHG emission ● Concentration of activities in urban directly affects assimilative capacity ● Relationship between urbanization and climate change!

According to the global trends mentioned above, it can be seen that the world is changing toward complexity and leading us to the situation where living conditions seem to become even more challenging due to limited choices and less assimilative capacity. Sustainability, or the ability to maintain a certain status or process of existing system (US EPA, 2009) has become the idea how we can rejuvenate the assimilative capacity of the earth.

Challenges in sustainable development

Sustainable development has been the focus of numerous international conferences, and research studies in multiple levels and several definitions were suggested by them. The most commonly cited definition that our vision is based on that is defined by Brundtland Commission:

"Sustainable development is development that meets the needs of the present without compromising the needs of future generations to meet their own needs" (Brundtland 1987). Considering most used definitions, Wheeler (1996) shows that following issues are common in all of them.

- A deep concern about environmental problem
- A view of the planet as a whole
- Holistic and systemic thinking
- A search for new balance between economic and environment
- Agreement on the need for a long-term perspective

Despite of all these efforts, little has been accomplished in achieving the ambitions of systemic change in development paths (Rockström et al. 2009). In addition, McCormick et al. (2013) argue that institutions in national and international level have not been successful in meeting goals, which are concerned with global warming and climate change.Moreover, they suggest that shifting the focus towards cities and urban areas is needed as a consequence of frustrations at slow pace of national and global actions regarding sustainable development against climate change. By having this view, cities are perceived as an engine for sustainable development in European regions (Rotmans et al. 2000a: 2000b). One of the supporting reasons is that cities are taking dominant roles in term of consumption, production and pollution that affect the global level (Sukhdev 2009).

Sustainable urban development

By shifting the focus on cities and considering above mentioned issues, Wheeler (1996, p.55) defines the sustainable urban development as follows:

"Sustainable urban development seeks to create cities and towns that improve the long-term health of the planet's human and ecological systems."

From transition management theory by Loorbach (2007), it is argued that in sustainable urban development a number of factors are inter-connected and it is multi-dimensional and dynamic. Hence, instead of sudden changes, steady transition is commonly needed. During the transition there is no possibility to completely control situations, but rather it should be steered and indirectly influenced towards sustainability direction. Considering cities as complex systems, transition researches have used various system-perspectives (Loorbach 2007). In studying sustainable cities, it is needed to use system dynamic approach, since it allows looking at a system as a whole. Additionally, it would be easier to understand and analyze interactions between different sectors, actors and issues (Radzicki and Trees

1995). As argued the whole system can be influenced and driven toward desired direction, if leverage points in the complex system are identified and pushed.

Sustainable urban transformation is not just about local action, but how it fits into multiple scales and levels, and the dynamic relationships that exist (García-Sánchez and Prado Lorenzo 2009). Therefore, managing the transition toward urban sustainability needs a coherent framework for systemic changes in order to address sustainable urban transformation in the context of different scales and the linkages across levels (Loorbach 2007; McCormick et al. 2013).

Understanding the system in Gothenburg city context

Reviewing projects

The aim of reviewing projects is to focus more on the local level to figure out, which types of projects related to sustainability are happening and are going to happen in the Gothenburg city. The process of reviewing projects was similar to other parts in a way that firstly students searched for projects individually and then shared their findings in a presentation session and put several projects on a board. Moreover some students contacted responsible people of several projects, which they found interesting and they discussed potential possibilities of conducting research on those projects as a master thesis. Since a high number of projects were found by reviewing different web pages, the references of the web pages are available in Appendix C for those who are interested to know more about them.

Stakeholder meetings

The intention of organizing stakeholder meetings is to invite people who are working with ongoing projects, and future planning. Since stakeholders are coping with challenges in a real time and setting, students had the opportunity to get in contact with project representatives for pursuing their research topics in presented projects. Most of the stakeholder meetings were organized by the C-lab coordinator, but students had the opportunity to invite relevant stakeholders in the lab by themselves. These meetings were held in the C-lab office and the sessions were facilitated by students. In order to get the best results out of the meetings, students had preparation sessions to decide, which questions should be asked and how the session should be set up. The list of stakeholders could be found in Appendix D to check who came to the C-lab.

Defining the potential leverage points as research topics with outside-in and inside-out perspectives

After spending three weeks for long discussions to define the sustainability criteria, and understand self-values, global trends, sustainability challenges, sustainable urban development and current situation of the system, finally it was the time for students to define the potential leverage points as research topics related to sustainability challenges and decide whether the projects could fit with their interests and research topics. Then, students had the opportunity to pair up with other students who shared similar interests or topics.

In order for students to discuss their research topics and compatible projects, a supervision session with John Holmberg,Kamilla Kohn Rådberg and David Andersson was organized in the group. During the session students were supposed to write down their research topics, related projects and why the research is important for transition towards sustainability. Afterwards, they presented their suggestions for the whole group and supervisors who tried to improve the ideas by giving constructive feedbacks. It should

be mentioned that considering both inside-out and outside-in perspective was recommended when defining research questions and choosing projects.

Inside-out perspective

As mentioned in the theory, inside-out perspective focuses on intrinsic motivation. Based on this perspective, feeling passionate and energetic about the research topic and chosen projects is the first step of going to phase II. For this thesis both authors were interested to the concept of living labs as an open innovation platform since it suits with their background, which is in the field of "Management of Innovation". Therefore, they had the opportunity to apply their knowledge in this project.

Outside-in Perspective

By applying the outside-in perspective, it should be possible to explain why the HSB living lab project is important for sustainability challenges and how it can contribute to transition. Based on transition management theory, where Multi-Level Perspective (MLP) is introduced (Geels 2011), the development can be driven through the linkages among three different levels: landscape (Macro level), regime (Mesolevel), and niche (Micro level). Based on this perspective, breakthrough or radical innovation occurs in a niche level where a safe environment for experimenting and growing such an innovation is provided. After the innovation is selected through socio-technical regime level where multiple actors influence on dominant practices based on the selected innovation, technological transition can occur in large scale at landscape level. In the stakeholder dialogue session, the living lab concept was presented as a platform in, which new solutions and ideas could be tested and new innovations could be developed by involving users. Moreover, tested solutions and developed ideas could be diffused much faster in society. Therefore, the living lab could be considered as a niche level for developing sustainable solutions. However, it was mentioned that the collaboration among parties plays an important role in the success of the project.

Based on these two perspectives, the HSB living lab project seems to be a proper case for further studies during phase II. Moreover, the project was introduced as a place for accelerating sustainable technologies. Hence it is quite relevant to the sustainable urban development topic, which is the theme of the C-lab 2015. Finally, since the project is collaboration among several organizations, the success of the project is dependent to the way that the partners are going to work together during the project. Therefore the authors were interested to look at the project from the partners' point of view to investigate their opinionsabout this project.

Phase II: Research study

Background

In general, sustainability challenges are complex and wide problems, which involve various parties and could be looked through different lenses (Hector et al. 2009). As Roome (2001) argues, sustainable development issues can be considered as meta-problems, which are characterized by their multiple facets relating to different stakeholders and time dependency. Thus, multiple stakeholders are needed when working with sustainability challenges. In addition, the sustainability challenges can also be considered as wicked problems (Waddock 2013). In order to explain wicked problems, (Weber and Khademian 2008) formulate these types of problems as unstructured, cross-cutting and relentless. It means that it is difficult to agree upon definition of problems and identify solutions.

Since wicked problems and meta-problems are too large to be tackled by a single actor; interorganizational collaboration is needed to face these types of problems (Trist 1983; Lozano 2007). By having organizations from different sectors such as public and private sectors in such an interorganizational collaboration to overcome sustainability challenges as shared problems, the form of collaboration can be defined as an interorganizational domain (Trist 1983; Linder 2000; Hartman, 1999). However, when Majamaa et al. (2000) discuss about sustainability in urban development, they emphasize on the role of end-users as the third partner besides public and private sectors.

One of the approaches that have attracted wide attention recently by involving end-users in the innovation process is the living lab approach.This approach is defined as a public-private-partnership of multi-stakeholders for creating, developing, and testing of new services and products with user-involvement processes in real-life setting (CORELABS 2007;Bergvall-Kåreborn et al. 2009). According to the definition, it can be seen that partners from public and private sectors can work collaboratively in the living lab context to develop solutions for an interorganizational domain while involving users as sources of innovation.

It would be beneficial to explore how collaboration in an interorganizational domain would occur in the early stages of collaboration in living lab context. As discussed in the end of the Phase I, the HSB Living Lab project can be seen as a case study of an interorganizational domain in which sustainable solutions would be developed.

Development of research questions

Assuming that collaborating partners would be involved in sustainable solution development by co-creating with both other partners and users in the living lab, this project can be considered as a practice of open innovation by having outside-in flow of information (Gassmann and Enkel 2004). It means that partners can gain knowledge and information from the living lab into their organizations. From this perspective of open innovation, the authors assumed that partners in the HSB Living Lab are collaboratively developing new solutions, which generate new knowledge in this platform. Therefore, at the beginning of the phase II, the authors were interested to investigate how these partners are going to internalize the new knowledge generated from the living lab into their organizations. The authors speculated that if the partners cannot capture values from the living lab platform, interorganizational

collaboration would not succeed. Based on reviewing literatures regarding absorptive capacity, the very first research question was defined. This question was asking how partners are going to capture the potential values in term of created knowledge from the living lab platform. However, based on the preliminary interviews, a better understanding of the project status was developed. It was found that this research question cannot be answered during this specific period since the project was at the beginning of its construction phase, which means no research project solution was implemented, and no result was generated in the living lab yet. Therefore, following this question was not possible.

Nevertheless, the preliminary interviews revealed the fact that the building will be ready in next few months and students are going to move in. Thus, a process for managing collaboration among partners in the living lab should be developed. Based on the knowledge support section in ENoLL (European Network of Living Labs), it suggested that there are two interrelated cycles: the management and collaboration cycle, and the product development cycle (See Figure 9 in Literature review chapter). According to the discussions with the project coordinator, it was shown that a structural process is needed in the first cycle of the living lab to manage the partners in collaboration for achieving collective actions in the next cycle. From reviewing literatures, few of them have studied the initiation phase of the collaboration in living lab context. However, in collaboration theories, it is proposed that a structural process is needed for guiding collaborative activities to achieve their goals by balancing interests between organizational level and interorganizational level (Gray 1985;Kaats and Opheij 2013;Thomson and Perry 2006). Also, the project coordinator mentioned that for developing the process, it would be beneficial to understand why the partners are part of the collaboration. Moreover, since the living lab is a new context for interorganizational collaboration among partners from different backgrounds.Vlaar et al. (2006)mention the issue that in early phases of interorganizational collaboration, partners usually have different understandings. Therefore, it is beneficial to investigate how the partners understand the living lab approach in the early stage of the project. Therefore, the generated research questions are as follows:

- Why are the partners collaborating in the living lab project?
    - Organizational level (Reasons for each partner)
    - Interorganizational level (Reasons for the all partners)
- How do the partners understand the living lab approach as an open innovation collaboration setting?

Literature review

This chapter starts with reviewing collaboration theories and describing a three-phase process through which an interorganizational collaboration develops. Furthermore, five dimensions of collaboration processes are presented to show key elements, which should be considered during the collaboration. Afterwards, open innovation theories are reviewed to explain how organizations use interorganizational relations and users involvement as sources of innovation. Finally, the living lab approach and its theoretical backgrounds are introduced to show how living labs are defined and what characteristics they have.

Collaboration

Definition of collaboration

Starting from the meaning of collaboration, it has been defined differently by several scholars. Some may understand that collaboration is similar to cooperation or coordination. However, there are some discrepancies. As defined by Chris Huxham, coordination and cooperation emphasize more on exchanging information, altering activities, and sharing resources for cooperation in order to achieve a common purpose and mutual benefits, while collaboration also includes enhancement of the capacity by working with others to reach mutual benefits (Huxham 1996). From the "collaboration handbook" (Winer and Ray 1994), *cooperation* is viewed as shorter-term informal relations that exist without any clearly defined mission whereas *coordination* has more formal relationships and understanding of missions, which in turn differs from *collaboration* that has more durable and pervasive relationship with full commitment to common missions. Accordingly, most scholars would accept that the differences between cooperation and collaboration are their depth of interaction, integration, commitment, and complexity; while cooperation is on the low side, collaboration is at the high end (Alter and Hage 1993; Himmelman 1996; Mattessich and Monsey 1992).

Furthermore, collaboration is a process where autonomous actors interact through formal and informal negotiation to share creation or discovery. During the process, partners jointly create rules and structures governing the relationships and ways to act or decide on the issues that brought them together (Thomson and Perry 2006). The understanding of collaboration as a process is rooted in two competing perspectives: Classic liberalism and Civic republicanism (Thomson and Perry 2006). Classic liberalism considers collaboration as a process that aggregates individual preferences into collective choices through self-interested negotiations due to the underlying assumption that organization enters into collaborative agreement to achieve their own goals (Thomson and Perry 2006). Huxham (1996) argues that self-interest is one of the basic reasons why organizations participate in collaboration, because they gain something that is not possible in other ways for instance in general level he mentions about learning, sharing risk, access to resources, and efficiency as reasons of collaboration (Huxham and Vangen 2005).

On the other hand, Thomson and Perry (2006) build upon March and Olsen (1989, p.126) to explain that civic republicanism views collaboration as an integrative process in which differences of parties are discussed to reach at "mutual understanding, a collective will, trust and sympathy [and the] implementation of shared preferences". According to Huxham (2005) some argue that moral imperative is the most important reason for collaboration. They believe when a society is facing meta-problems, which have different aspects and could not be tackled by one organization, collaboration among multiple

organizations is needed. By having this view Trist (1983) introduces the interorganizational domain. Based on the definition by Trist (1983), Gray defined a domain as "the set of actors that become joined by a common problem or interest."

In the domain level, Gray and Wood (1991, p.146) reviewed several definitions of collaboration and based on the process perspective, they suggest that "collaboration occurs when a group of autonomous stakeholders of a problem domain engage in an interactive process, using shared rules, norms and structure to act or decide on issues related to that domain". In this definition stakeholders are organizations who are interested in the problem domain; however, at the beginning of the collaboration they might have different or same interests and their perspectives on interests could change during the collaboration. Based on reviewing several theories, Wood and Gray (1991) suggest that the discussion regarding collaboration can be framed into 'Preconditions-Process-Outcomes' model.

This thesis follows the definition of collaboration provided by Gray and Wood (1991). Based on this view, collaboration is considered as a process in the domain level and the study will focus mainly on the preconditions and the process of collaboration, where collaboration actually occurs.

Preconditions

All the following preconditions in this part are based on Wood and Gray (1991). According to the resource dependence view, organizations are concerned with reducing environmental uncertainties without increasing their dependencies to other organizations. Based on this theory actors should have high stakes and high interdependencies to collaborate in a domain. Political approach is another theoretical perspective, which is concerned with the question that who has power and resources and who gains benefits from distributing them. Using this theory, having a shared purpose can stimulate actors to collaborate; hence they should share at least one common interest to be motivated.

Process

Wood and Gray (1991) defined in their literature that the process component could be seen as a 'black box' where interactive collaboration takes place with least understanding. However, based on literatures, there are two perspectives in defining a collaborative process: The developmental phases of collaborative process by Gray (1985) and the five dimensional model of collaboration process by Thomson (2001).

First perspective: The developmental phases of collaborative process

Considering collaboration as a process, Gray (1985) uses a model suggested by McCann (1983) to explain how collaboration develops in an interorganizational domain. The model is consisted of three sequential phases: problem-setting, direction-setting, and structuring. The underlying assumption is that dynamics in each phase can be managed to improve the likelihood that collaborative relationships are achieved and sustained (Gray 1985). The following part describes key issues of each phase:

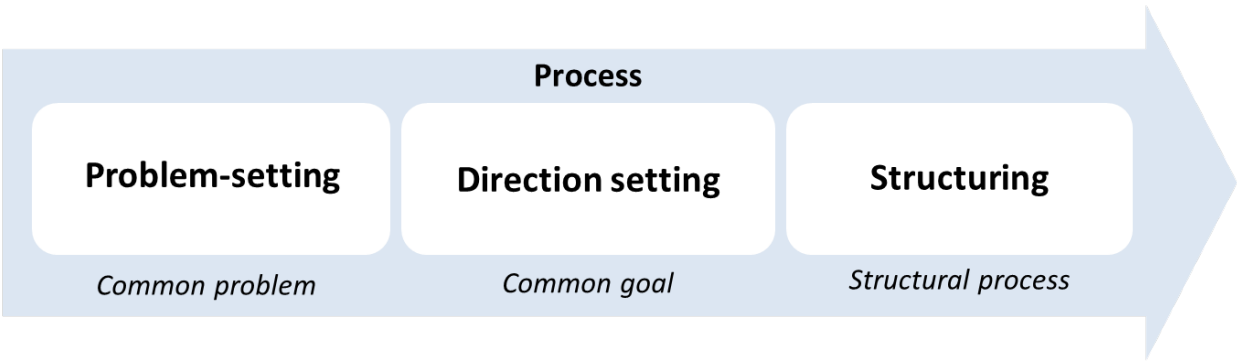


Figure 5: Three developmental phases of collaboration process in interorganizational domain (Gray 1985)

Problem-setting

As Gray (1985) explains, the main objective of this phase is to identify key stakeholders and develop mutual acceptance about the cause that has brought all the stakeholders together. Discussing about a domain can serve as a useful method of stimulating collaboration by increasing the stakeholders' awareness of their interdependence (Wood and Gray 1991). This phase plays an important role in the process, since future efforts could be prevented if partners cannot reach to an agreement about stakeholders and shared issue. Once, partners in collaboration recognize and develop joint appreciation of their interdependencies and agree upon what the shared issue is in the collaboration, a common purpose can be developed in the next phase. Huxham (1996) argues that purpose of collaboration could be expressed in different ways by partners. For instance they can show it during dialogues, decisions and actions, but he suggests that having an explicit statement of purpose could add value to collaborative activities. A statement of purpose would clarify the partner's' identity, level of commitment and boundaries of collaboration. Moreover it would enable partners to recognize inappropriate activities during a partnership to avoid opportunism (Huxham 1996).

Direction-setting

For the direction-setting phase, main focus is to identify common purpose of collaboration among stakeholders (Gray 1985) and what they should contribute individually and collectively for achieving desired situation (McCann 1983). Shared values are identified while participants in collaboration engage to jointly envision their desired future of the domain, develop common explanation of goals and outcomes, and connect stakeholders' activities toward mutually desirable outcomes (Gray 1985). With a common purpose and joint interdependencies, governing rules, roles, and processes could be established in structuring phase of collaboration.

Structuring/Implementation

After setting a direction, managing interactions among stakeholders in a systematic way becomes crucial issue in the structuring phase (Gray 1985). Since stakeholders are perceived as co-creators of changes towards future state, a long-term structure should be designed to support their activities. The structuring process is dynamic since the mutually acceptable framework of collaboration needs to be developed through iterative negotiation among stakeholders. This is also supported by the framework of Ring and Van de Ven (1994), which conceive the structuring process as cyclical rather than linear (Thomson and Perry 2006). Based on the framework, participating organizations in collaboration can determine their mutual commitments and re-negotiating if they see that the commitments are not implemented in a reciprocal manner (Thomson and Perry 2006). In this phase tasks and activities are allocated, and roles

and responsibilities are assigned to those partners in collaborative project. (Vlaar et al. 2006) suggest that in the beginning phases of interorganizational collaborations, parties usually have different understanding of a certain situation. This seems to occur since collaborative parties come from diverse backgrounds, experiences, sizes, cultures, or industries. Moreover they argue that a shared understanding of the context where the collaboration is embedded is essential for collective actions in implementation stage. (Vlaar et al. 2006) Therefore they suggest that having a formal discussion about contributions, outputs and the process of collaboration can help organizations to develop a better understanding of the collaboration context and parties. They discuss that during formal processes parties have more focus, reflect upon issues, express themselves, and keep interacting.

Second perspective: The five dimensional model of collaboration process

Thomson and Perry (2006) develop on Thomson's (2001) research that systematically reviews various scholars' viewpoints on different elements of collaboration, to explain that there are five interdependent dimensions composing the collaboration processes.

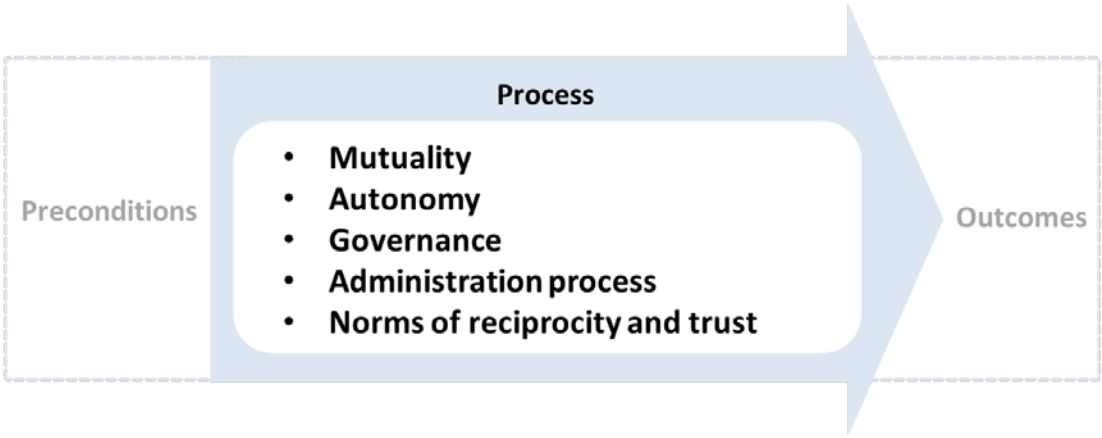


Figure 6: Five dimensions of collaboration processes (Thomson and Perry 2006)

When comparing with the lens for examining the complexity of collaboration processes suggested by (Kaats and Opheij 2013), both tend to have commonalities among these five dimensions. There are interdependencies among five dimensions in the way that alteration in one dimension can influence on another dimension and variation across dimensions (Thomson and Perry 2006). Instead of specifying the optimal level for all five dimensions, it is better for project manager of collaboration to identify a balancing point among different dimensions (Thomson and Perry 2006). According to the research of Thomson and Perry (2006), it is argued that better understanding of the variables and complex nature of the five key dimensions can increase the likelihood that positive outcomes from collaboration will occur.

From both Thomson and Perry (2006) and Kaats and Opheij(2013), these five essential dimensions are summarized and shown below.

1.Mutuality dimension

People or organizations do not usually decide to collaborate without a reason. Either for their self-interests or shared interests, collaborating organizations must gain more or less mutual benefits from involving in collaboration (Thomson and Perry 2006). Mutuality among partners shows interdependency between them in a situation that some need other's competencies to fulfill their own interests (Thomson and Perry 2006). Hence, mutuality seems to be related to both interests of an organization and its expectations on others. In addition, it is argued that mutuality can offer a foundation for building common understanding among partners from different backgrounds (Wood and Gray 1991; Cropper 1996). This common understanding is crucial for developing a shared ambition. However, even if different partners may expect on different things to be delivered from a collaboration, a shared ambition among all involved organizations can unite them to drive the collaboration forward (Kaats and Opheij 2013). When developing a shared ambition, the interests of all partners need to be taken into consideration. Additionally, the ambition not only needs to be shared, but also needs to add value and be attractive to involving parties (Kaats and Opheij 2013).

2.Autonomy dimension

This dimension is aligned with the underlying assumption of classic liberalism perspective that every party in a collaborative project has its own interests. Thomson and Perry (2006) argued that in reality, partners usually possess a dual identity, which maintains distinct organizational identity separated from collaborative identity. They continued to argue that there is implicit tension between self-interest and collective-interest (Thomson and Perry 2006). Huxham (1996) also explains that partners in a collaborative project can justify their level of contribution by their own, and it is called autonomy. The common purpose would be pursued by all partners if they realize that it is important and urgent to them. Otherwise, the individual interests of each partner are likely to be put in front of the collaborative missions (Thomson and Perry 2006). It is important that not only all the interests of stakeholders should be fulfilled, but collective interests should also be addressed. Therefore, in order to put the collective interests into a central position of collaboration and increase understanding of the problem that partners are jointly seeking to tackle, proper conditions such as a context of trust and reliability in dialogues are needed (Kaats and Opheij 2013).

3.Governance dimension

Any kind of organization requires a proper organizational structure and governance mechanism. A collaborative partnership also needs them to effectively facilitate collective actions to achieve shared missions (Kaats and Opheij 2013). The key point of governance dimension is to define how joint decisions can be made in order to govern partners' behaviors, and reach agreement on collaborative activities and goals (Thomson and Perry 2006). Since in collaboration there is no actor who has power over others, the control power is shared among partners. Consequently, participative decision making through negotiation and commitment processes is needed. However, it should be considered that reaching agreements which are compatible with all different partners' interests do not imply to agree on the best solution, but imply that all partners are willing to support the decision (Thomson and Perry 2006). Expectation on joint decision is to ensure that all partners agree upon their commitments, adhere to them, and respect to the shared responsibilities. Beyond that, Thomson and Perry (2006) also found that a shared vision and commitment to a supra organizational goal can drive the partners

toward collective actions rather than pushing the responsibility to others. Further, governing collaboration is a process in balancing between trust and control (Kaats and Opheij 2013). Based on experiences of Kaats and Opheij (2013), since some partners might seek a way to control over others to achieve their own self-interest, appropriate governing structures are essential for developing trust and commitment among partners.

4.Administration dimension

In addition to the governance dimension, collaboration among different partners most often also needs an administrative structure to drive decisions and commitments from governance into actions. From Thomson's research (2001), it is found that key characteristics of administrative structure are presence if there are clear roles and responsibilities, capacity to set boundaries, concrete achievable goals, and good communication (Thomson and Perry 2006). Due to the condition in which partners are autonomous and voluntary participants with interdependent relationships, traditional mechanisms such as hierarchy and standardization seem to be less effective across organization's boundaries (Huxham and Vangen 2005). Thomson and Perry (2006) argued that most of scholars agree that the key for getting things done in a collaborative setting is to find the right balance between administrative capacity and social capacity to build relationship (Thomson and Perry 2006). Hence, the coordinating role, which coordinate communication, disseminate information, and assure jointly designed governing rules, seems to be very essential in building and sustaining interorganizational relationships in collaboration.

5.Norms of trust and reciprocity

Relationships are crucial in formation, development, and management of partnerships in collaborations (Kaats and Opheij 2013). In the collaboration where people from different backgrounds work together, the relationships between stakeholders are developed based on a combination of trust and vigilance (Kaats and Opheij 2013). Trust is a fundamental element of interorganizational collaborations since it is underlying other dimensions to drive collective action (Ostrom 1998). Therefore, Bardach (1998), Huxham and Vangen (2005) and Kaats and Opheij (2013) suggest that trust is an essential indicator of the potential success of collaborative partnership. Even though building trust consumes excessive amount of time and energy to nurture the environment to establish relationships, it needs to be addressed when initiating collaborative projects (Thomson 2001a; Huxham and Vangen 2005). Thomson and Perry (2006) refer to Ring and Van de Ven (1994) to argue that if collaborative partners interact and build trust over a long period of time, the "I will if you will" reciprocity can be lifted up to long-term commitments with psychological contracts, where formal organizational role relationships and legal contracts are replaced by personal relationships and informal commitments.

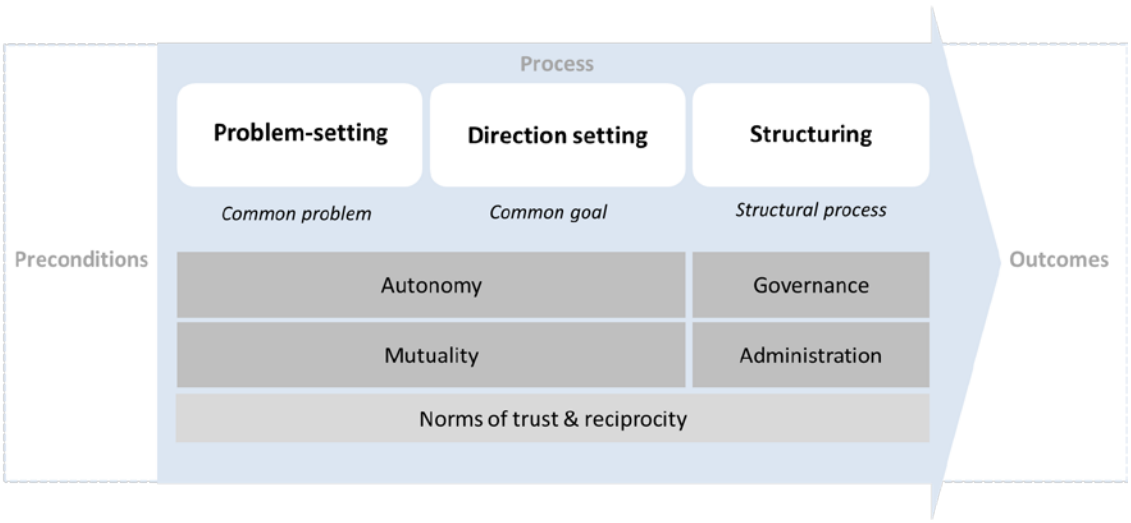


Figure 7: Theoretical framework by combining the developmental phases model and the five dimensional model

From the literature review, both two perspectives on a collaborative process seem to complement each other. The developmental phase model can be applied to show how collaboration should be developed along the process while the five-dimensional model can support the developmental-phases model by explaining what the key elements of collaboration process should be considered and how these elements influence on the progress of collaboration.

Open Innovation

Open innovation concept lies on the new way of thinking about approaches through, which companies can generate ideas and introduce them to market (Chesbrough 2003). For practicing open innovation approach, three processes, which are defined as outside-in, inside-out and coupling are identified by Gassman and Enkel (2004). Outside-in process occurs when organizations enhance their knowledge through external sources such as customers and other organizations to improve their innovation. Inside-out process enables organizations to bring out their ideas and innovations to markets through new channels. Finally, coupling process is a combination of outside-in and inside-out processes in, which organizations collaborate with other partners to give and take knowledge. Organizations among different industries have started to realize the limitation of their internal research and development activities, and have recognized the need for accessing knowledge and technologies from outside their organizations (Carlsson et al. 2011). An important point is that open innovation practices and absorbing knowledge through outside-in processes are better understood in R&D intense and large organizations, therefore when it comes to traditional and low-tech sectors, which have no or low R&D or investment (Hirsch-Kreinsen 2008) they need a third party such as technology intermediaries to help them to gain the external knowledge (Spithoven et al. 2010).

In order to approach sources from outside the organization, Bahemiaand Squire (2010) argued that developing wide and deep relationships with external parties such as suppliers, customers, competitors, consultants, research institutes and universities is important. Therefore, based on this idea, open innovation concept has been used in different contexts such as user-centric innovation and interorganizational collaborations, but it is worth mentioning that not all these interorganizational

activities can be considered as open innovation if organizations are mainly focusing and relying on their internal competencies (Giannopoulou et al. 2011; Ytström 2013).

As Inauen and Schenker-Wicki (2011) argued, Interorganizational collaborations can occur in different forms among multi stakeholders from a same industry, cross-industry, and industry-university. Their findings show that collaboration will influence positively on R&D management, innovativeness and innovations of companies. More specifically they conclude that companies can gain several benefits such as having information about new technologies, and flexibility in their innovation process, developing valuable network and contacts, and asking for public fund supports. However, more research is needed to understand about managing and organizing interorganizational collaboration where both universities and companies are involved.

User-driven innovation

User-centered concept may not be taken as a totally new paradigm since the concept is probably adopted from design methodology where users are usually playing a central role when designing either products or services. From the research of Edvarsson and his colleagues (2010), the findings from experiments show that the ideas initiated by users and in-house developers often have distinction to some extent; for example, the ideas initiated by users are likely to be original while those of in-house people are more likely to focus on reliability (Westerlund and Leminen 2011). Hence, it can be found that many of today's organizations take users as sources of innovation. The concept of sources of innovation is also supported by Von Hippel's theory of lead-user innovation, which claims that lead users can significantly contribute to development of innovation (Von Hippel 2005). Many scholars have tried to identify benefits that can be obtained by including users into innovation process. Based on Zaltman (2003), at least 80% of new products and/or services are likely to fail in launching to markets; however, the chance of failure can be reduced by having co-development process with users since their insights can increase the likelihood of market-fit results (Westerlund and Leminen 2011). In addition, insights from users can also accelerate development processes and reduce the development cost (Westerlund and Leminen 2011).

Recently, it has been found that user-involvement in innovation processes has been shifted from user-centered approach where users are considered as subjects to a participatory where users are considered as partners (Dell'Era and Landoni 2014). Beyond just gathering feedbacks or observing behaviors of users to identify their needs, those users can become co-creators of innovation satisfying their unmet needs. Applying this user-driven innovation concept seems to require a new specific mindset for entire organization to be more open to external sources of ideas (Westerlund and Leminen 2011).

Collaboration in Living Lab context, a user-driven innovation approach

Why Living Lab is essential

In order for organizations to have access to users and interact with them, the living lab approach is implemented. The living lab approach can help companies in traditional industries to become open innovation companies by having users as co-creator in real-life setting (Westerlund and Leminen 2011). Additionally, in some cases, the living lab approach is considered to be as an integrated technological socio-economic approach for sustainable solution development. In this view, the gaps caused

unsustainable activities can be minimized by increasing interactions between development of solution and consumption behaviors of users (Liedtke et al. 2012).

Living lab definition

As defined in the Living Lab Handbook (2010), the living lab concept is 'an open innovation environment in real-life setting in, which user-driven innovation is the co-creation process for new services, product and societal infrastructures.' This definition shares the two primary elements of the living lab concept: a real-life experimentation environment and the involvement of users in innovation process as co-creators. Some scholars describe Living lab concept as "a user-centric research methodology to sense, prototype, validate and refine complex solutions in multiple and evolving real-life settings" (Dell'Era and Landoni 2014, p.139).

The concept of living lab can also be considered as an emerging model of partnership between public and private sectors where citizen or users are integrated into innovation process to work together with companies and public organizations such as university in order to create, prototype, validate and test new services, businesses, and technologies in real-life contexts such as cities, regions (Dell'Era and Landoni 2014). From this perspective, companies or organizations that participate in living lab projects, can consider the living lab as open innovation intermediaries (Almirall and Wareham 2011), where the companies are accessible to external knowledge and able to capture outside-in ideas from either users or other partners in such collaboration. The living lab concept can improve linearity of traditional innovation process, even ordinary open innovation process, with cyclical model by having explicit feedback paths from users and feed-forward options in testing (Mulvenna et al. 2010).

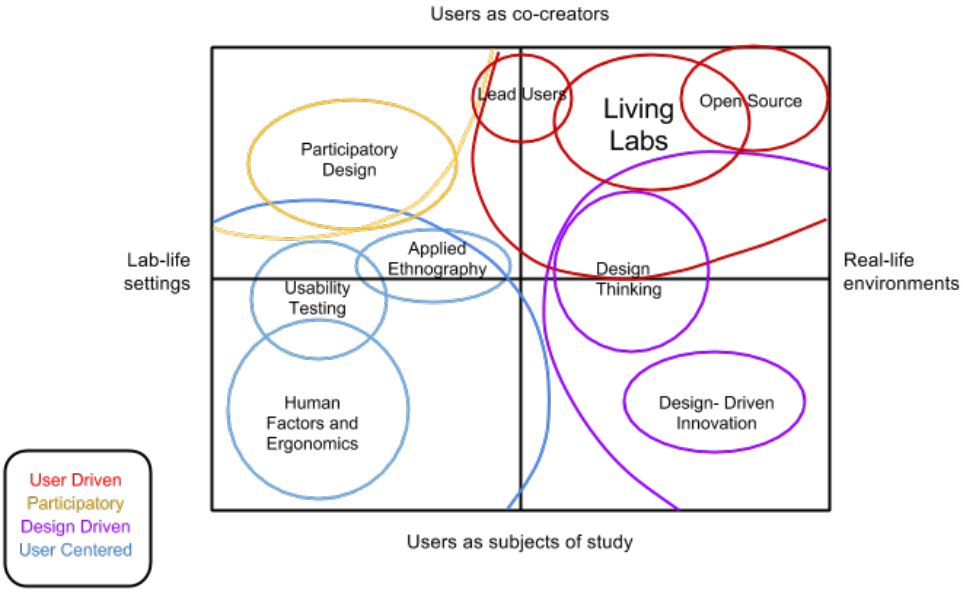


Figure 8: Mapping Living Lab approach with other kinds of user-involvement processes (Almirall and Wareham 2011)

Key characteristics of living lab setting

- Experimentation in real-life environment

  As defined by (Ballon et al. 2005), the Living lab approach is highlighted on experimental environments where ideas are iteratively tested with users in their real life setting rather than specific circumstance.

- User-involvement throughout innovation creation process

  There are different roles of users in the Living lab. The roles can be categorized based on users' activities such as co-creator, contributor, tester, and informant (Veeckman et al. 2013)

Management of a living lab project

According to the framework provided by the knowledge support from ENoLL (European Network of Living Labs), there are two interrelated cycles of managing living lab project (as shown in Figure 9: The management and collaboration cycle and the product development cycle. With this framework, it shows that interorganizational collaboration in a living lab context seems to be in the first cycle.

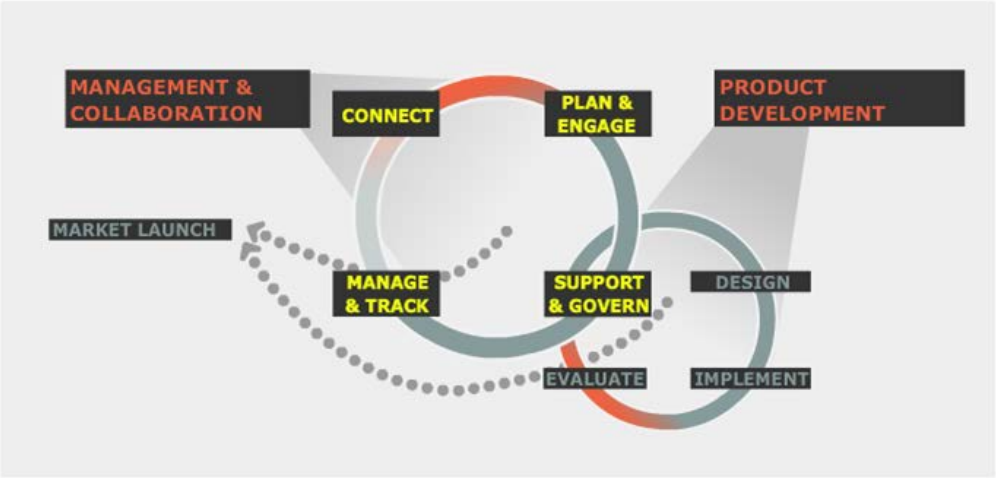


Figure 9: Two key cycles of any living lab project (ENoLL)

- Main focus of management and collaboration cycle
  - To achieve collaboration management, which means all stakeholders jointly commit to the plan mutually fulfilling the needs of all stakeholders.
  - Main activities in this cycle: Collaboration process and research agenda management, which requires facilitation techniques

- Main focus of product development cycle
    - To achieve product development as planned to products and services launched in market.
    - Main activities in this cycle: According to Schaffers et al. (2007), main activities in the Living Lab approach consist of:
        - Co-creation: Users and producers co-design ideas
        - Exploration: Focusing more on discovery of emerging utilizations, new behaviors, and market opportunities
        - Experimentation: Testing those pilot solutions in live scenarios with user communities.
        - Evaluation: Assessing the solutions (either products or services) in term of possibility for further implementation.

In this chapter, a body of literature has been reviewed toprepare the theoretical foundation of discussion's chapter and address each research question. These literatures cover the following areas: collaboration, interorganizational domain, developmental phases of collaboration, five-dimensional modelof collaboration processes, open innovation, user-involvement, living lab characteristics and management of living labs. Regarding the first research question, (1) "Why are the partners collaborating in this living lab project?" the process definition of collaboration is considered to explain the preconditions of collaboration by providing empirical data which show partners' self-interest. Furthermore, the first two phases of developmental model of collaboration -problem setting and direction setting- are going to be discussed in more detail.Moreover, the five-dimensional model isgoing to be applied for explainingessential issues that the project manager should consider during collaboration.

For the second research question, (2) "How do they understand the living lab approach as an open innovation collaboration setting?" the literatures regarding open innovation concept and user-involvement would show that the open innovation can be practiced by interorganizational collaboration and user-involvement. Accordingly, the discussion chapter is going to focus on the partners' understanding of the open innovation concept in the early stages of the collaboration when no research project is implemented. Finally the living lab concept has been reviewed in order to address the understanding of partners on the collaboration context.

Methodology

In order to understand how the research study was conducted and the research questions were answered during the phase II, this part explains about research strategy, design, data collection, and analysis approaches. Furthermore, some factors, which show the quality of the research and ethical issues, are discussed.

Research Strategy

Since the main question motivating this research is related to perspective of people and their organizations, a qualitative approach was chosen as the research strategy. Qualitative approach is suitable for studies in, which the main focus is on words, opinions and ways that individuals interpret their world (Bryman and Bell 2003; Krishnaswami and Satyaprasad 2010). Moreover, it provides opportunity for researchers to get closer to objects of the study and understand their view.

(Bryman and Bell 2003) in their book discuss about the relation between research and theory. They mention that theory is an outcome of most qualitative studies. However, in recent years this strategy has been used more often for testing established theories. It is worth mentioning that the purpose of this research is not to develop a new theory but theories were used as a background of the research in order to understand the empirical data.

Another issue that they mention in their book is about the research quality. Despite of increasing number of qualitative studies, there are some critics regarding its reliability and validity, which would be discussed further in the last part of this chapter.

Research Design

Bryman and Bell (2003) define research design as a framework for data collection and analysis. They provide different types of designs such as experimental, cross-sectional, longitudinal, case study and comparative. Based on the research questions of the thesis, the single-case study design is the most suitable approach, which could be applied, since the study is going to explicate the collaboration among partners in deep level. In addition, using case study approach is suggested when a research is answering "how" or "why" questions and an extensive explanation of a situation is needed (Bryman and Bell 2003).

Method (Data collection, literature review)

According to (Bryman and Bell 2003) qualitative interview provides a flexibility, which makes it an appropriate tool for collecting data in qualitative studies. However, the level of flexibility differs depending on the way that interview is conducted. For the purpose of the thesis a list of key questions were generated before interviews to be used as a guideline. This list could be found in the Appendices (E, F, G, and H). Therefore, it could be concluded that semi-structure interview was the approach of collecting data for empirical chapter.

In this case all the representatives of participating organizations were identified and at least one interview was conducted with each of them. Except three of them, all the interviews were conducted face-to-face and in interviewees' offices. Phone meetings were organized for interviewing three partners and asking follow up questions from partners. Moreover, some follow up questions were sent to partners by email.

Besides the interviews, the case descriptions, which were available in the partners' web pages and reports were reviewed to have a better understanding of the project status.

Literature review

Reviewing existing literatures played a significant role during the whole research process. By searching for literatures, researchers could understand about academic works, which have been developed in the relevant fields (Reed 1998). In order to develop an understanding, secondary sources (journals, books, and conferences) were searched mainly through internet by generating keywords. One strategy for finding relevant works was to search for backward and forward citations. Backward citations were available in reference part of each source, and forward citations could be found through Google Scholar web page. To access the resources, Chalmers library - Summon - was used as the main channel. Moreover, informal discussions with experts and project coordinator guided us to find applicable and relevant theories.

Analyzing qualitative data

Based on the data collection methods, which are used in this study, qualitative data are generated from the interviews and documents. Since there are few well-established rules for analyzing qualitative data, it is not as easy as analyzing quantitative data (Bryman and Bell 2003). In order to analyze these types of data, (Renne and Taylor-Powell 2003) suggest to first focusing the analysis based on the questions that were asked from interviewees. In the next step themes and patterns should be identified and placed in different preset categories. The development of categories might be different based on the purpose of each study. Finally, interpretation of data is possible by matching the theme and categories (Renne and Taylor-Powell 2003). In this thesis, themes were identified based on the interview guideline to understand how each interviewee answered to questions and categories were developed based on the theories, which were found during literature review process. After that a table was developed to map each theme to the related category. However it is worth mentioning that the process of analyzing the data was an iterative process in, which more literatures were reviewed and follow-up questions were asked from interviewees. Finally, the table was filled by both researchers and the results were discussed among them to avoid misleading interpretations.In addition, the supervisor was involved during the process to provide valuable feedbacks.

Quality of the research

To make sure that a research has high quality, there are two criteria, which should be considered. Based on (Bryman and Bell 2003), validity and reliability are two main factors, which have been used to show the quality of a research; however these factors suites better with quantitative strategy. Therefore, they show that some researchers such as (Lincoln and Guba 1985) suggested using alternative elements, which could fit with qualitative strategy. Credibility, transferability, dependability and conformability are proposed terms for qualitative strategy. These points are going to be discussed based on (Bryman and Bell 2003).

Credibility means to be able to show that the findings are believable in the thesis. One way of increasing credibility is triangulation, which means using more than one source of data. In this thesis, documents describing the case and previous research studies related to the case were considered as the second source of data.

Transferability considers whether results are applicable in other contexts. In order to ensure the transferability, the context of the case is introduced in the case setting part. In addition, the information of participating organizations and the representatives of these organizations as interviewees are described in the table (3) to clarify the situation in, which the research was conducted. By providing a clear picture of the context, it would be possible for other researchers to recognize when the findings are relevant.

Dependability is concerned with having same results and applying findings in other times. In order to increase dependability, it is suggested to keep records of all materials during the research process. In this research, all the interviews were recorded and afterwards they were fully transcribed to assure that all data would be considered in analysis.

Finally, conformability argues about objectivity of researchers. It is concerned with influences of researchers' values on the study. However, it is discussed that having complete objectivity is not possible, but researchers should try to act in good faith (Bryman and Bell 2003). During the thesis process all the partners were interviewed to consider all actors' perspectives and during the interviewing sessions, researchers tried to avoid asking guiding questions and play a neutral role.

Ethical considerations

In their book (Bryman and Bell 2003) introduce ethical principles, which are categorized by (Diener and Crandall 1978). Based on these categories four areas should be taken into consideration during a research study: harm to participants, lack of informed consent, invasion of privacy, and deception.

Harm to participants can include different aspects such as influencing on participants' career and future employment. In addition to the participants' situation, this study is concerned with the future of the case. Since the case of this study is in the early phases of collaboration and the partners are going to work together for ten years, it is decided to present anonymous quotations in the empirical chapter. In addition when the results are discussed and concluded, no specific organization is pointed out to make sure that it would not influence negatively on the collaboration.

Regarding the second and third principles, all the interviewees were informed about recording devices and they were asked to feel free to pause the recording in any point of the interviewee. Moreover an email was sent to all the interviewees to inform them that the name of their organization is going to be mentioned in the introduction of the case. In order to assure that the partners' privacy is not invaded, all the documents related to the case were selected from public documents, which are available through internet.

Finally, at the beginning of each interview the purpose of the study was explained as clear as possible to the partners to show them how the results are going to be used in this study.

Limitations

One limitation of the current study is about the communication with interviewees. The first issue is concerned with the language used during interviews. It should be taken into account that Swedish is the native language of all the interviewees and some of them might not be able to express their opinion perfectly in English. Another issue is related to conducting phone interviews. Based on the distance and time limitation, some of the interviews were conducted through phone and it might influence on the communication quality.

Another limitation is related to using public documents available through internet. In this study, as a matter of ethical consideration, just the public documents are reviewed for finding information about the project description. It should be considered that by reviewing private and internal documents such as organizational project description and partnership contracts, different conclusions could be presented.

Moreover, the opinions and statements in the empirical findings and discussion chapters are going to be presented in a way that no partner organization can be recognized and judged. As another ethical consideration, this study tries to do not influence on the collaboration project negatively. Since the project is in the early stages and the partners are going to work together for ten years, it was decided to do not point at any specific organization and keep the results as anonymous as possible.

Finally, since the project was in the construction phase, all the representatives had a busy schedule. This means that we did not have the chance to gather all of them in a dialogue session and listen to their opinions at the same time. For authors as the members of the Challenge lab was a wish to use dialogue as a tool to have higher impact on the project.

Empirical findings

In this chapter, the empirical findings from the research are shown. The empirical findings are divided into two sub-sections: Empirical setting and Key findings.

Empirical setting

In this section, project description, participating organizations and current project status are shown in order for readers to have an overview of the case and a better understanding of the context the case is embedded

Background and Project description

The HSB Living Lab would be a three-floor residential building, which consists of 25 student apartment and it is located at the south end of the Johanneberg campus of Chalmers University of Technology (Hagy and Balay2014).

HSB Living Lab project is part of the Smart Sustainable District (SSD) flagship sponsored by Climate-KIC*. In the SSD project several districts around Europe are selected to show how new tools, technologies and policies can improve a district based on sustainability measures. Johanneberg where the HSB living lab is going to be located is one of those districts. The aim of SSD is to increase human well-being, economic vitality and reduce resource use and environmental impact (Rosado 2015). As part of this project, HSB living lab is going to provide a co-creation environment in, which *sustainable technological innovations for sustainable living* will be identified and diffused in the city level. In HSB website, it is showed that HSB will work with a variety of partners to create the arena for knowledge on sustainability and technological solutions that can be used in future production (Anon 2015a). It is mentioned in Johanneberg District Factor 10 report that HSB Living Lab is planned as a built infrastructure for advanced research on the flows of energy, materials and water through living space and their relationship to state-of-the-art design and technology.

Main objective of this HSB living lab project is to understand how people will live in the futureby having a holistic approach in which sustainability is central (Anon 2015b). The living lab would be a mobile building where students are going to live and different sectors such as academia, community stakeholders, and industry will go further along together to develop research, and demonstrate new solutions and test their ideas (Vinnova 2013). The proximity to these three parties in the construction sector creates a unique opportunity to develop and test all technology, legislation and practices (Vinnova 2013). As one of the key features of the living lab concept, the HSB Living Lab project will focus on the active role of users as co-creator. The design of the building would help to interact with residents and learn how their behaviors change according to new sustainable products or services. The collaboration in the living lab project is going to last for ten years and after that the building would be moved to another place (Chalmers 2014).

Partners in this collaboration and their backgrounds

The living lab project was initiated by three main organizations - Chalmers, HSB, and Johanneberg Science Park. Based on the interviews, Johanneberg Science Park considered themselves as a catalyst for initiating collaboration by scouting and inviting potential partners to the project. Apart from the initiator organizations, the goal is to have ten partners from different industries to collaborate with. However, currently there are six participating organizations as partners of the living lab project (see Table 3). It

*Climate-KIC is one of three Knowledge and Innovation Communities (KICs) created in 2010 by the European Institute of Innovation and Technology (EIT). The EIT is an EU body whose mission is to create sustainable growth. They support this mission by addressing climate change mitigation and adaptation (http://www.climate-kic.org/about/)

should be mentioned that not all the partners were involved from the beginning and they joined at different stages of collaboration. In order to be a partner, organizations have to pay an annual membership fee, which will be allocated for research and development projects in the HSB Living Lab. Moreover, each organization needs to provide at least one representative who is mainly responsible for coordinating between the HSB Living Lab project and his/her organization; however, these representatives are also involved in decision making for research projects and direction setting of HSB Living Lab by having their own perspectives.

Table 3: The list of the partner organizations

Organization	Background	Representative person (s)
A (Chalmers)	University	• Project coordinators of the living lab • University representative • Researchers
B (HSB)	Housing corporation	• Project leader of the living lab
C (Goteborg Energi)	Electricity and Heating providing companies	• Research and Development strategist
D (Tengbom)	Architecture company	• Chief Sustainability Officer
E (Peab)	Contractor company for construction	• Sustainable development manager
F (Bengt Dahlgren)	Consulting company for HVAC system	• Head of Department Energy and Environment
G (Electrolux)	Manufacturer for household appliances	• Innovation and Technology manager
H (Vedum)	Sanitary ware and fitting manufacturer*	• Marketing manager
I (Johanneberg Science Park)	Science park	• Director Open Arena

Remark:

* It is not included in the interviews. (They were recently involved in the project)

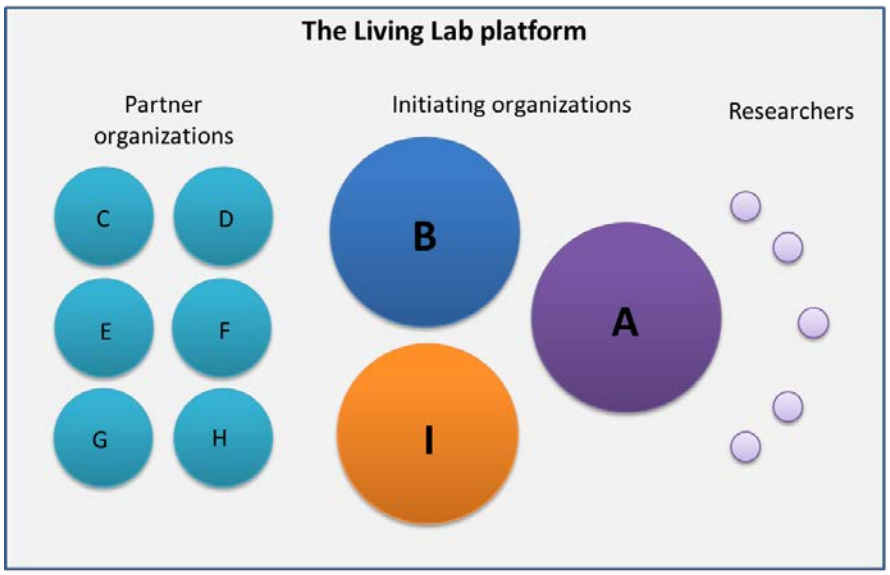


Figure 10: Illustration of different partners participating in the HSB Living Lab project

Current situation

When this study was conducted, the project was in the construction phase. Therefore all the partners who are involved in the construction phase usually organize weekly or monthly meetings together to update the progress and discuss issues mainly regarding the construction of the building. According to the interviews, prior to this study there were several workshops with partners to discuss about the goals of HSB Living Lab. However, the core operating process such as decision making process, research project evaluation criteria, and funding research projects have not been set. Based on the interview with the project coordinator, the roles of partner companies in the living lab have not been defined yet as well.

Before this study, seven focus areas were developed for research projects in the HSB Living Lab. These focus areas are divided to: Architecture and movability, Laundry room and community hall, Minimization of resources, Material and technology, Accessibility, Process for new construction, and Future housing association. Also, several workshops were conducted to develop some potential research projects, which could be potentially implemented in the lab in the later stages. In the workshops, there were representatives of partner companies, researchers, and students to co-create ideas. There are 17 research projects that are going to be experiment in the living lab have been already decided (Hagy and Balay 2014). However, these research projects have not been physically implemented in the HSB Living Lab yet since the building is not completed.

By having a clear picture of the HSB living lab project as the case of this thesis, the following part is going to present the results, which were found during interviews.

Key findings

This section presents the data gathered from interviews conducted with representatives of partner organizations in the HSB Living Lab. These interviews were conducted with eight out of nine partners presented in table 3 to answer the research questions. Therefore, firstly the findings are going to present the partners' interests, common cause that has gathered them together and the goals of the project to figure out why they are part of the living lab project. Secondly, the findings show how they understand the living lab approach based on their explanation and expectation from the partners and users.

1. Why partners are collaborating in the HSB living lab project

Interests of partners

From the interviews, all representatives responded to the questions regarding why did their organization decided to involve in the HSB Living Lab project by showing their organizational interests in the project. The results from the interviews can be categorized into three main interest areas (See figure 11).

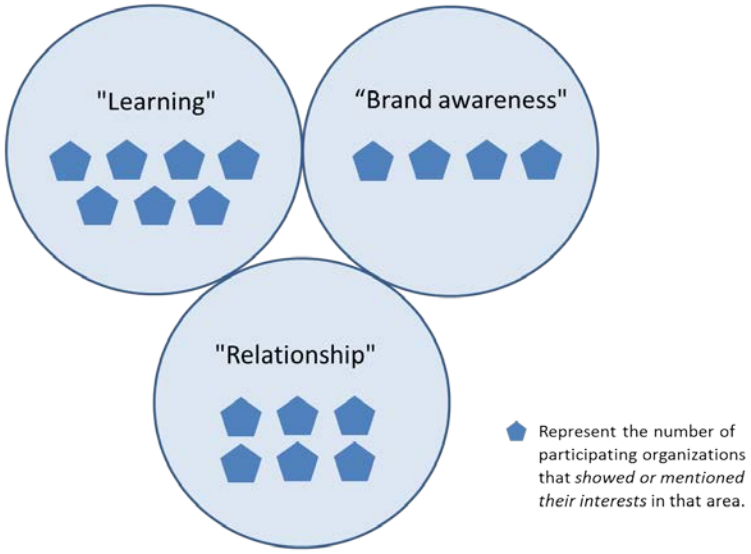


Figure 11: Three categories of partners' interests

- *Brand awareness*

Since the living lab approach and the building is different from ordinary projects in many ways, it has a high potential to receive wide attention from media, students, society, or even in national level. The brand awareness is one of the main reasons that partners were mentioning during interviews. By being part of the project, they want to show their customers and society that they are working with latest technologies and they have high-level competencies. Moreover, some of them expressed that they want to become the attractive employers for students or other experts who are looking for career opportunities. In the following some of the interviewees' opinions are quoted to show what they mentioned during the interviews.

“By being in this project people will learn what our company stands for,so marketing is our core value that we show we can be part of this projects.”

“In two years everybody knows about living lab, and everybody in Sweden and internationally talk about it.”

“We think that with these kinds of projects we can show our customers that we involve ourselves innew techniques and we are on the top we want to stay on the top.”

“We want them to see us as the most attractive employer.”

- *Relationship*

As mentioned in the empirical setting chapter, the partners are coming from various businesses, but most of them are related to the housing industry. Therefore, some of the partners have had experience to work together previously in other ordinary projects, but there is something special with the living lab project. Having ten years partnership in a project is something new for most partners and they consider it as an opportunity to strengthen their relationship with other partners including the university, and other partner companies. When partners discuss about making relationship, they mention about different ways to get closer to the other partners. For them this project could be an opportunity for networking and getting familiar with experts in other organizations. Moreover, they see the project as a great opportunity to show their competencies to other partners. By having a network and better understanding of competencies, partners are looking forward to work closely in more projects either in the living lab or other ordinary projects. The following shows some quotations that the representative of partner companies mentioned during the interviews.

“This is a really good way to have contact with academy and maybe this can lead to cooperation in other project and get contact with researchers when we have other problems"

"The relations with both Chalmers and other partners involved... we will have for long term"

"We usually cooperate, and in this case we know the partners so it is easier to work with them and easily team up with partners." "...find new projects to cooperate with partners."

"The other part is learning how the other companies work and what do they focus on so that is more of relation thing. We want to get contact with other partners ... for other future projects."

"For HSB side, we hope to do a good job for them and do more projects for them in the future."

"I want to create a huge network with for example Chalmers students, PhD students"

- *Learning*

Based on the interviews, all representatives mentioned about their interests to have access to learn from participating in this project; however, some of them showed that they tend to focus more on the other two aspects. The main activities of the living lab project would be about conducting research and testing new solutions. Therefore, the partners are interested to learn about the new technologies and be able to compare different solutions in the real life settings, which the living lab can provide for them. Some of them mentioned about their interests about learning from interactions provided by the living lab. On the one hand, they want to learn from interacting with other partners and explore how they are thinking about the future way of living. On the other hand, they want to learn from students who are going to live in the building. However, it was mentioned that they are not sure and it is not clear for them how they can

achieve their goal of learning from users. In addition some expressed their interests in the building process and they want to learn how to build movable and modular building, but most of them mention that the building by itself was not the main reason of choosing the project. Finally, the partners are interested to learn how they can work with researchers. Among the partners, some of them have been part of projects, which involves researchers, but not all of them have this experience. Therefore, the long term collaboration in the living lab can provide the opportunity for them to expand their activities with the university.

> *"I hope that we come up with ideas, which would be able to do research and gain knowledgeto our company. Open exchange of ideas and doing research."*
>
> *"I expected that it [the project] will be open source sharing of knowledge"*
>
> *"One is how the houses of future will look like and how energy system would be connected."*
>
> *"It would be interesting to see how to interact with local productions like solar panels andto see how it would affect people living in the house."*
>
> *"We can learn and also we can learn how to work with other customersto develop housing and develop apartments."*
>
> *"With this kind of open sharing ideas where we can receive inputsfrom colleagues in other areas and also from a lot of students"*

Common cause

When partners were asked to explain what is the common problem that has gathered all of them together in this project, they mentioned about various issues. Some of them mentioned about sustainability and developing sustainable solutions.

> *"We really want to cooperate with customers and other partners. Especially when you are working with sustainability issues you need to cooperate because we cannot solve it by ourselves."*
>
> *"We know it's about the sense of sustainability."*
>
> *"I think [the living lab] it is a lot about human, individual and because it is related to food, water, energy flow... it has been a lot about sustainability that is interconnected; for instance, social sustainability."*
>
> *"In district heating grid that we aim to decrease the amount of fossil fuels, we have strategic decision for the town 2030 that we will use no natural gas in the system. And how can we do this and how to deal with the loads in the house to adjust in what time of a day"*

Meanwhile, some of them were not sure if there is any clear defined common cause. During the period in, which the study was conducted most partners were focusing on construction challenges. Since most of the partners mentioned about sustainability, they were asked to elaborate on that topic. Two views were explored regarding sustainability. Firstly they were asked to explain about their internal organizational sustainability criteria and vision, and then clarify the common understanding of sustainability for the living lab project. After reviewing interviews, the results show that few partners have no clear sustainability vision in their organizations, even though they are working with sustainable issues.

"Right now we are developing more specific goals for the whole company ...it is quite hard to formulate sustainability goals"

"... We have one area that just started, which is about sustainability in supply chain"

For those partners who have sustainability vision, they need clarification to be able to relate them to objectives of the living lab project. Considering the living lab project, the common understanding of sustainability is not well defined and clarified for all partners. Some of them discuss about both social and environmental issues, while some discuss mainly about environmental issues. One of the respondents mentioned that "The lab should be part of the process in defining sustainability."

"We do have vision and strategy in our company. It is more in overall perspective to seewhy we consider sustainability and being [but] we cannot use them as criteria for specific project."

"It is a broad concept but we consider those three legs of economy ecology and environmentally"

Goals of the project

In order to figure out the goals of the project, several documents were reviewed and the following goals were found.

"Main objective and purpose is to create future sustainable living where academia, community stakeholders and industry will further along." VINNOVA, 2013

"Research in innovative technology, architecture and social connection is done in order to develop future sustainable accommodation." HSB annual report, 2014

"The construction sector is a complex industry and it takes time to get the innovations to the market. HSB Living Lab provides new opportunities to promote innovation and provide the opportunity to test new materials and techniques before they are used on a large scale, which ultimately saves time and money.

"The research is connected to the HSB Living Lab can be divided into two different parts. Partly it's about developing new sustainable building materials, the project Next Generation Building Envelope, and partly about finding new ways to measure and influence their electricity consumption, in the project Home Energy Management" Chalmers, 2014

Moreover, according to the project manager one of the goals of the project is to push the boundaries of the construction industry and develop sustainable solutions for living. Moreover aforementioned seven focus areas are defined for achieving these goals. Other partners mentioned about testing and comparing new technologies as the goal of the project.

2. Understanding of the living lab approach

Most of partners share the common understanding of the living lab approach. They perceive the living lab approach in HSB Living Lab project as a platform to interact with external stakeholders to collaboratively develop ideas. They also expected to capture these outside-in ideas back to their organization. In addition, many of them perceive it as a test-bed where companies and researchers come together to test and develop their ideas and solutions in the real life setting. (See Figure 12) They mentioned that constructing the building is not the main point of the project, but it is the knowledge and research, which makes their

understanding of the living lab. However, for few of them the modularity and mobility of the building is part of their definition of living lab.

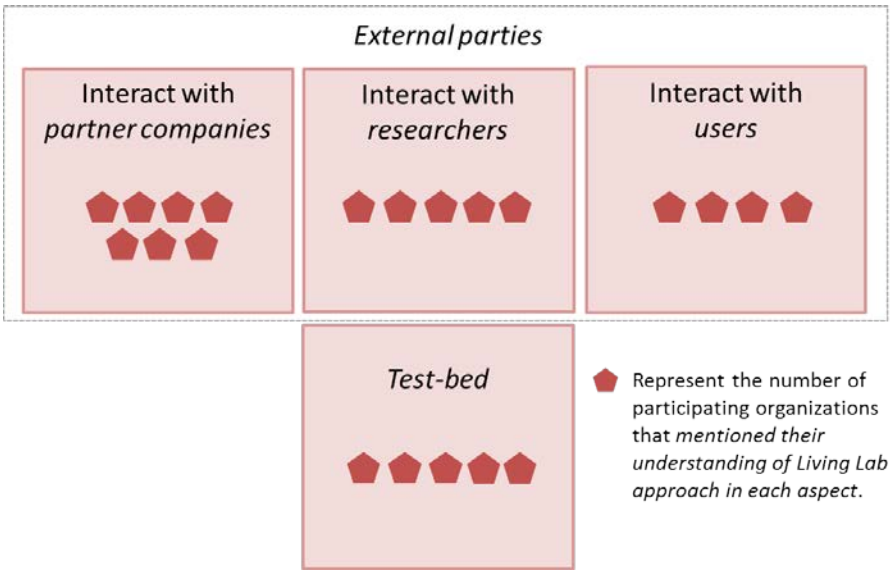


Figure 12: Overview of how participating organizations perceive the living lab approach in the project

According to the interviews, the expectations of partners can show how they understand the living lab approach.

The expectations on other partner organizations

From the interviews, many of them mentioned that they expect to discuss and collaboratively develop ideas or potential research projects with other partner organizations. Some of them explained that this platform provides them the opportunity to learn from working and co-developing ideas with partners from different business backgrounds or different expertise.

> *"We work in that way that if we have an idea we are supposed to lift it up and say I have an ideaand I want to do this, then we discuss together how we finance this idea and during that discussionit is open for other partners to say that I am interested and I can work in this project as well"*

> *"For example, there is one thing that we are going to do, which is lifecycle analysis that we are going to do that with [other partners, which are] interested to results and [one of the partners] can provide us some data."*

> *"Business partners will involve in application part. We would work with them. And alsothere is some knowledge, tacit knowledge about understanding societal issues and building industry."*

Moreover, some of respondents explained that they had already participated in some workshops to define the research topics with other partners in the partner group. Nevertheless, several projects were suggested from the university, thus it was not clear for companies how those projects were developed and selected.

During the interviews, some partners mentioned in their expectation about having a clear and transparent process, which shows what the partners are doing in the collaboration, how they can be part of projects and, which projects are going to be implemented in the living lab. However, it is worth mentioning that

project coordinator has developed the preliminary model for the process but he found the difficulty to discuss with those representatives of participating organizations in the project since most of the partners are focusing on construction. Additionally, having a process and culture that encourage openness and sharing knowledge is another point that partner wanted to be developed. One of the respondents mentioned that with the open culture it would be beneficial for developing new ideas for future by working with colleagues from other organizations. This kind of environment does not quite exist in his organization for exploring innovative ideas.

The expectations on researchers

Based on the interviews, the partners' expectations on working with researchers from the university are diverse. Many of them expect to connect with researchers via research projects in the living lab. Some show their expectation that with this platform they can learn about new technologies and new solutions by working closer than earlier to those researchers in the living lab. However, some partners explicitly mentioned that they expect to use the results from researches directly in other projects outside HSB living lab context. Some partner companies raised their concern regarding practicality issue for those researches from university. It was mentioned during the interviews that some partners show their intention to provide their problems or requirements from industry perspective in real life context and share their industrial practices with academia.

> *"It is interesting to be near researchers and take share of what they are producing."*
>
> *"[Researcher] maybe have to go out in the real life and ask questions, thenew in our company or other companies can give input [knowledge] to researchers."*
>
> *"I hope this project will bridge some distances between everyday work and universities. So, we can listen and learn from research and also they can listen to needs and demands of real work"*

The expectations on user involvement

Based on the interviews, many of the partners expressed their expectations on user-involvement in the project. Since users, which in case are students who are going to live in the living lab building are key part of the living lab approach, the partners were asked to explain their opinion about the role of users in the project. Most partners mentioned that they want students to live in the building as they are living in a normal student building, some partners wanted students to be active and interested to provide feedbacks during research development, and some partners did not have any specific role for students and they wanted to keep it open to see what would happen when students settle down and projects start. The common point among partners is obscurity about how much students as users should be involved in the projects

> *"Nothing more than that they are themselves. That they are going on in their life as normally. I think that is the most important."*
>
> *"We probably need to go to the home and interview them, filming themand doing research and be Ok with this way of living."*
>
> *"It is interesting to see how this interaction would affect your behavior."*

"We will have a lot of input living there ... I really hope it would be like thatto have dialogue with people living there."

"Participate in workshop (evaluating or creative), be available for information session,answering questionnaires."

The expected contribution

During the interviews, the respondents were also asked about their expected contribution on the project. Among the three initiator organizations, the university is going to mainly contribute by providing researchers to develop the research projects and analyze the data generated from the lab. The science park is contributing mainly in the beginning of the project by acting as an catalyst for gathering relevant organizations to this project, therefore they would not be actively part of research projects in the future stages. Apart from three initiator organizations, the other partners who pay the mandatory annual membership fee mentioned that they are willing to contribute to co-creation workshops with researchers and users to provide ideas and share their expertise. In term of additional human resources for managing the research projects and implementing the ideas from the workshops, they suggested that it would depend on attractiveness of each project and they cannot predict now.

“It depends, which project we are involved in. it is not one person for whole year.It could be half person per year or even less, it depends on the project.”

Discussion

In this chapter, the empirical findings would be discussed based on the theoretical framework presented in the literature review chapter. Accordingly, a better understanding of the situation in the HSB living lab project would be developed based on different perspectives of partners in this collaboration. The discussion will also help in providing recommendations for further development of the project.

Aim of this research: To understand why the partners are collaborating in this living lab project (considering both organizational and interorganizational level) and to investigate how these partners understand the living lab approach as a collaboration setting.

1. Why the partners are collaborating in the HSB living lab project

Defined as collaboration in interorganizational domain

According to the empirical setting,this HSB living lab project can be considered as a collaboration for participating organizations from both public (university) and private companies such as HSB, Tengbom, Bengt Dahlgren, Electrolux, etc. since all representatives from partner organizations showed that their organizations have a long-term commitment. The partners will have tight relationships in this project for ten years in order to develop sustainable home for tomorrow as their common mission. This seems to fit the definition provided by Winer and Ray (1994) that collaboration is more formal relationship with full commitment to achieve common purposes and focuses more on long-term than shorter term relation. Moreover, based on the empirical setting, it is published in several project description documents that the HSB Living Lab project will collaboratively develop sustainable living solutions for future home. Accordingly, having the joint-focus on sustainability as a meta-problem that exceeds the capability of single firm to control, the collaboration in the HSB Living Lab project can be considered as collaboration in the interorganizational domain based on the definition provided by (Gray and Wood 1991). McCann (1983) suggested that collaboration in an interorganizational domain develops through the following three sequential phases: the problem setting phase, the direction setting phase, and structuring phase. However, prior to the developmental phases, (Gray and Wood 1991) suggested that at the starting point of collaboration process there are the preconditions that motivate stakeholders to collaborate.

Precondition of interorganizational collaboration

For precondition of interorganizational collaboration, Gray and Wood (1991) argued that all stakeholders should have at least one common interest to be motivated for participating in an interorganizational collaboration. As shown in the empirical findings, the interests that all partners mentioned during the interviews are mixed and can be categorized into three main groups: raising awareness of their brands, developing and maintaining relationship with partners, and having access to external knowledge for learning. Due to their different backgrounds and their different organizational missions, these self-interests seem to be the distinct motivations for each organization. Based on this finding, it can be argued that participating organizations share the similar self-interests in three different areas, which motivate them to collaborate in the HSB Living Lab project. Having common understanding on these shared interests among the partners seems to be necessary in the initial phase of this interorganizational collaboration.

Problem setting phase

As the first step, in order to create common understanding in the problem setting phase, Gray (1985) suggested that the mutual acknowledgement of the problem domain that brings all partners together should be developed and attention of the partners to the domain should also be recognized. As presented in the empirical findings, the common problem that some respondents mentioned during the interviews is the sustainability issue. Some of them were not confident that they have any clearly defined shared problem. Many of them are aware that they cannot overcome the sustainability challenges by just themselves - it is beyond single organization's boundaries. When they were asked about their organization's vision regarding sustainability, some do not have clear definition of sustainability for their organizations. It can be argued that the partners are aware of the sustainability issue as the problem that have brought all of them together in the collaboration but they do not have common understanding on the definition of sustainability. The partners in this project may see sustainability from various perspectives. Some are interested in resource consumption and energy efficiency, some emphasize on social sustainability, and some want to include biodiversity issues in the sustainability concept. It seems that a clear definition of sustainability is needed as a frame, which can guide and help the partners for discussing about research projects. With these diverse definitions of sustainability, it could be difficult for the partners to reach a consensus when making decision about research projects, which should be implemented in the living lab to collectively tackle sustainability challenges they currently share.

Direction setting phase

Gray (1985) mentioned that the primary objective of the direction setting phase is to collectively define common goals of interorganizational collaboration. It is also shown in many published documents that partners in the HSB Living Lab expect to collaboratively develop sustainable living solutions for future home. During the interview with project manager, it was mentioned that one of the goals for this collaboration is to push the boundaries of construction industry and develop sustainable solutions. On the other hand, it was mentioned by some respondents that they had several workshops and meetings with all partners to discuss and develop the common goals based on the seven focused areas for this interorganizational collaboration. Some of them mentioned that there are several common goals, but they did not mention or talk about them in the interviews. Also, they found it difficult to explain where this collaboration is heading towards. Moreover, partners should identify what should be done individually or as a group (McCann 1983). In the living lab projects, it is shown that most of the partner companies expected to contribute to the project by mainly sponsoring annual membership fee for research projects and having representative in the partner group. Apart from these, their contribution would depend on each project. Huxham (1996) argued that each partner may confront with intrinsic tension between its self-interests and shared interests in the problem domain. From the autonomy perspective, if there is any conflict between collaboration's goals and individual's organizational goals, this tension could lead each partner to justify its own contribution level that is sufficient for them to only achieve their own self-interests (Thomson and Perry 2006). It can be argued that unclear common goals could lead the participating organizations to contribute to the project more toward their own goals of collaboration than the collective goals of interorganizational collaboration.

Structuring phase

In the structuring phase, the objective is to develop a structural process for effectively facilitating collective actions in order to achieve shared missions (Gray 1985). As it is shown in the literature review chapter, there are two different cycles: management and collaboration cycle, and product development cycle. Since the main focus of the management and collaboration cycle is getting all the partners in collaboration commit to a plan for the product development cycle, it can be argued that the structural process can be considered as a process for management and collaboration cycle. From the interview with the project coordinator, it was shown that he found difficulty to discuss with all partners about the structural process where partners will involve in decision making for research projects in the HSB Living Lab and to identify the roles of partners in the collaboration. In this situation (Vlaar et al. 2006) suggest that going toward more formal form of process structuring can attract more attention from partners. One of possible explanations could be that most of their focuses are getting the building stand within the deadline. However, based on the interviews, many of the partners showed that they would like to work with other partners, researchers and users in order to get new ideas but they are not sure what the process should be.

The five-dimensional model to understand how these key elements influence on collaboration

As suggested by Thomson and Perry (2006) the five dimensions are interdependent, and changes in one dimension can influence on others, and cause variation across dimensions (Thomson and Perry 2006).

In the governance and the administration process dimensions, both Kaats and Opheij (2013), and Thomson and Perry (2006) argued that a joint-decision making process is defined in order to achieve the shared goals of collaboration by creating commitment and governing stakeholders into actions. It was mentioned in the finding that the project coordinator is also aware about developing the structural process, but he found difficulties to involve the partners to discuss about how the joint decision will be made in the project. One of the possible causes is lack of clear common goals of the collaboration. It could be argued that without a clear structural process, the progress of collaboration would be influenced. However, it could also be discussed that in order to have a clear structural process, the clear collective goals should be determined beforehand. Otherwise, it would be difficult for participating organizations to ensure that the developed structural process would guide them towards their common goals of collaboration.

From the mutuality dimension perspective, collaboration is usually originated when participating organizations see mutual benefits in the collaboration. The common goals of the interorganizational collaboration should lead collaborative activities to achieve the mutual benefits for partners. Therefore, to define the common goals, it is important to understand the mutuality of collaboration first. Even though it was mentioned during the interviews that some workshops were conducted to discuss about the common goals, it could be argued that the mutual benefits might not be shown or discussed earlier. Thomson and Perry (2006) explain that mutual beneficial interdependencies in collaboration are based on either self-interests or shared problems that individual organizations cannot solve on their own. It can be argued that in order for partners to jointly define the common goals to achieve their mutual benefits from collaboration it is necessary for them to have shared understanding of self-interests and collective problems that they are trying to solve. Lack of shared understanding of these issues could deter actions in later stages such as common goals setting, developing the structural process of collaboration.

In the norms of trust and reciprocity dimension, trust is defined as a core element of relationship in driving collective actions (Ostrom 1998). Thomson and Perry (2006) argued that in addition to administrative capability, it is important for project coordinator to have social capacity to build relationship. It was mentioned by some partners that it would be good if the role of project leader for joint research projects is taken by a neutral organization like Johanneberg Science Park, which has built relationship with partners in industry before. It can be discussed that partners seem to trust a person from a neutral organization to become a leader of co-projects. Also, having a neutral person in leading discussion could help partners to develop common understanding of their mutuality. Based on the findings, it supports that these five dimensions are critical for interorganizational collaboration and they can influence on progress of collaboration. Therefore, in order to enhance likelihood of achieving desired outcomes from interorganizational collaboration, a project manager or a project coordinator should be aware of these five influential issues and ensure that all five dimensions are fulfilled. Missing one dimension could hinder overall progress of collaboration.

2. Understanding of Living Lab approach as an open innovation collaboration context

Defined as an open innovation platform for participating organizations

As mentioned in the theory, the basic idea of the open innovation concept is changing mindset and recognizing that external sources such as other organizations and customers can be used to improve innovation processes (Chesbrough 2003; Inauen and Schenker-Wicki 2011). The findings show that all the partners express their interests to participate in the living lab setting to gain and develop new ideas with external stakeholders including users, researchers from the university, and the other partner organizations. However, their main focus is on taking ideas out of the living lab, which could be considered as practicing outside-in processes (Gassman and Enkel 2004).

Since open innovation concept is used in different contexts such as interorganizational collaboration and user-centric innovation (Giannopoulou et al. 2011) and the living lab project is a mix of both approaches, it would be clearer if the interorganizational collaboration and user involvement aspects are discussed separately. Therefore the following part would discuss first from the interorganizational collaboration view to figure out the partners' understanding on how they are going to work with each other. After that the discussion about open innovation would continue from user involvement view to understand how the partners see the role of users in the living lab.

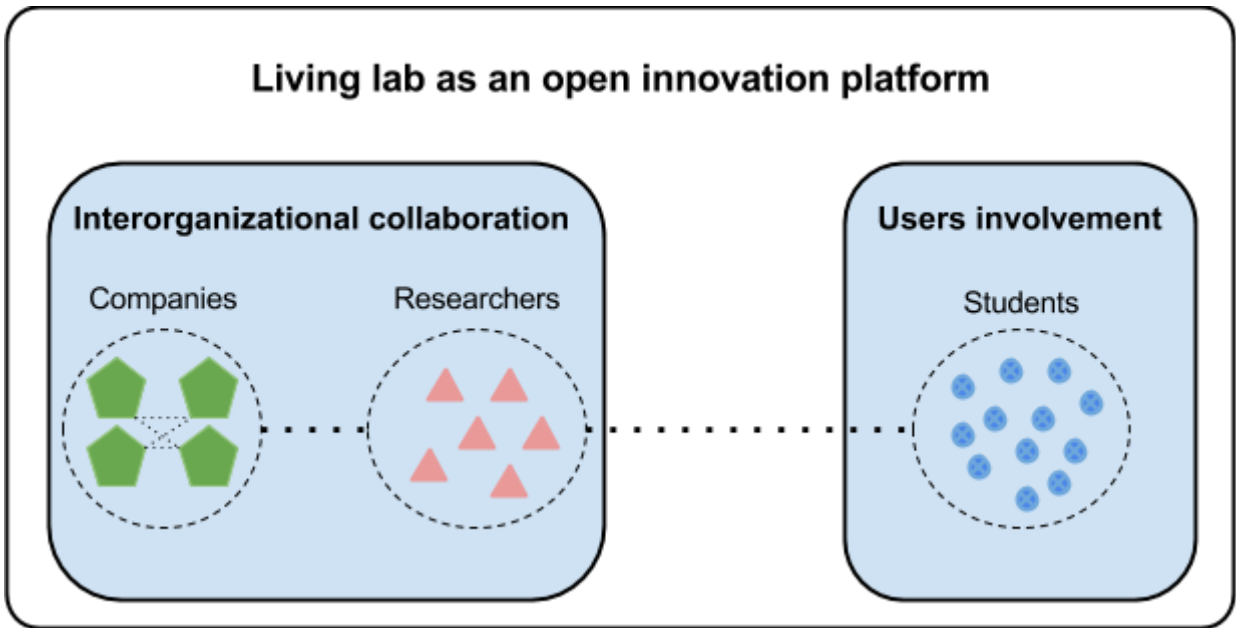


Figure 13: Practicing open innovation by interorganizational collaboration and user involvement

Open innovation from interorganizational collaboration aspect

As it is mentioned in the theory, if during collaborations partners primarily count on their internal resources to develop new solutions, those collaborations could not be considered as open innovation practices (Yström 2013). When this research study was conducted, the living lab project was in the construction phase and no research project has been implemented in the living lab yet. However, partners explained that they had been part of several workshops focusing on different focus areas to define research projects together and they developed some research project topics, which could be developed in the living lab after the construction phase. The point is that they showed their interest to have more workshops, develop project together and discuss about potential projects in the partner group. In this way, they can combine their expertise and knowledge with other representatives and produce results, which are not achievable by a single organization. Some of them also mentioned about an open environment for sharing ideas because they see that with an open culture, creative ideas can emerge by co-creating with others. Based on this, it could be argued that idea generation workshops among different companies seem to be an approach how the partners intend to co-create ideas with other organizations and engage other partners into research projects for further co-development.

However, when considering collaboration with academia or researchers, the partner companies expressed their different expectations on how they are going to co-create with them. In this collaboration, the university plays a significant role for creating knowledge and initiating research projects. During the interviews, companies showed their interest to get introduced to more researchers who are working in relevant fields, even though some mentioned that they expect to be able to use just the results from researches for new technologies and solutions. Additionally, they expected practical solutions, which could be used in other projects. As Inauen and Schenker-Wicki (2011) shows in their research, companies can enhance their innovativeness by having access to new technologies when collaborating with universities. Based on the findings and theories, potentially the partners' expectations regarding accessibility to new technologies and researchers would be satisfied. However, the issue regarding

increasing innovativeness could be discussed in detail. Most of the partners are working in the low R&D intensive industry. Although they are interested in getting closer to researchers in academia, many of them raise their concern regarding the practicality of academic research and the ability of using the results. Some mentioned that they are willing to share their problems or requirements that they have in real practice to researchers. Based on this, it could be argued that there is a gap between industry and academia but participating in the living lab project could help companies in low R&D intensive industry to learn how they can collaborate with researchers to increase their capabilities to innovate. For the co-creation process between companies and researchers, difficulties could be found to start from co-creation level, since they are aware of the gap in term of practicality. However, as some partner companies show their interests to share their real-life practices, it could be argued that collaborative activities can start from sharing knowledge about new technologies and industrial practices to jointly discuss about how to address the gap.

Open innovation from user-involvement aspect

Based on theoretical chapter, one of the main characteristics of the living lab approach, which distinguish it from other innovation approaches is being user centric and involving users in different stages of innovation process (Dell'Era and Landoni 2014). However, users can play various roles such as co-creator, contributor, tester, and informant (Veeckman et al. 2013). The empirical findings show that all the partners are aware of this feature and they would like to involve users in innovation processes, but the partners have diverse perspectives on the roles of users, from being just informants to contributors by involving in idea generation workshops. Few of them mention about having co-creation workshops with users. Moreover, the methodologies and processes for engaging users seem to be unclear for most of them. It could be argued that companies in traditional industry like construction industry may have less experience in user-involvement. Hence, they seem to confront a difficulty to define the co-creation methods and processes in the living lab. On the other hand, some of them mentioned that by having this platform they can have access to several sources of information from users such as users' behaviors. It could be discussed how these partners in low R&D intensive industry would utilize this kind of information. One of them expressed during the interviews that researchers could play an intermediary role to translate this kind of information for their organization in order to utilize in solution development. It could be argued that in the co-creation process with users there is also a gap between users and companies. Involving researchers in co-creation process with users could help companies to internalize knowledge and insights from users into partner's organization.

General understanding of the living lab approach

In addition to the acknowledgement of their interdependencies by comprehending their self-interests, collective interests, and their expectations on other participating organizations, Vlaar and his colleagues argued that understanding of the context they are embedded is also necessary for collective actions among partners from different backgrounds in interorganizational collaboration (Vlaar et al. 2006). From the empirical findings, it is found that most of the partners share the same understanding of the key elements such as interaction with users in real life settings, developing new solutions, and being open to external ideas in the living lab approach, even though they seem to have some minor differences about the level of user involvement, and being innovative.

Even if they share the similar general understanding of living lab approach, there is still room to discuss whether they are going to be able to absorb knowledge from this setting. Most of the interviewed partners are working as low intensive or no R&D organizations. Spithoven et al (2010) suggests that they need help from a third party to internalize the created knowledge. In their study, they consider collective research centers as assistance to enable those types of organizations to gain knowledge from their environment. Based on the background of the organizations, most of them are working with low R&D intensities, but they consider the living lab approach as a bridge, which can provide them the opportunity for gaining new knowledge by working with partners and especially getting closer to work with university. Hence, even though these partners are from low R&D intensive industry, being part of this kind of platform can help them to become more opened in innovation process by interacting with other external organizations, researchers, and users.

Conclusion

The HSB living lab project has a high potential to contribute to the improvement of knowledge about sustainable technologies and sustainable living solutions for society. By considering the HSB living lab as an interorganizational domain where partners are going to face meta-problems (in this case those are sustainability issues), which cannot be tackled by a single organization, it can be concluded that having at least a common self-interest, shared understanding of the problem that has brought them together, and common goals of the interorganizational collaboration is crucial for collaborating partners. In addition partners should understand the context of the collaboration. Therefore, these issues are going to be highlighted while answering the research questions.

Why are the partners collaborating in the living lab project?

The first research question aims to answer why the partners of the HSB living lab project are collaborating in this project. In the individual level, each partner expresses its self-interests to explain why they are part of this project. In general their self-interests can be categorized into three groups: raising awareness of their brands, developing relationship with partners, and having access to external knowledge for learning. Since they have these self-interests in common, it could be concluded that most probably these interests would be satisfied during the collaboration.

In the interorganizational level where the partners are considered as a group, two critical issues have been taken into account in order to answer why they are collaborating in the living lab project.

- Defining the problem that has gathered them in the collaboration
- Clarifying the goal of collaboration

For the first point, the conclusion is that in the current situation the problem is not defined clearly. However, if partners try to develop a clear definition and criteria for sustainability to frame it and explain what it means in the project, sustainability issue has a high potential to be considered as the problem domain of this interorganizational collaboration.

Regarding the second point, although partners have had some activities to set goals for this project, it cannot be concluded specifically what the goal of the project is. Thus, before structuring the processes, partners should consider to discuss and formulate the long-term goals in a high enough level, which every partner can relate to and engage in.

In conclusion, the importance of acknowledging self-interests among the partners and clarifying the problem together with goals should not be underestimated since those will have significant influence on structuring the process in the interorganizational collaboration.

How do the partner organizations understand the living lab approach as an open innovation collaboration setting?

The purpose of the second research question is to answer how the partners understand the living lab approach as an open innovation collaboration setting. The answer of this question would explain their understanding of the collaboration context.

This study reveals that the partners have a basic shared understanding of the living lab concept. They understand the living lab approach as a platform for getting new ideas from external parties, either other participating organizations or users. Based on this, it can be concluded that the partners are aware of this platform as an open innovation environment. However, the way that they are going to work with each other and involve users should be clarified for them in order to align their understanding with the theoretical concept of the living lab. Therefore structuring the processes and discussing about that can improve their understanding of the context. The benefit of developing and discussing the process is that the role of each partner and users, and their contribution would be clarified. Moreover, they would be able to decide about methodologies for engaging users in innovation processes.

Future research

This part presents future possible research topics, which are related to the living lab project. One possibility is to investigate how the partner companies are going to internalize the results of research projects into their organizations' knowledge. Since in the time of this thesis no project was implemented in the living lab, it was not possible to answer the question. However, when some results are produced from the living lab it would possible to follow the topic.

Furthermore, it would be beneficial for managing the collaboration to map the partners individually based on their interests and contributions. However, this is possible when some research projects are implemented and the level of the partners' interest and contribution could be witnessed. In this way the partners and project manager can develop clearer picture of each partners' position.

Moreover, since companies showed their concerned about the practicality of the results, it would be beneficial to study the influence of the living lab on university-industry interaction. Another potential topic could be related to the role of project coordinator in these types of projects where partners with different characteristics are involved. Finally, if the problem that has brought them together and the goals of the living lab project are not going to be clarified, in the long-term it would be interesting to understand how these issues would influence on the success and direction of the project.

Bibliography

Almirall, E. and Wareham, J., 2011. Living Labs: arbiters of mid- and ground-level innovation. Technology Analysis and Strategic Management, 23 (1), pp.87–102.

Alter, C. andHage, J., 1993. Organizations working together, Sage Publications Newbury Park, CA.

Anand, S. and Sen, A. (2000).Human Development and Economic Sustainability. WorldDevelopment, 28 (12), pp.2029-2049.

Anon, 2014a. materialflows.net: Material intensity by world region 1980-2011. Materialflows.net. Available at: http://www.materialflows.net/trends/analyses-1980-2011/material-intensity-by-world-region-1980-2011/ [Accessed March 16, 2015].

Anon, 2014b. World Urbanization Prospects 2014: Highlights, UNITED NATIONS PUBN.

Anon, 2015a. About. HSB.se. Available at: http://www.hsb.se/kampanjer/hsblivinglab/Om/ [Accessed May 17, 2015].

Anon, 2015b Care for the future. HSB.se. Available at: http://www.hsb.se/in-english/care-for-the-future/ [Accessed May 17, 2015].

Anon, Ageing UNFPA - United Nations Population Fund. Available at: http://unfpa.org/ageing [Accessed March 16, 2015].

Anon, CO2 emissions (kg per PPP $ of GDP), Data, Table. Available at: http://data.worldbank.org/indicator/EN.ATM.CO2E.PP.GD [Accessed March 16, 2015].

Anon, Urbanization, UNFPA - United Nations Population Fund. Available at http://unfpa.org/urbanization [Accessed March 16, 2015].

Atkisson, A. and Hatcher, R. 2001. The compass indexof sustainability: Prototype for a comprehensive sustainability information system. Journal of Environmental Assessment Policy and Management, 3 (4), pp. 509–532.

Bahemia, H. and Squire, B.S., 2010. Managing open innovation at a project level, a dynamic managerial capability perspective. Available at: http://druid8.sit.aau.dk/druid/acc_papers/djhg6qcmllenxiah9trg4iysgfqb.pdf [Accessed March 25, 2015].

Ballon, P., Pierson, J., & Delaere, S., 2005. Test and Experimentation Platforms For Broadband Innovation: Examining European Practice. In: Conference Proceedings of 16th European Regional Conference, International Telecommunications Society (ITS), Porto, Portugal, 4-6 September, 2005.

Boardman, J., Sauser, B., 2013. Systemic Thinking: Building Maps for Worlds of Systems. Wiley & Sons, Hoboken, NJ.

Bardach, E., 1998. Getting agencies to work together: The practice and theory ofmanagerial craftsmanship, Brookings Institution Press.

Bergvall-Kåreborn, B., Ihlström Eriksson, C., Ståhlbröst, A., & Svensson, J., 2009. A Milieu for Innovation - Defining Living Lab. Accepted to the 2nd ISPIM Innovation Symposium, New York, December 6-9.

Brundtland, G.H., 1987. Report of the World Commission on environment and development: "ourcommon future." United Nations.

Bryman, A. and Bell, E., 2003. Business research methods. Oxford: Oxford University Press.

Cassidy, J., 2014. Piketty's Inequality Story in Six Charts, The New Yorker. Available at: http://www.newyorker.com/news/john-cassidy/pikettys-inequality-story-in-six-charts [Accessed March 18, 2015].

Chalmers, 2014. Here are the first pictures of the HSB Living Lab. Available at: http://www.chalmers.se/sv/nyheter/Sidor/H%C3%A4r-%C3%A4r-f%C3%B6rsta-bilderna-p%C3%A5-HSB-Living-Lab.aspx [Accessed April 25, 2015]

Chesbrough, H.W., 2003. Open innovation: The new imperative for creating and profiting from technology, Harvard Business Press.

CORELABS, 2007. CORELABS - AMI@Work Communities Wiki. Available at: http://www.ami-communities.eu/wiki/CORELABS [Accessed May 18, 2015].

Cropper, S., 1996. Collaborative working and the issue of sustainability. Creating collaborative advantage, pp.80–100.

De Grave, A., The Sharing Economy: Capitalism's Last Stand? Resilience. Available at: http://www.resilience.org/stories/2014-05-05/the-sharing-economy-capitalism-s-last-stand [Accessed March 18, 2015].

Dell'Era, C. and Landoni, P., 2014. Living Lab: A Methodology between User-Centred Design and

Participatory Design. Creativity and Innovation Management, 23 (2), pp.137–154.

DESA, 2009. ‘Creating an Inclusive Society: Practical Strategies to Promote SocialIntegration’, Available at: http://www.un.org/esa/socdev/egms/docs/2009/Ghana/inclusive-society.pdf [Accessed April 30, 2015].

Dreborg, K., 1996. Essence of backcasting. Futures, 28 (9), pp.813-828.

ENoLL - European Living Lab - Knowledge Centre. Available at: http://knowledgecentre.openlivinglabs.eu/ [Accessed May 18, 2015].

HSB, 2014. Årsredovisning HSB Göteborg. Available at: http://www.hsb.se/globalassets/regionalt-innehall/hsb-goteborg/media/dokument/dokument-per-omrade/om hsb/arsredovisningar/hsb_arsredovisning_2014_slutversion.pdf [Accessed May 8, 2015]

García-Sánchez, I. and Prado Lorenzo, J., 2009. Decisive factors in the creation and execution of municipal action plans in the field of sustainable development in the European Union. Journal of cleaner production, 17 (11), pp.1039–1051.

Gassmann, O. and Enkel, E., 2004. Towards a theory of open innovation: three core process archetypes. In R&D management conference. Available at: http://www.alexandria.unisg.ch/export/DL/20417.pdf.

Geels, F.W., 2011. The multi-level perspective on sustainability transitions: Responses to seven criticisms. Environmental Innovation and Societal Transitions, 1 (1), pp.24–40.

Giannopoulou, E., Yström, A. and Ollila, S., 2011. Turning open innovation into practice: open innovation research through the lens of managers. International Journal of Innovation and Technology Management, 15 (03), pp.505–524.

Gray, B. and Wood, D.J., 1991. Collaborative Alliances: Moving from Practice to Theory. The Journal of applied behavioral science, 27 (1), pp.3–22.

Gray, B., 1985. Conditions Facilitating Interorganizational Collaboration. Human relations; studies towards the integration of the social sciences, 38 (10), pp.911–936.

Grimm, N.B. et al., 2008. The changing landscape: ecosystem responses to urbanization and pollution across climatic and societal gradients. Frontiers in ecology and the environment, 6 (5), pp.264–272.

Hagy, S. and Balay, P., 2014. Adaptable Design for the HSB Living Lab - flexible, co-created spaces in student housing. Göteborg : Chalmers University of Technology (Examensarbete - Institutionen för bygg- och miljöteknik, Chalmers tekniska högskola, no: 2014:20).

Hector, D., Christensen, C. and Petrie, J., 2009. A problem-structuring method for complex societal decisions: Its philosophical and psychological dimensions.European journal of operational research, 193 (3), pp.693–708.

Hester, P. and Adams, K. (2013).Thinking Systematically About Complex Systems.Procedia Computer Science, 20, pp.312-317.

Himmelman, A.T., 1996. On the theory and practice of transformational collaboration: Collaboration as a bridge from social service to social justice. Creating Collaborative Advantage. London: Sage Publishers. Available at: http://www.commbuild.org/documents/himmcola.html. [Accessed April 2, 2015].

Hirsch-Kreinsen, H., 2008. “Low-Tech” Innovations. Industry and Innovation, 15 (1), pp.19–43.

Höjer, M. and Mattsson, L. (2000). Determinism and backcasting in future studies. Futures, 32 (7), pp.613-634.

Holmberg, J., 1998. Backcasting: A Natural Step in Operationalising Sustainable Development. Greener Management International, (23), 30–51. Retrieved from http://www.greenleafpublishing.com/greenleaf/journaldetail.kmod?productid=84andkeycontentid=8

Holmberg, J., Robert, K. H., 2000. Backcasting: a framework for strategic planning, International Journal of Sustainable Development and World Ecology 7, pp.291–308.

Holmberg, J., 2014. 4. Transformative learning and leadership for a sustainable future: Challenge Lab at Chalmers University of Technology. In P. B. Corcoran et al., eds. Intergenerational learning and transformative leadership for sustainable futures. Wageningen Academic Publishers, pp. 91–102.

Hooke, R.L., Martín-Duque, J.F. and Pedraza, J., 2012. Land transformation by humans: a review. GSA today: a publication of the Geological Society of America, 22 (12), pp.4–10.

Huxham, C. and Vangen, S., 2005. Managing to collaborate. Abingdon: Routledge. Available at: http://www.researchgate.net/profile/Siv_Vangen/publication/265599699_Managing_to_Collaborate_flyer/links/541536590cf2fa878ad3f0bf.pdf. [Accessed March 23, 2015].

Huxham, C., 1996. Creating collaborative advantage, London: Sage.

Inauen, M. and Schenker-Wicki, A., 2011. The impact of outside-in open innovation on innovationperformance. European Journal of Innovation Management, 14(4), pp.496-520.

International Wellbeing Group (2013). Personal Wellbeing Index: 5th Edition. Melbourne: Australian Centre on Quality of Life, Deakin University

Investopedia, 2003. Economy Definition, Investopedia. Available at: http://www.investopedia.com/terms/e/economy.asp [Accessed March 18, 2015].

Isaacs, W.N., 1993. Taking flight: Dialogue, collective thinking, and organizational learning. Organizational dynamics, 22 (2), pp.24–39.

Jerome, L. W., n.d., Taxonomy of Triple Helix Innovation - Asia Triple helix Society. Available at: http://www.triplehelixinstitute.org/sites/default/files/uploaded/documents/TaxonomyOfTripleHelixInnovation.pdf. [Accessed March 10, 2015].

Kaats, E. and Opheij, W., 2013. Creating Conditions for Promising Collaboration: Alliances, Networks, Chains, Strategic Partnerships, Springer Science and Business Media.

Kochhar, R., 2014. Projections for the global population in 2050.

Krishnaswami, O.R. and Satyaprasad, B.G., 2010. Business research methods, Himalaya Publishing House.

Liedtke, C., Jolanta Welfens, M., Rohn, H. and Nordmann, J., 2012. LIVING LAB: user-driven innovation for sustainability. Int J of Sus in Higher Ed, 13(2), pp.106-118.

Lincoln, Y.S. and Guba, E.G., 1985. Naturalistic inquiry, London: Sage.

Loorbach, D., 2007. Transition management: new mode of governance for sustainable development, Dutch Research Institute for Transitions (DRIFT).

Lozano, R., 2007. Collaboration as a pathway for sustainability. Sustainable Development, 15 (6), pp.370–381.

Madlener, R. and Sunak, Y., 2011. Impacts of urbanization on urban structures and energy demand: What can we learn for urban energy planning and urbanization management? Sustainable Cities and Society, 1 (1), pp.45–53.

March, James G., and Johan P. Olsen. 1989.Rediscovering Institutions: The Organizational BasisofPolitics. New York: Free Press.

Mattessich, P.W. and Monsey, B.R., 1992. Collaboration: What Makes It Work. A Review of Research Literature on Factors Influencing Successful Collaboration, Amherst H. Wilder Foundation, 919 Lafond, St. Paul, MN 55104.

Max-Neef, M., 1993. Human scale development: Conception, application, and further reflections. London: Apex Press.

McCann, J.E., 1983. Design Guidelines for Social Problem-Solving Interventions. The Journal of applied behavioral science, 19 (2), pp.177–189.

McCormick, K., Neij, L., Anderberg, S. and Coenen, L., 2011. Advancing sustainable urban transformation. Journal of Cleaner Production, 19(13), pp. I-II.

Meadows, D., 1997.Places to Intervene in a System.Whole Earth Catalog. Available online at: http://www.wholeearth.com/issue/2091/article/27/places.to.intervene.in.a.system# [Accessed February 25 16, 2015].

Melamed, C., Hartwig, R. and Grant, U., 2011. Jobs, growth and poverty: what do we know, what don't we know, what should we know? Growth, 18 (6), p.10.

Mulvenna, M., Bergvall-Kareborn, B., Wallace, J., Galbraith, B., Martin, S., 2010. Living labs as engagement models for innovation. eChallenges, 2010, pp. 1-11, Warsaw: IEEE.

Neck, C. and Houghton, J., 2006. Two decades of self-leadership theory and research. Journal of Managerial Psych, 21 (4), pp.270-295.

Nevens, F., Frantzeskaki, N., Gorissen, L. and Loorbach, D., 2013. Urban Transition Labs: co-creating transformative action for sustainable cities. Journal of Cleaner Production, 50, pp.111-122.

OECD, 2013. OECD Guidelines on Measuring Subjective Well-being, OECD Publishing.

Ostrom, E., 1998. A Behavioral Approach to the Rational Choice Theory of Collective Action Presidential Address, American Political Science Association, 1997.The American political science review, 92 (01), pp.1–22.

OWG, 2014. Open Working Group proposal for Sustainable Development Goals.

Paulus, B.,Nijstad, P. and A., B. 2013. Group creativity: innovation through collaboration. New York: Oxford University Press, Inc., pp.326-328.

Pisano, U., 2012. Resilience and Sustainable Development: Theory of resilience,systems thinking and adaptive governance. ESDN Quarterly Report 26.

Quist, J. and Vergragt, P., 2006. Past and future of backcasting: The shift to stakeholder participation and a proposal for a methodological framework. Futures, 38(9), pp.1027-1045.

Robinson, J., 1982. Energy backcasting: a proposed method of policy analysis. Energy Policy 10 (4), 337 – 344.

Radzicki, M.J. and Trees, W.S., 1995. A system dynamics approach to sustainable cities. Systems Dynamics Proceedings, 1, pp.191–210.

Raworth, K., 2008. Climate wrongs and human rights. Oxford: Oxfam International.

Robert, K.H., Daly, H., Hawken, P. and Holmberg, J., 1997. A compass for sustainable development. International Journal of Sustainable Development and World Ecology, 4 (2), pp.79–92.

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F., Lambin, E., Lenton, T., Scheffer, M., Folke, C., Schellnhuber, H., Nykvist, B., de Wit, C., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R., Fabry, V., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P. and Foley, J. (2009). A safe operating space for humanity. Nature, 461(7263), pp.472-475.

Roome, N., 2001. Metatextual organizations: Innovation and adaptation for global change. Centre for Sustainable Development and Management, Erasmus University.

Rosado, L., Hagy, S., Kalmykova, Y., Morrison, G., and Ostermeyer, Y., 2015. A living lab co-creation environment exemplifying Factor 10 improvements in a city district. Journal of Urban Regeneration and Renewal 8 (2), pp.171–185.

Rosales, N., 2011. Towards the Modeling of Sustainability into Urban Planning: Using Indicators to Build Sustainable Cities. Procedia Engineering, 21, pp.641-647.

Rotmans, J., van Asselt, M., Anastasi, C., Greeuw, S., Mellors, J., Peters, S., Rothman, D. and Rijkens, N., 2000a. Visions for a sustainable Europe. Futures, 32(9-10), pp.809-831.

Rotmans, J., van Asselt, M. and Vellinga, P., 2000b. An integrated planning tool for sustainable

cities.Environmental Impact Assessment Review, 20 (3), pp.265-276.

Ryan, R. and Deci, E., 2000. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist, 55 (1), pp.68-78.

Sadorsky, P., 2013. Do urbanization and industrialization affect energy intensity in developing countries? Energy Economics, 37 (0), pp.52–59.

Saez, E. and Berkeley, U.C., Striking it Richer: The Evolution of Top Incomes in the United States (Updated with 2012 preliminary estimates).

Sandow, D., & Allen, A. M. (2005). The nature of social collaboration: How work really gets done. Reflections: The SoL Journal on Knowledge, Learning, and Change, 6(2/3), 1-14.

Schaffers, H., Cordoba, M., Hongisto, P., Kallai, T., Merz, C., Rensburg, J., 2007. Exploring business models for open innovation in rural living labs. Available at: http://researchspace.csir.co.za/dspace/handle/10204/1583 [Accessed March 22, 2015].

Seiffert, M. and Loch, C., 2005. Systemic thinking in environmental management: support for sustainable development. Journal of Cleaner Production, 13 (12), pp.1197-1202.

Sen, A., 1999. Development as freedom. New York: Knopf.

Simmie, J. and Martin, R., 2010. The economic resilience of regions: towards an evolutionary approach. Cambridge Journal of Regions, Economy and Society, 3 (1), pp.27-43.

Spithoven, A., Frantzen, D. and Clarysse, B., 2010. Heterogeneous Firm-Level Effects of Knowledge Exchanges on Product Innovation: Differences between Dynamic and Lagging Product Innovators,Journal of Product Innovation Management, 27 (3), pp.362–381.

Sukhdev P: Costing the Earth. Nature 2009, 462:277.

Sullivan, A. and Sheffrin, S.M., 2003. Economics: Principles in action. Upper Saddle River, New Jersey 07458: Pearson Prentice Hall.

Thomson, A.M. 2001. Collaboration: Meaning and Measurement. Ph.D. diss., Indiana University – Bloomington.

Thomson, A.M. and Perry, J.L., 2006. Collaboration processes: Inside the black box. Public administration review. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1540 6210.2006.00663.x/full [Accessed April 2, 2015].

Trist, E., 1983. Referent Organizations and the Development of Inter-Organizational Domains. Human relations; studies towards the integration of the social sciences, 36 (3), pp.269–284.

UNDESA, 2010. Trends in Sustainable Development - Towards Sustainable Consumption and Production 2010-2011. Sustainable Development Knowledge Platform. Available at: https://sustainabledevelopment.un.org/index.php?page=viewandtype=400andnr=15andmenu=1572 [Accessed March 16, 2015].

US EPA, O. of R.A.D. and US EPA, Office, Real org responsible for content spelled out, 2009. Sustainability, EPA Research, EPA. Available at: http://www.epa.gov/sustainability/index.htm.

Van der Elst, K., and Davis, N., 2014. The Future Availability of Natural Resources A New Paradigm for Global Resource Availability.

Veeckman C., Schuurman D., Leminen S., Westerlund M., 2013. Linking Living Lab Characteristics and Their Outcomes: Towards aConceptual Framework. Technology InnovationManagement Review, 3 (2). Available at:http://timreview.ca/article/748.

Vinnova, 2013. Framtidens hållbara boende - Vinnova. Available at: http://www.vinnova.se/sv/Resultat/Projekt/Effekta/2011-01544/Framtidens-hallbara-boende/[Accessed March 20, 2015].

Vlaar, P.W.L., Van den Bosch, F.A.J. and Volberda, H.W., 2006. Coping with Problems of Understanding in Interorganizational Relationships: Using Formalization as a Means to Make Sense. Organization Studies, 27 (11), pp.1617–1638.

Von Hippel, E., 2005. Democratizing innovation: The evolving phenomenon of user innovation. Journal fürBetriebswirtschaft, 55 (1), pp.63–78.

Waddock, S., 2013. The Wicked Problems of Global Sustainability Need Wicked (Good) Leaders and Wicked (Good) Collaborative Solutions. Journal of Management for Global Sustainability, 1 (1), pp.91–111.

Wang, P. and Bai, Y., 2012. The Theoretical Analysis on the Allocation of Urbaz Resources Based on Agglomeration Economies. In Affective Computing and Intelligent Interaction. Springer Berlin Heidelberg, pp. 881–890.

Weber, E.P. and Khademian, A.M., 2008. Wicked Problems, Knowledge Challenges, and Collaborative Capacity Builders in Network Settings. Public administration review, 68 (2), pp.334–349.

Westerlund, M. and Leminen, S., 2011. Managing the challenges of becoming an open innovation company: experiences from Living Labs. Technology Innovation Management Review, 1 (1). Available at:http://timreview.ca/article/489 [Accessed March 2, 2015].

Winer, M. and Ray, K., 1994. Collaboration Handbook: Creating, Sustaining, and Enjoying the Journey, Amherst H. Wilder Foundation, 919 Lafond, St. Paul, MN 55104.

Wood, D.J. and Gray, B., 1991. Toward a Comprehensive Theory of Collaboration. The Journal of applied behavioral science, 27 (2), pp.139–162.

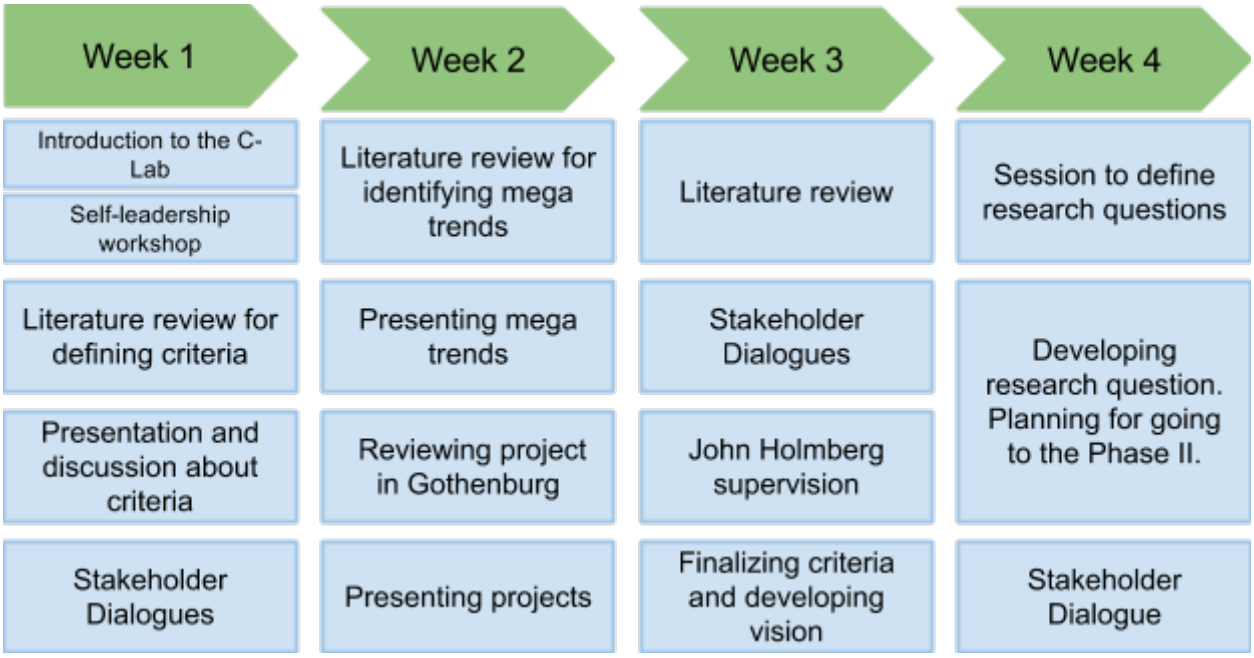
Yström, A., 2013. Managerial practices for open innovation collaboration: Authoring the spaces "in-between." PhD diss. Chalmers University of Technology.

Zaltman, G., 2003. How customers think. Cambridge: Harvard Business School Press, Harvard University.

Zlotnik, H. ed., Population Distribution, Urbanization, Internal Migration and Development: An International Perspective, United Nations, Department ofEconomic and Social Affairs PopulationDivision.

Appendix

Appendix A: Schedule for the Phase I in the C-Lab



Appendix B: Global trends regarding sustainability

Global trends

In order to understand how the global trends influence on societal challenges, the funnel concept was applied as a framework for investigation.

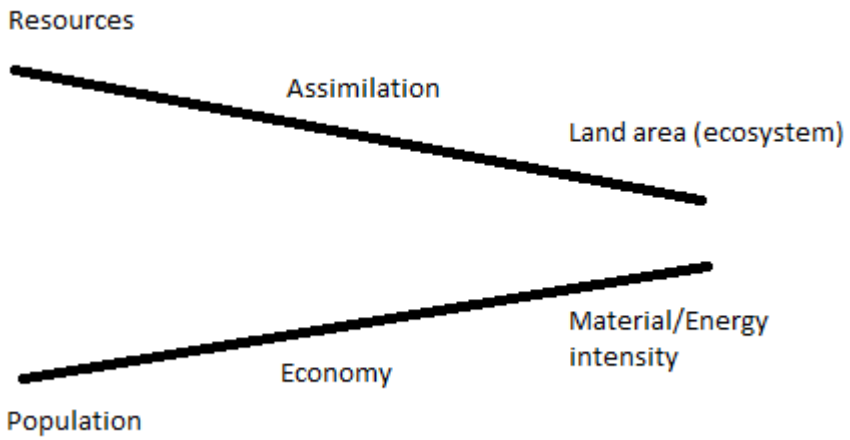


Figure 14: The funnel simply represents that the room to maneuver is becoming narrower (Robèrt et al. 1997)

Population

It was forecasted by United Nations (2011) that there will be approximately ten billion people globally in 2050 (Zlotnikn.d.). The total number of world population is increasing; high growth in developing countries (UNDESA 2010), but the overall growth rate is declining. This could be caused by the falling fertility rate and mortality rate (Zlotnikn.d.) Accordingly, there have been both a shift of median age and a change in structure of population by age toward more ageing society (Anon n.d.). This can imply that those countries with ageing population such as Germany, Japan may have to support more dependents such as elderly over 65 (Kochhar 2014).

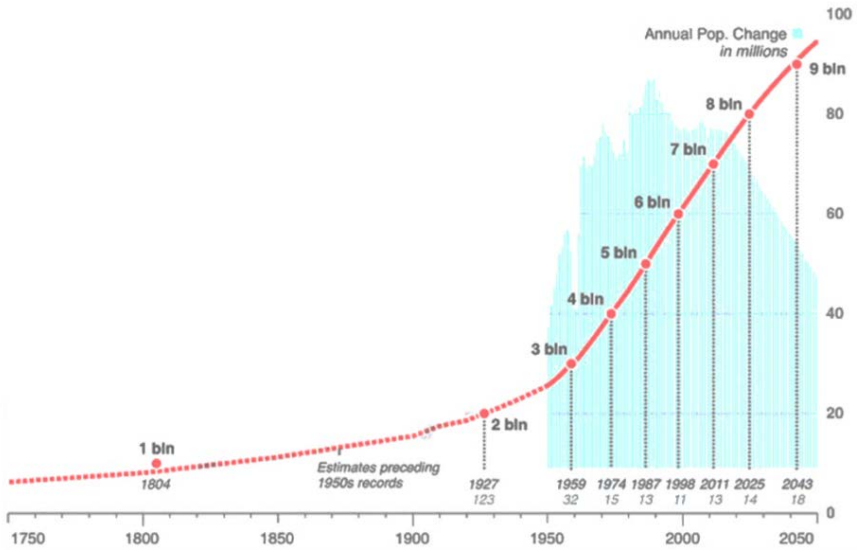
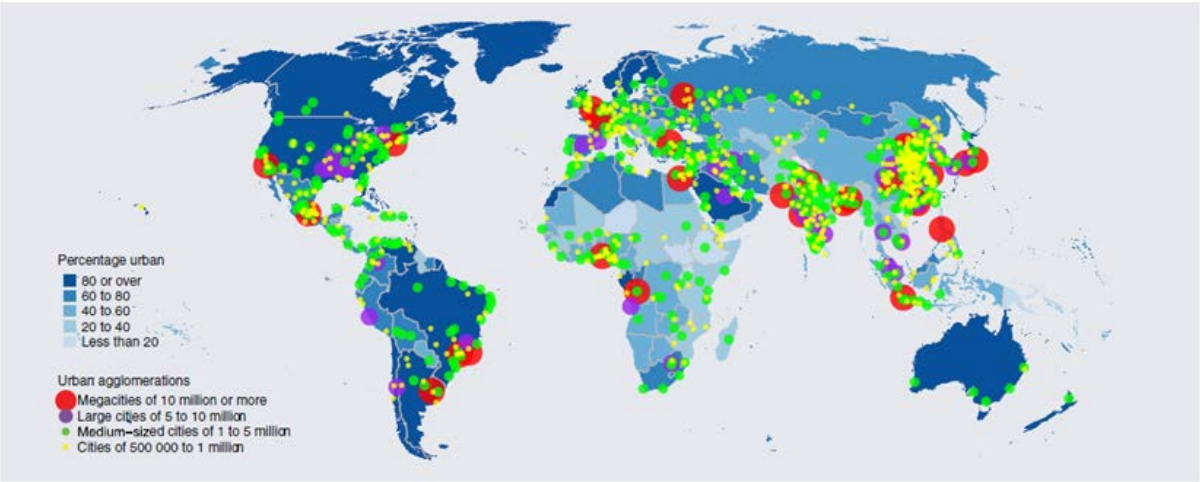


Figure 15: Global population growth predicted by UN

Source: United Nations, Socioeconomic Data and Application Centre, Populationaction.org (2011)

Meanwhile, over 60% of global population will accumulate in urban areas (Zlotnikn.d.). Due to "rural-to-urban migration" trend, there are 180,000 people moving to cities every day or estimated two people per second into cities (Zlotnikn.d.). Currently, several developed countries in Europe such as Germany already have more than half of their population in city areas (Zlotnikn.d.). Compared to that of developed countries, the annual growth rate of urbanization in developing countries is more than three times (Zlotnikn.d.). However, the total estimated number of slum dwellers is also continuously rising (UNDESA 2010).



Note: The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Figure 16: Percentage urban and location of urban agglomerations with at least 500,000 inhabitants, 2014

Source: (Anon 2014c)

Economy

As defined by investopedia, economy is the large set of interrelated economic production and consumption activities, which aid in determining how scarce resources are allocated (Investopedia, 2003). As a consequence of industrialized economy, where extensive manufacturing technologies drove production of consumer goods into the market, economic development and social change have also happened along the time (Sullivan and Sheffrin 2003). Incomes and exchanging activities in the market have become main drivers of economic growth and consumption rate (Zlotnikn.d.). The performance of economic activities of each country is commonly measured by Gross domestic product (GDP). In the report from UN, it showed that several countries with the fastest GDP growth since 1980 experienced rapid growth in energy use and oil consumption (UNDESA 2010).

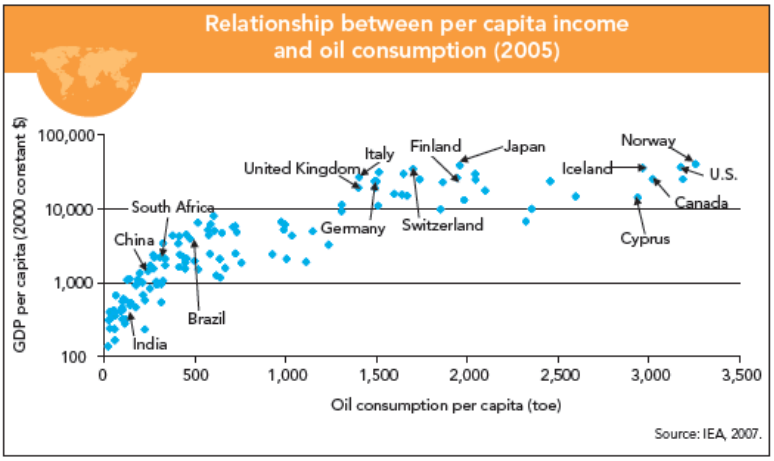


Figure 17: Relationship between GDP per capita and oil consumption across countries(UNDESA 2010)

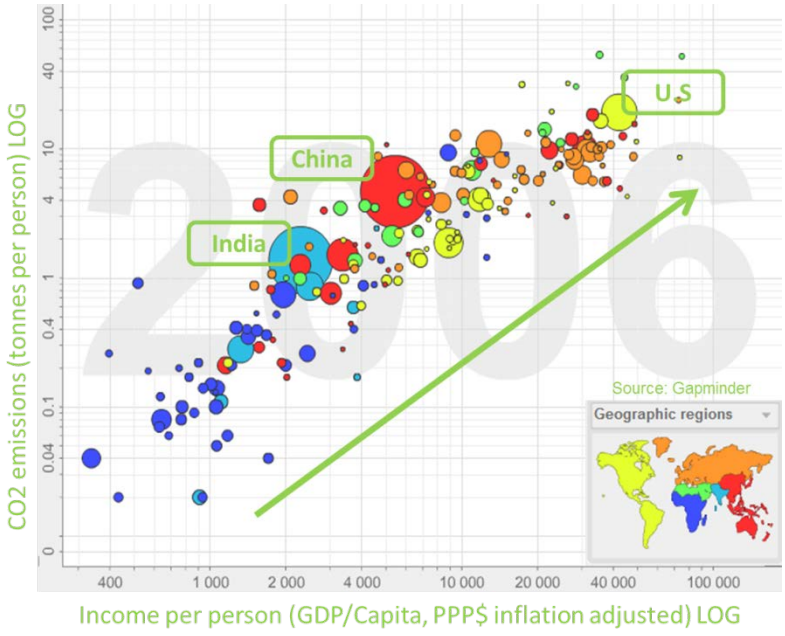


Figure 18Figure 18: Relationship between CO2 emissions and income per person(Anon n.d.)

In social aspect, economic growth, employment, and poverty reduction are inter-related (Melamed et al. 2011). In order to have a better employment opportunity, a number of people decide to migrate into urban areas due to concentration of activities such as production, employment are common in several big cities (Anon n.d.). However, based on recent publication by Piketty, the figure 19 shows that the share of top percentile in total income among Anglo-Saxon countries[1] is increasing, similar to that of first half of twenty century. Moreover, this is supported by another research by Saez that the top decile income share in the U.S. reached new high at slightly over 50% in 2012 (Saez and Berkeley n.d.). It can imply that the rising inequality is becoming a global phenomenon (Cassidy 2014).

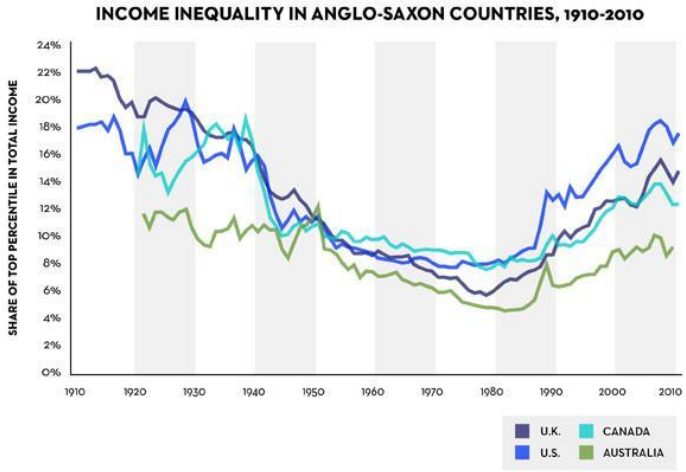


Figure 19: Income inequality in Anglo-saxon countries, 1910-2010(Piketty and Goldhammer 2014)

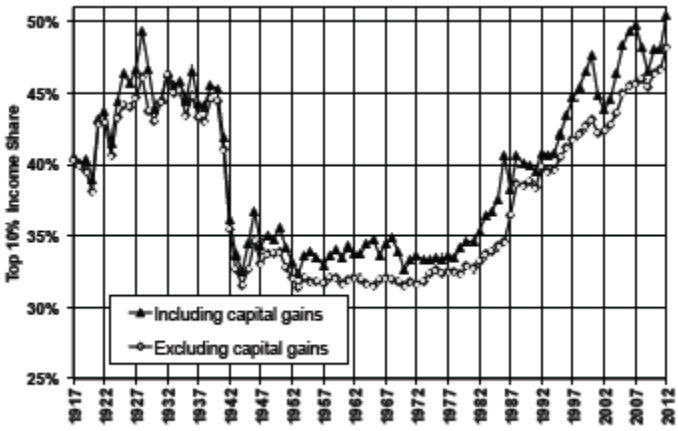


Figure 20: The top decile income share, 1917-2012 (Saez and Berkeley n.d.)

Piketty argued that at the point that rate of return from capital exceeds economic growth shown in figure 20, the inequality are likely to rise since the incomes from capital are growing faster than those incomes from wages, which a large group of people depend on. Unequal ownership of assets, not unequal wages, seem to be the key driver of income disparities (Piketty and Goldhammer 2014).

[1] Anglo-Saxon countries are referred to Australia, Canada, and the United Kingdom

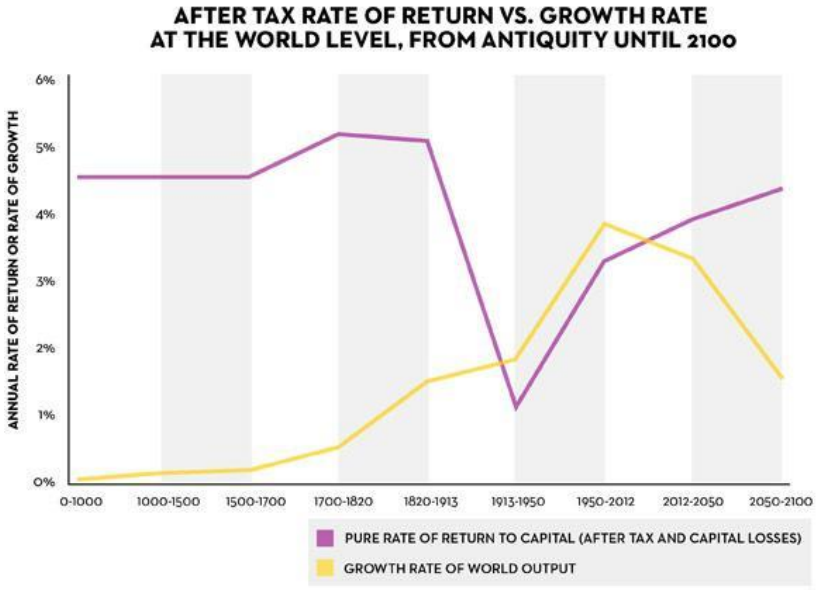


Figure 21: Comparison between rate of economic growth and rate of return to capital (Piketty and Goldhammer 2014)

In the era of growing inequality, the traditional economic framework is becoming obsolete.

(de Grave n.d.), while collaborative economy is introduced as a potential alternative of new economic paradigm, "Access over ownership" concept of collaborative economy, which relies on horizontal networks and distributed power within communities (de Grave n.d.).

Material/Energy Intensity

Material/energy intensity are defined as a measurement unit for determining the amount of material or energy needed in producing a certain product. As an indicator for sustainable development, the less intensity of either material or energy is, the more efficient production is.

As the figure shown below, the material intensity in developed regions such as Europe and US has steadily declined due to the improvement of material efficiency (Anon 2014a). Meanwhile, the material intensity of Asia has been increased rapidly since 2000. It can imply that international trade and relocation of material intensive economic activities to Asia could support the rise of Asia's material extraction. In overall, the world average of material intensity hardly decreases, potentially resulting in exhaustion of materials for global demands. According to a research in 76 developing countries by Sadorsky (Sadorsky 2013), it was stated that the impacts of urbanization on energy intensity are mixed. Even though the net-effect of urbanization is to increase energy intensity from the concentrate of consumption and production, one percent of increase of economic activities by urbanization can provide an opportunity to increase energy efficiency and reduce energy intensity by -0.45% to -0.35% due to economies of scale.

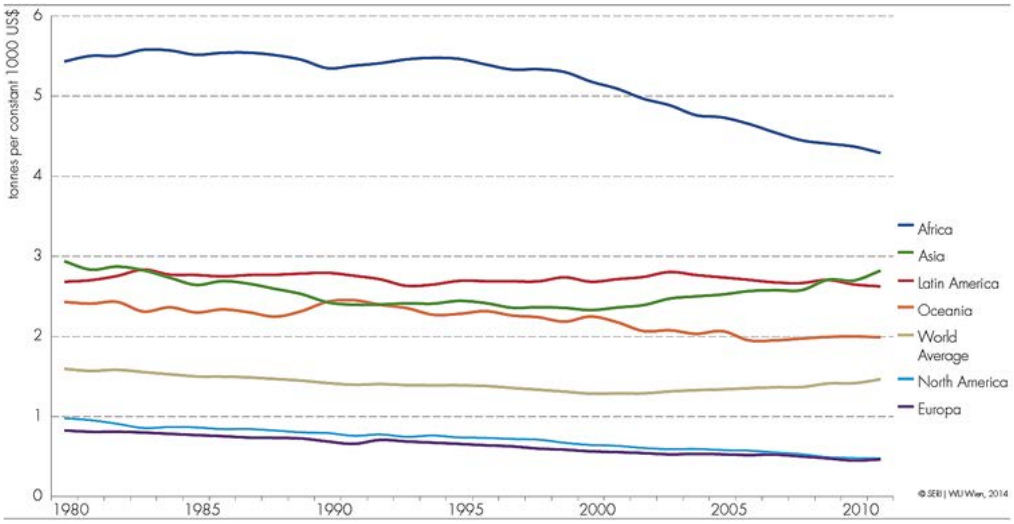


Figure 22: Material intensity of six world regions and the world average in relation to constant GDP

(Anon 2014a)

Resources

Considering the other side of funnel, the trend of resource availability tends to align with the speculation in previous section that there are potential threats of resource exhaustion (Van der Elst et al. 2014). The global population growth also influences on resource consumption rate, as the UN report in 2010 stated that the consumption of mineral resources, including fossil fuels, per capita has been increased dramatically.

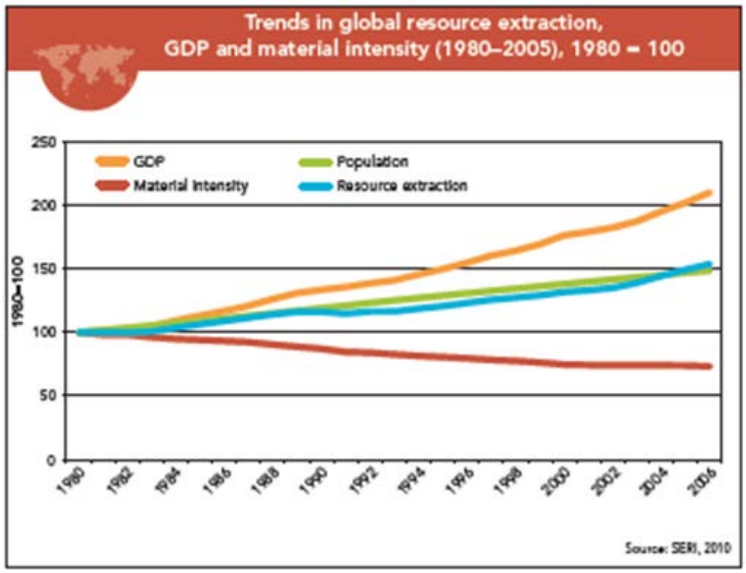


Figure 23: Trends between resource extraction and population growth (UNDESA 2010)

The accelerating material and fossil energy demand among global population has also started to be perceived in commodity prices (UNDESA 2010) as shown in Figure 24 and Figure 25.

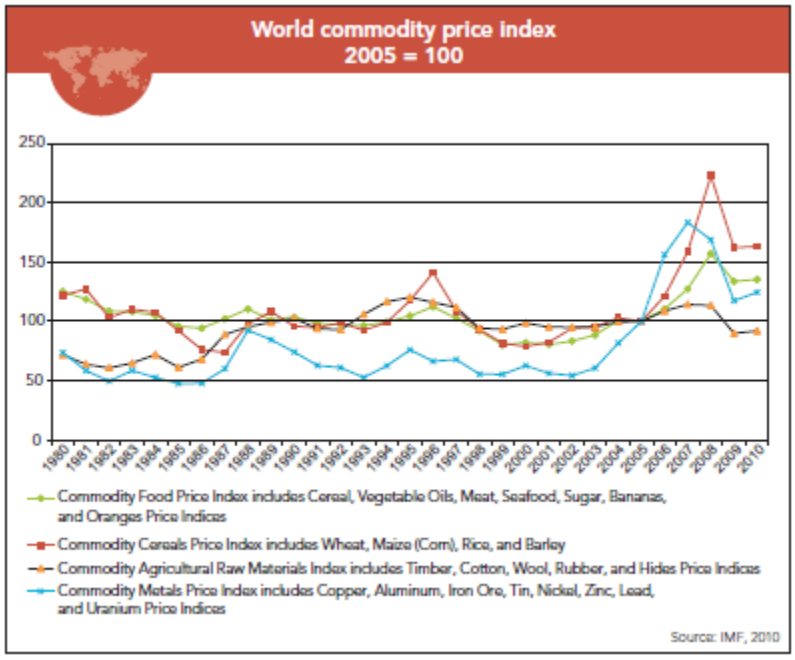


Figure 24: World commodity price index (UNDESA 2010)

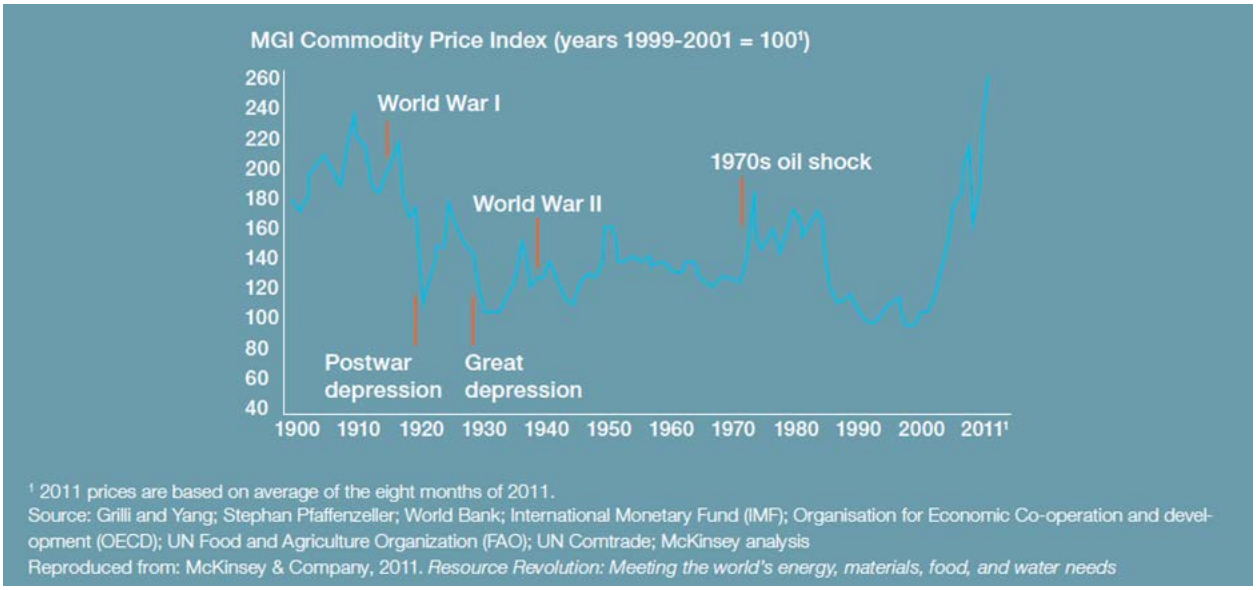


Figure 25: MGI commodity price index (Anon 2014b)

As mentioned in economy trend that those countries with high GDP growth rate are likely to experience high energy consumption, it can imply that the growth in population, income and wealth are expected to

put higher pressure on resource allocation. According to the research on agglomeration economy by (Wang and Bai 2012), it is argued that the urban agglomeration economics have stronger effect in resource allocation than localization economies.

Land area

As a result of global population trend, it is obvious that a large amount of land areas have been modified and utilized for human population. It was estimated by Hooke, Martin-Duque and Pedraza (2012) (Hooke et al. 2012) that over fifty percent of land have been allocated for human activities such as agriculture, building shelters, finding medicines, industrial production, mineral extraction, etc. In addition, urbanization trend also significantly increases concentration of consumption and space utilization in urban areas.

Assimilation capacity

By definition, assimilation capacity means the ability of the environment to carry waste materials without negative effects on the environment or on users of its resources. So, the pollution in the environment only occurs when this assimilation capability is exceeded (encyclopedia). Due to the urbanization trend, it can be implied into multi-aspects of the consequences such as water and energy consumption, building construction, materials and resources consumption, waste generation. The concentration of these activities is likely to affect the assimilative capacity of urban areas. It is argued that cities account for 75% of global resource consumption (Madlener and Sunak 2011) together with over 70 percent of GHG emissions from production-based activities in developed countries (Grimm et al. 2008). In addition, the effect of urbanization is stronger than that of population on emission to atmosphere as illustrated in Figure 26.

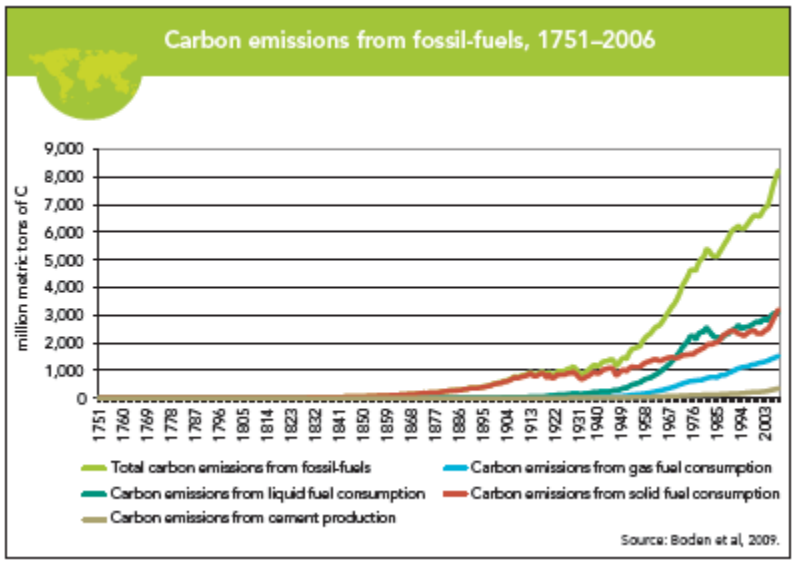


Figure 26: Carbon emissions from fossil-fuels (1751-2006)

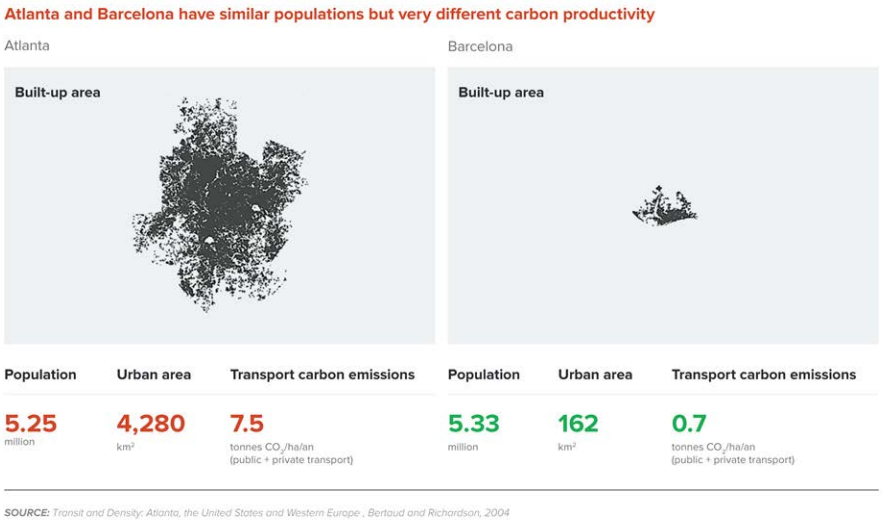


Figure 27: Comparing the amount of carbon emission between Atlanta and Barcelona (2004)

Consequently, urban areas really need to be taken into consideration in order to take actions for regaining their assimilative capacities.

Appendix C: Links of web pages used for reviewing projects

Link of web pages
http://www.mistraurbanfutures.org/en
http://www.goteborg2021.com/
http://gmv.gu.se/
http://goteborg.se/

Appendix D: List of stakeholders who came to the Challenge lab

Stakeholders	Subjects
Leonardo Rosado	Johanneberg District Factor 10
Area of Advance	Projects on campus Johanneberg
HolgerWallbaum	District projects
Shea Hagy	HSB living lab
Gunnar Ohlin	Electricity bus project

Appendix E: Interview guideline – project coordinator

First interview with the project coordinator and a researcher to understand the project.

HSB living lab in overall

- What is the living lab? How does it differ from other kinds of collaboration project or user-oriented research?
- What do you mean with third generation of living labs?
- What are the ultimate goals of HSB living lab?
- What is the plan for HSB living? (Short-term, Long-term)
- Who own the HSB Living lab?
- How will the HSB Living lab diffuse the innovations developed in the lab to the society?
- As I heard there is a ten-year timeframe for the living lab, what would be the next step after ten years?

Company-related

- , which companies are invited to participate in this living lab?
- How are these companies selected and invited?
- Is there any plan for involving more companies?
- Why these companies would like to join in this kind of collaboration?
- What do they expect from the collaboration? What would they get from participating in the living lab?
- How will you manage the results from this collaboration?

Operation-related

- Do you have any regular meeting with these companies or any other stakeholders? What are the purposes of these meeting? Who will be the one who facilitates this kind of meeting?
- What are the most common challenges that occur in these meetings? How did you deal with them?

Appendix F: Interview guideline – project manager

First interview with the project manager of HSB.

Objective:

To understand the current situation from HSB's perspective and understand the goals and visions of HSB on the living lab project.

HSB's vision and perspective

- Why did HSB decide to be a part of this living lab project?
- What is the HSB's vision for the project?
- What do you expect from investing in this living lab as your infrastructure?
- According to the goals and expectations that you mentioned, what is your plan for achieving them?
- What would be the contribution of HSB on the living lab project? (e.g. financing, human resources)

Partner companies

- How did you choose the partner companies for the HSB living lab project?
- What would be your expectation toward these partner companies in contributing for the living lab project?
- Do you think that these partner companies share the same vision with your company?

Type of ideas

- Who is responsible for gathering ideas and selecting, which ideas should be implemented or tested in the living lab?
- So, which type of projects should be implemented in this living lab? (e.g. innovative project) Do you have any criteria for idea selection so far?

Appendix G: Interview guideline – partner companies

Interview with partner companies and HSB

Basic information:

- Please explain what is your role and responsibility in your organization
- What is your role and responsibility in the HSB living lab project?
- Have you had experiences working in projects similar to HSB living lab?

Self-interest:

- Why your organization was interested to be part of the living lab project?
- What is your company's goal from participating in the project?
- How do you see the benefits of the project for your company?

The problem:

- What is the problem that partners are going to solve together?

Sustainability

- What is the role of sustainability in the project?
- Do you have sustainability vision in your company?
- Is sustainability defined for the project?

Perception

- How do you perceive the living lab platform?
- How do you define the living lab project for someone who has no idea about the living lab?
- What would be the ideal outcomes of the living lab project?

Expectation

- How do you expect to collaborate with other partner companies? (Just sharing info/Co-create ideas/Co-develop solutions)How?
- How do you expect to collaborate with researchers and university?(Just sharing info/Co-create ideas/Co-develop solutions)How?
- How do you see the role of users (students who are going to live in the living lab)? (Just sharing info/Co-create ideas/Co-develop solutions)How?
- What kind of ideas /projects that should be implemented in the living lab platform?

Contribution

- How many people are assigned to support this project?
    - How is it going to be in the long term?
- How are you going to provide your ideas to the LL?
- How are you going to contribute financially?

Challenges

- What challenges are you facing in the project?
- What would be the challenges of this project in long-term?

Appendix H: Interview guideline – university representative

Interview with the university representative (project initiator)

- How the HSB living lab project was initiated?
- How do you see sustainability? What is the definition about sustainability in the living lab from your perspective?
- Do you have some framework or some things that are clear that all the partners can understand because when we were talking about this to them, they haven't mentioned about it at all?
- How do you see the role of users?
- Are you going to have some processes to use their ideas or feedback?
- What do you expect from partners?
- Are you going to define some projects with those partners?
- About workshop that you had with companies, are you going to have more kind of those workshops?
- What have you done to communicate the ideas that you have with those partners?
- What is the obstacle here?
- How do you think it can get better? (To put all partners in one page)
- How the university is going to contribute to the project?
- Are those partner companies going to make decision with Chalmers and HSB?
- If there are competing research projects from both partners and sponsors, how can the projects be selected?
- What is the problem that partners are going to solve together?