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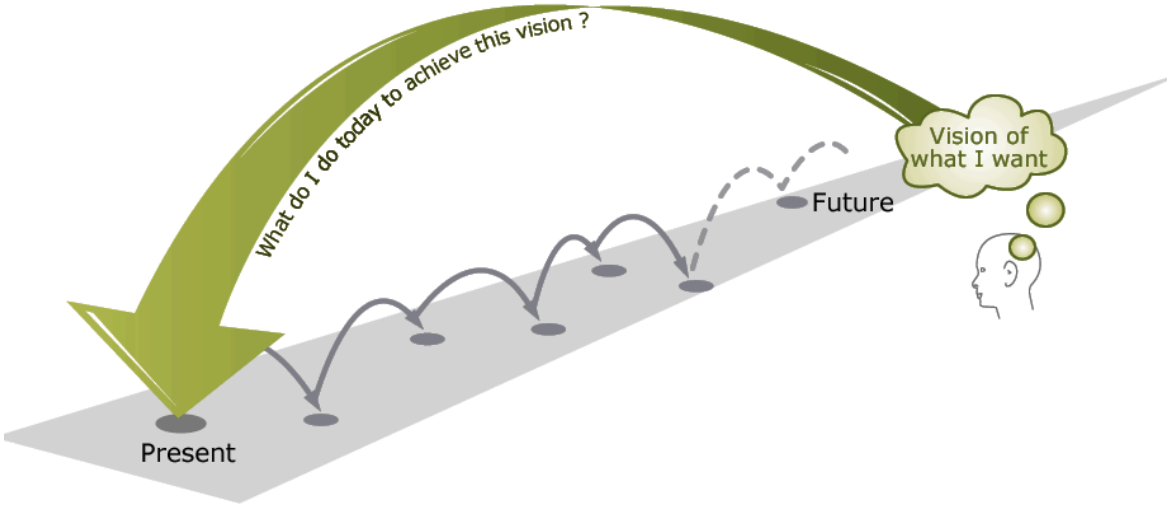

Insights from a benchmarking study of backcasting processes

Applied on the low-carbon transition of Västra Götaland

Master's Thesis in Sustainable Energy Systems

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Master's Thesis in Environmental Engineering and Urban Planning

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Cover:
[The backcasting framework as developed by The Natural Step,
giving an overview of the philosophy of the methodology that is used in this thesis]
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Insights from a benchmarking study of backcasting processes

Applied on the low-carbon transition of West Sweden

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Abstract

Increasing concerns are being raised about the symptoms of the present unsustainable trends linked to the systems we have built up to fulfill our needs. This calls for a transition in systems related to energy supply, mobility, agriculture, and consumption. In order to successfully contribute to this transition challenge criteria for urban sustainable development were set up. The criteria were then set in relation to the current situation to identify a local leverage point where the system could be intervened. In this leverage point a research project was defined to contribute to the low-carbon transition project conducted by The Regional Council Västra Götaland [VGR] with the purpose to by 2030 cut the dependence on fossil fuels within the region and by 2050 be fossil free.

This thesis benchmarked backcasting projects in Canada, The Netherlands and Sweden to identify enabling factors for backcasting projects to reach their full potential. Factors identified were categorized in eleven areas and combined with theories related to transition management. These were then applied on the current operations within the VGR-project with the objective to create an action-plan based on scenarios towards a fossil-independent region by 2030 by using backcasting.

The main findings indicate that the multi-stakeholder dialogue process would gain from a participatory backcasting framework, whereas the current VGR approach leans towards an Innovation Lab. To strengthen the long-term approach originating from the project the shared governance needs to integrate more perspectives to not only focus on environmental criteria and climate change. An important factor to support the long-term development of the transition project is to evaluate the process as well as realize follow-ups and monitor achievements of the action plan. Finally, the role of citizens in the process needs to be specified in order to reach the deliberation level wished for.

Keywords: backcasting, sustainability, climate change, low-carbon transition, multi-stakeholder dialogue, challenge lab, change agent

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Finally, this work would not have been possible without the support of international researchers and practitioners of backcasting who accepted to answer our many interview questions. We are grateful for the opportunity offered by Birgitta Nilsson, Amanda Martling and Jörgen Larsson from the project group of the Västra Götaland Regional Council to let us be observers and inquirers of their transition process and for the chance to contribute at our level to the design and the progress of the regional low-carbon transition for a ‘good life’.

We would also like to thank Martin Sande and Bernard le Roux among others who have not been directly involved in this thesis but who have helped us along the way to broaden our perspectives and give us feedback on our thoughts.

Glossary

COOL: Climate OptiOns for the Long Term
DRIFT: Dutch Research Institute for Transitions
GHG: green house gas emission
TM: Transition management
UTM: Urban Transition Management
VGR: Regional Council Västra Götaland
CMAP: Chicago Metropolitan Agency of Planning
MLP: Multi-level perspective

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1 Introduction

Fundamental social changes are required to tackle our present unsustainable way of fulfilling many societal needs (e.g. energy, mobility, food production). One major symptom of this unsustainable way of living is climate change. Governments agreed in the Copenhagen Accord (UNFCCC, 2010) to reduce emissions enough to keep global average surface temperatures from rising to 2°C above pre-industrial levels in order to limit dangerously disruptive climate impacts. The International Energy Agency warned the nations that "the world is not on track to meet the target agreed by governments to limit the long-term rise in the average global temperature to 2 degrees Celsius" (IEA, 2013, p. 9). A low-carbon transition is needed to change the current trends regarding global greenhouse gas (GHG) emissions.

The Västra Götaland Regional Council (VGR) in Sweden is currently setting up a process to develop an action plan with concrete actions directing the region towards a low-carbon transition, being fossil independent (80% GHG reductions compared to 1990 levels) by 2030 and fossil free by 2050. This master thesis was part of The Challenge Lab and was developed in collaboration with VGR to examine the potential of implementing a backcasting framework by identifying enabling factors for such a process to succeed initiating a transition at a regional scale.

Below a short presentation will be given of The Challenge Lab and the background of the VGR low-carbon transition project followed by the purpose, research question, scope and delimitations of this thesis.

1.1 The Challenge Lab

The Challenge Lab is a space for master students to "take on the planet's biggest challenges together with industry clusters, government and academia" (The Challenge Lab, 2014, *Home section*). The Challenge Lab can be described as:

- A process based on backcasting (Holmberg & Robert, 2000) and dialogue;
- A laboratory to prototype and experiment transformation;
- A void from today's problems to envision new solutions;
- A platform for developing a systemic vision where our social and economic systems support nature and human wellbeing;
- A vision of 10 billion happy people on this planet.

The Challenge Lab is all that and everything else the students design it for, in order to facilitate local initiatives addressing global challenges. The Challenge Lab was created in 2014 to enable students to develop their role as change agents taking on societal challenges. They seem to be capable of being both unthreatening to the societal actors in power today and challenging dominant trends by focusing on sustainability transition (Holmberg, 2014).

This year the Challenge Lab story began with a preparation course on the theme *leadership for sustainability transitions*. Part of the course was a 'sustainable campus' project where the students in a backcasting exercise characterised a desirable campus in the future, identifying the gaps with today's situation and finally developed and assessed scenarios for the transition to come. The attention and interest generated amongst the stakeholders of Chalmers was very positive and became a good illustration of the potential by using backcasting building on a desirable future vision in order to move forward.

The Challenge Lab master thesis 2015 was on the theme *sustainable urban development* and the first month was dedicated to the *Phase 1,* where the 13 students in dialogue with a variety of stakeholders identified gaps between today's situation regarding urban development and the vision of a sustainable society. By building upon personal strengths and local opportunities each student or as a team of two developed a research project. These research projects were defined to have the potential to positively influence Gothenburg, Sweden and the world towards a sustainability transition, which was the *Phase 2* of the thesis conducted during the next three months. The results were to be shared with the stakeholders related to each research project during a final presentation at Lindholmen Visual Arena.

Below an introduction will be given of the *Phase 2* project identified.

1.2 Project background

The political board of VGR has decided on the goal of becoming independent of fossil energy by 2030 (e.g. heat, electricity, transportation). Currently the local and regional governmental bodies in collaboration with academia are trying to design a backcasting process that will result in a strategy for reaching the target. A major process is to be carried out during 2015 involving inhabitants, companies, governmental officials, researchers and politicians.

The GHG emissions per capita in the Västra Götaland County were during 2012 approximately 7 ton and has decreased by approximately 10% since 1990 (Naturvårdsverket, 2015). This was calculated by dividing the total GHG emissions within the regional boundaries (Figure 1) with the number of inhabitants living there and is thus a top-down approach to calculate the emissions

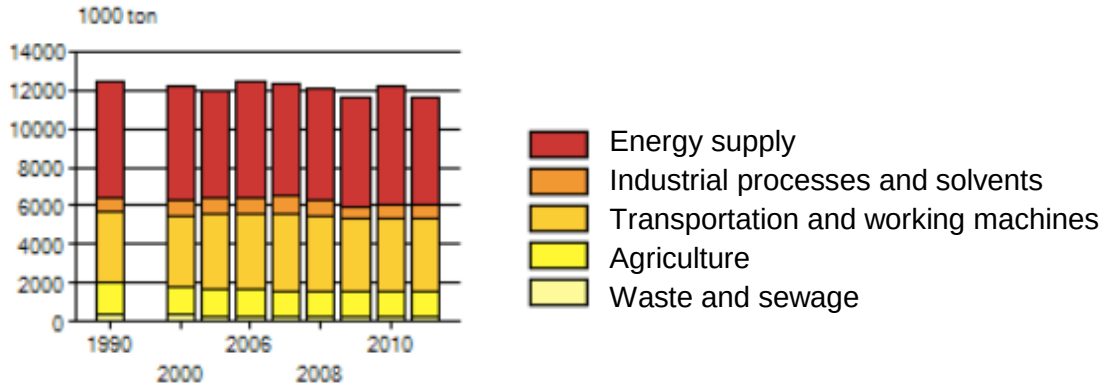

Figure 1 - Total greenhouse gas emissions within the Västra Götaland County per sector (Naturvårdsverket, 2015)

Another way to calculate the emissions in (caused by) the region is to use a bottom-up approach looking at the emissions from each citizen's consumption. Then the emissions are accounted for no matter in the world they occurred. No such calculations have been made regarding the Västra Götaland County but in a recent study made by Larsson & Bolin (2014) the consumption-based emissions as of 2010 in Gothenburg were 7.4 Mton per person (Figure 2).

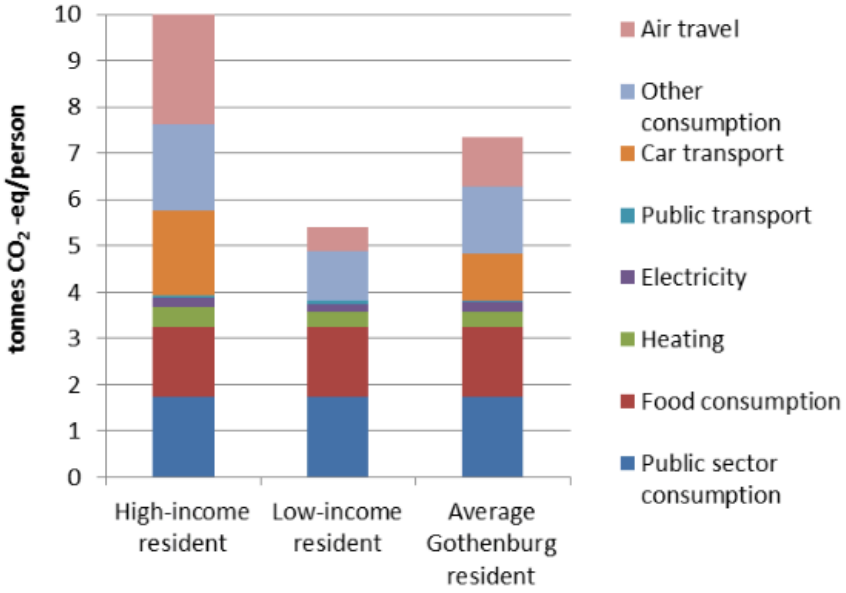

Figure 2 - Emissions from the different typical households in Göteborg in 2010 sub-divided into different domains (Larsson & Bolin, 2014)

Both ways of calculating the emissions gives the implication that much has to be done in order to reach the goal of being fossil independent by 2030 and fossil free by 2050. In order to reach the 2 degree target adopted by the European Union stating that "the global annual mean surface temperature increase should not exceed 2°C above pre-industrial levels" (European Union Council, 2005, p.2) the emissions per capita and year in Sweden should be max 1-2 tons (Larsson & Bolin, 2014).

In the Swedish context this calls for a transition[1], as the current trends using either a geographical perspective or a consumers' perspective gives us indications that the GHG emission reductions are either happening too slow, or even going in the wrong direction (Naturvårdsverket, 2013). As it seems that current practices with incremental change through policy have up until today not been enough to solve the problems, researchers and practitioners are seeking out for complementary approaches.

VGR is currently conducting a project with the purpose to develop an action plan to initiate local actions going in line with their climate strategy to reach the targets. There is a strong will within the regional council's environmental division to identify win-win situations in this project to not only deal with the climate challenge but cross-fertilizing the actions with other societal challenges (Nilsson, personal communication, April 15, 2015) to get more credibility reaching out to a broader audience. During the fall multi-stakeholder workshops will be held on different themes to work further with the main challenges.

It is from this background that the purpose of this thesis and the research question will be formulated.

1.3 Purpose and research question

This thesis intends to contribute to the development of a climate transition at a regional scale by conducting research on how backcasting has been used to tackle long-term complex problems elsewhere, to gain key insights that could be useful to include when designing a process dealing with a low-carbon transition.

The purpose of this work is to develop new insights about how a low-carbon transition process could be designed and what the key enabling factors related to planning, execution and follow-up could be for such a multi-stakeholder backcasting project.

To fulfil the purpose, the following research question was formulated:
What are the main enabling factors for a backcasting project to reach its full potential and how can they be applied when designing a process for a low-carbon transition?

1.4 Scope and delimitations

In order to identify enabling factors for backcasting processes to be applied on a low-carbon transition project, the study will focus on backcasting and transition management theories as well as finding more process-oriented "know-how" by benchmarking projects that have used a backcasting approach.

[1] A low-carbon transition on a societal scale refers to the time-period during which change occurs from a society dependent on fossil fuels to a condition where it is not.

Emphasis on this thesis will lie on the first steps in benchmarking; identifying what to benchmarking, collecting data and analysis. An integration-workshop will be held once the results of this thesis are finalized to integrate the findings reaching maturity in the current VGR project.

The theoretical background of transition management will only be touched upon, as it is too rigorous to cover in a master thesis. Focus will lie upon the implications of transition management theory when designing projects, with a particulate interest for general principles, design and engagement dimensions. No comparative evaluation will be made between transition management and backcasting as methodologies as this has been done elsewhere (Quist et al., 2010). Though, the differences regarding the aim and desirable outcomes for each methodology will be partly discussed to create an understanding when to use which one.

An understanding of the current VGR project and their organizational structure will be achieved in parallel with writing this thesis. The ability to question the underlying assumptions of the process and the worldviews commonly accepted in the organization can be seen as double-loop learning (2.7 Organizational learning). It should be noted that this thesis is not aiming at improving the organizational learning within VGR.

1.5 Outline of thesis

Chapter 2 of this thesis will present an overview of the theories directly related to the research question (i.e. backcasting, transition management and stakeholder engagement). Other concepts useful to analyse the low-carbon transition project at VGR are presented in the three sections dedicated to integrated approach towards sustainable development, multi-level perspective and organizational learning.

Chapter 3 describes the methodology used during *Phase 1* and how the research question was formulated. Chapter 4 presents the results of *Phase 1* of the Challenge Lab about how backcasting was used in practice to come up with this research project.

In chapter 5 the benchmarking-methodology chosen for *Phase 2* is explained, including ethical considerations. Chapter 6 focuses on the findings from each benchmarked project, followed by a descriptive presentation of the VGR low-carbon transition project, which is up to date as of beginning of May 2015.

Chapter 7 consists of an analysis of the case study results set into relation with the theories presented, ending up with a list of enabling factors for a backcasting project to reach its full potential and an analysis of the current situation of the VGR project.

Chapter 8 is dedicated to the discussion of The Challenge Lab, the results obtained from the selected methodology and its limitations. Chapter 9 contains the main conclusions from the study and recommendations to integrate the enabling factors identified.

2 Theoretical framework

Below theories and concepts central to this thesis are introduced, giving the reader a broader understanding of the frameworks used and assumptions made when analysing the current process at VGR and to draw conclusions from the benchmarked projects.

2.1 Integrated approach towards sustainable development

Sustainable development as adopted by the World Commission on Environment and Development involves an integrated approach to the economy, society and environment (United Nations, 1987). However in reality the focus has been rather one-sided, setting either climate first by focusing on environmental aspects or focusing on the economic implications of sustainability. The message from the 12th chapter on sustainable development and mitigation in IPCC's fourth assessment report states that "the importance of social, political, and cultural factors is only now getting more recognition", where "integration is essential in order to articulate development trajectories that are sustainable, including addressing the climate change problem" (IPCC, 2007, p.693).

Regarding the benefits of climate change mitigation the third IPCC assessment report identifies three kinds of approaches in literature (IPCC, 2001):

- The first approach is represented by literature mainly focusing on mitigation, with the recognition that there may be benefits in other areas.
- The second approach is found in literature focusing on other areas such as air pollution control, where measures might also benefit the climate via 'ancillary benefits'.
- In the third kind of literature, policy objectives are combined in order to define costs and benefits from an integrative perspective, to obtain so-called co-benefits.

There is not much literature published related to the co-benefits but the field is seen as interesting and goes well in line with the claim from the 2007 IPCC working group on sustainable development that *integration is essential to address the climate change problem*. Climate change mitigation efforts will benefit our next generations, but co-benefits has the quality of providing local or regional improvements distinguishable for the current generations, such as increased social interactions due to increased accessibility, health improvements through reduced air pollution or improved energy security due to renewable supply with off-grid energy access (IPCC, 2014).

Therefore, instead of setting climate goals first, it might be an idea to set development goals first, which in many aspects will create conditions in which climate change mitigation can effectively be pursued. This would make other co-benefits carry a share of the costs, leading to a change in the cost ranking of climate mitigation options (IPCC, 2007).

One way of widening the perspectives to the climate challenge in science is via integrated assessment. Rotmans and Dowlatabadi (1998) defines integrated assessment as “an interdisciplinary process of combining, interpreting, and communicating knowledge from diverse scientific disciplines in such a way that the whole set of cause-effect interactions of a problem can be evaluated from a synoptic perspective” (cited by Tansey et al., 2002, p. 97). The central purpose of integrated assessment is not to advance knowledge, but to inform policy and decision-making process, reaching beyond the limits of a single discipline.

Another way of widening the perspectives of the climate challenge is to not treat is as a purely environmental problem, integrating the desirable future also with economic, social and wellbeing criteria (Holmberg & Robert, 2000).

2.2 Backcasting

Below central theories behind the backcasting approach will be presented. An explanation how it is done in practice is presented in *Methodology Phase 1* of this thesis as this thesis itself follows a backcasting approach.

Backcasting is a process that first describes a desirable future then works backwards from this point to the present. It is then possible to determine the physical feasibility of that future and identify what measures would be required to reach that point (Robinson, 1990). It has historically been compared with forecasting (Figure 3), which consists of creating scenarios based on dominant trends, “therefore unlikely to generate solutions based on breaking trends” (Dreborg, 1996, p. 814).

Three kinds of scenarios can be distinguished by what kind of future they describe: business as usual presents what *would* happen, forecasting based on current trends would present what *could* happen whereas backcasting scenarios are created to show what *should* happen (Vergragt & Quist, 2011).

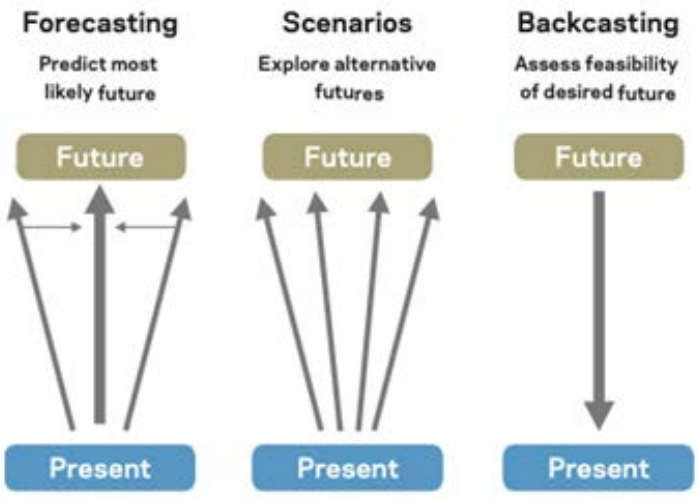

Figure 3 - Comparison between backcasting and forecasting (J. Robinson, personal communication, May 4, 2015)

Dreborg (1996, p. 816) means that backcasting is “especially promising:

- when the problem to be studied is complex, affecting many sectors and levels of society;
- when there is a need for major change, i.e. when marginal changes within the prevailing order will not be sufficient;
- when dominant trends are part of the problem - these trends are often the cornerstones of forecast;
- when the problem to a great extent is a matter of externalities, which the market cannot treat satisfactorily;
- when the time horizon is long enough to allow considerable scope for deliberate choice”.

Weaver et al. (2000) clarified that backcasting can be referred to as a tool, an entire methodology, a step in a methodology, an operational approach or even a concept. In literature backcasting has been presented in various ways, with differences in how results have been achieved, how stakeholders were involved, topics and scales of the systems addressed, methods applied and level of follow-up after process completion (Vergragt & Quist, 2011). Backcasting as a tool for change management is emphasizing the needs to unlearn dominant trends and perspectives because “our perceptions of what is possible or reasonable may be a major obstacle to real change” (Dreborg, 1996, p.816) who then questions our ability to change; as a society, as an organization or as an individual.

Since the late 1980s, backcasting has been applied in a broader scope of sustainability issues such as transport systems, technical development and regional development (Quist & Vergragt, 2006). It has had a natural tendency to gravitate towards projects working with energy and emissions, leaning into a singular focus on technical issues. From a business perspective of sustainable development a methodology was specifically developed by Holmberg (1998) which in The Natural Step case is separated into the four steps:

- Step 1: describing criteria for a successfully sustainable society;
- Step 2: analysing the current activities of the company in relation to criteria for sustainability;
- Step 3: envisioning possible solutions;
- Step 4: developing strategies to fill in the gap between the existing situation and the desirable future sustainable situations.

Regarding the selection of strategies at step 4, Holmberg (1998, p.39) has recommended considering the 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?”

Lately backcasting processes have been opened up for wider participation, which Robinson (2003) identified as the "second generation" of backcasting. In this case non scientific-experts are involved in the process. The main arguments in favour of a more participatory approach have been summarized by Tuinstra et al. (2002) as:

- "It helps to bridge the gap between a scientifically defined environmental problem and the experiences, values and practices of actors who are at the root of both cause and solution of such problems;
- Participation helps in clarifying different, often opposite, views and interests on a problem, making problem definitions more adequate and broadly supported;
- Participation has an important learning component for the participants;
- Participation in the scientific assessment may improve the quality of decision making, not by taking over the role of scientific expertise but by adding and complementing it with other dimensions. As such it increases feasibility, prevents implementation problems, reinforces the commitment of stakeholders, increases the democratic content, etc."

In a participatory approach, scientific knowledge is not considered by definition more valuable than practitioners' knowledge as "an expert is not a special kind of person, but each person is a special kind of expert, especially with respect to his or her own problems" (Mitroff, cited in van der Kerkhof, 2001). On this matter, Eames and Egmose (2011) raised concerns about backcasting leading to "elite technocratic processes [when participation is] largely restricted to a limited circle of professional experts from academia, industry and NGOs [because] they are seen as a risk of capture by particular interests and framings of sustainability" (p. 770).

Regarding the future development of backcasting, it has been acknowledged that "a broader research agenda should also include […] the evaluation of methods and tools that were applied within a backcasting framework [and] new participatory backcasting studies must be undertaken and also thoroughly evaluated" (Quist & Vergragt, 2006, p. 1042). They insisted on the necessity of a knowledge transfer from the academia to the professionals of the governments, the private sector and other organizations who are working on sustainability issues.

As backcasting is used as a methodology in this thesis no further description will be given here. The reader is encouraged to read in Methodology *Phase 1* to learn more how backcasting can be used in practice.

2.3 Transition management

The Dutch Research Institute for Transitions (DRIFT) has created a guide for urban transition management (UTM), based on the assumption that transitions cannot be fully controlled, but initiated and accompanied. Transition management has most recently been developed based on insights of European projects dealing with climate mitigation, where other sustainability aspects related to emissions were included but seen as secondary.

The theories behind the guide are grounded in interdisciplinary research dealing with long-term complex processes of structural change in society, formulated as complexity-based governance tenets and leading to “a multilevel, multiphase process of structural change in societal systems” (Loorbach, 2010). Since the environment in which transition occurs is dynamic, the guide has emerged from action, research and participation (Wittmayer & Schäpke, 2014), and gotten credibility and continuous improvements with lessons from cases on different societal scales and levels (Rotmans & Loorbach, 2009) and the MUSIC project (Wittmayer, Schäpke, van Steenbergen & Omann, 2014). Central to the transition management framework are the contributions of small-scale experiments and actions towards a sustainable future (van den Bosch & Rotmans, 2008). The guide was carefully translated from the rather abstract transition management philosophy and its rigorous theories, without loosing too much of its complexity (Roorda, Steenbergen, & Wittmayer, 2014).

The challenges related to CO_2 emissions are not always desirable ‘nor action inspiring, motivating them to be reformulated and cross-fertilized to be inspiring and stimulate actions. The approach is based upon six principles (Roorda et al., 2014):

- Get an insight into the system – create an understanding of the complexity of the challenges;
- Aim for system innovation in small but radical steps – guided by a long-term perspective trying to innovate instead of optimize;
- Give room to diversity and flexibility – explore multiple pathways when developing strategies and working with actions;
- Co-create – engage multiple stakeholders in a deeper engagement than just asking for input, everyone could be considered a decision maker;
- Give room to change agents – support actors who adopt new or alternative ways of thinking as their momentum can trigger and mediate transition;
- Facilitate social and institutional learning – provide time for reflection and create a setting supporting openness and mutual trust.

The main focus within the transition management process is the transition arena. It is defined as a temporary informal well-structured setting where change agents with diverse backgrounds gather to elaborate the transition. Criteria for finding and selecting change agents within the UTM framework are:

- Willingness to go beyond business as usual;
- Openness and appreciation of other perspectives;
- Competences such as leadership, creativity, analytical skills, and coalition building skills.

The change agents are not approached as stakeholders but rather recruited on their personal title, where a diverse composition of the group is desired. Together the change agents define the challenge, create a shared long-term vision and develop pathways for realizing it. Therefore change agents are not selected based on their traditional power, but on their considered power to challenge the status quo and initiate a transition (Roorda et al., 2014).

Below follows a presentation of each step (party overlapping) of the transition management process all from the UTM guide (Roorda et al., 2014). The structure of should be considered non-static, as each process has to be adapted to specific circumstances and needs for the actual project.

Setting the scene

During the first phase the transition team is formed in order to make the coordination clear and to provide a solid foundation for the process. The team ideally consists of three to five people from the initiating organization, some external experts on the topic addressed, transition management experts and/or a facilitator. The transition team is organizing and designing the whole process by specifying the issue, anchoring it to the local opportunities and finding relations with projects dealing with similar issues and current policy priorities.

Exploring

During the second phase the local dynamics are explored and understood better by making a system and actor analysis. The analysis should lead to an overview of the system (including cause-effect chains) and a detailed analysis of its state and characteristics. The history is also important here since it can create an understanding of path dependencies. The actor analysis is made by input from the system analysis and data gathered with the snowball method, where a first group of actors identified are asked to mention other stakeholders that could join the transition arena group, e.g. contacts in their own network. When the stakeholder mapping is clear, the change agents are selected and invited to the meetings to form a transition arena group.

Framing the challenges

When framing the challenges a collective understanding of the problem is created among the participants in the transition arena group. The starting point is the finished system analysis that is presented by the transition team. The issues are to be framed as a transition challenge that triggers in depth-discussions and creates a sense of urgency.

During the first meetings the participants are able to see their own input placed in the broader context. At this step, the group setup is still open to adjustment inspired by the participants' reflection on the composition of the arena and potential lacking expertise in the group. It is also possible to deny future participation to any participant who disrupts the group chemistry. The discussions here will most likely improve the system analysis that can also be reviewed at this step.

Envisioning

The purpose with this step is to create a common vision and develop a shared language within the transition group. Possible futures are discussed which then become an anchor point for long-term strategies and short-term actions. The envisioning exercise is just as important as the vision created, as it allows the participants to step into a desirable future. Different time frames are used to catalyse the discussions: a time frame of 15 years can be used to create an urgency to act and another time frame of40 years to envision the final condition.

Reconnecting the long-term and short-term

During this step where the future is bridged with the present using a condensed version of backcasting (8.2) it is possible to invite more people to the process at this phase. The session gives insights in what is needed to reach the envisioned future, with goals and interventions in the short-, mid-, and long-term, where transition paths are developed. The ideas converge into a transition agenda. The agenda indicates short-term actions, making it easier for external actors to take part since they can relate it to their own agendas and strategies. The group has to reach some kind of consensus about which transition path seems to be the most desirable.

The transition arena is closed after the agenda has been produced, where focus should now be on follow-up activities to support and engage actors elaborating actions in line with the transition agenda. The whole work made by the transition team should be put together in a narrative.

Getting into action

If no action has been executed in parallel with the previous steps this step is about 'learning by doing'. The actions should be in line with the narrative and be specific enough to be both feasible and radical enough to be symbolic for the future shift. The actions aim at showing that the envisioned future is attainable.

The transition arena participants use their networks to involve actors who are relevant to the experiments: policy actors can be linked to certain actions or working groups, business plans can be set up and funding can be searched for. It is important that the narrative is safeguarded to make sure that the actions go in line with it.

Possible success factors of making a transition agenda leading to actions are:

- Direct relation between transition agenda to a highly prioritized policy or societal problem;
- Availability of resources;
- Tangible evidence of the effectiveness and benefits of transition experiments.

Though some agendas might remain as wish list it does not necessarily imply that the process was a failure, as the process itself can be just as important to provoke and open up the mind-sets of the people involved.

Engaging and anchoring

The outcomes from the transition arena are now followed up to stimulate, empower and engage even more actors, trying to get more people, organizations and initiatives to work towards a sustainable future. The outcomes from a transition management approach would ideally be:

- A sense of direction;
- An impulse of local change;
- Collective empowerment.

Where what follows after this last step is to get into action.

2.4 Multi-Level Perspective

Transition management theory distinguishes three separate levels where socio-technical change can take place in society: niche, regime and landscape (Figure 4). Transitions are considered as the interplay of multiple developments at three different socio-technical levels (Geels, 2002):

- The niche (Micro level), where breakthrough and radical innovations appear at the first place, addressing a specific limited market. It is favourable to prototyping, and preparing scaling-up of the innovation.
- The regime (Meso level) corresponds to the existing ways of performing with the different technologies, infrastructures, policies, etc. Changes will occur in much longer time-scale in connexion to lock-in mechanism and path dependency.
- The landscape (Macro level) is made of our societal structures and is something we are part of but is beyond the control of any individual actor. Changes in landscape are very slow due to their dependence to demographic trends as well as cultural and political awareness.

Niches and socio-technical regime are "similar *kinds* of structures, although different in size and stability", the last one being bigger and more stable (Geels & Schot, 2007, p.402). They both have the character of organizational fields, being community of interact groups, and work through societal systems. Socio-technical landscapes are different in their structure because they "do not determine action, but provide deep-structural 'gradients of force' that make some actions easier than others […] with technical, physical and material backdrop that sustains society" (Geels & Schot, 2007, p.404).

Using the analogy of a landscape, some elements of the landscape are relatively static (e.g. soil condition, lakes, mountains) but other parts of the landscape are dynamic (e.g. rainfalls, storms, lightning). Therefore three categories of landscape (Van Driel and Schot, cited in Geels & Schot, 2007) have been defined as :

- Slow changes (e.g. climate);
- Long-term changes (e.g. industrialisation);
- Rapid external shocks (oil price fluctuation).

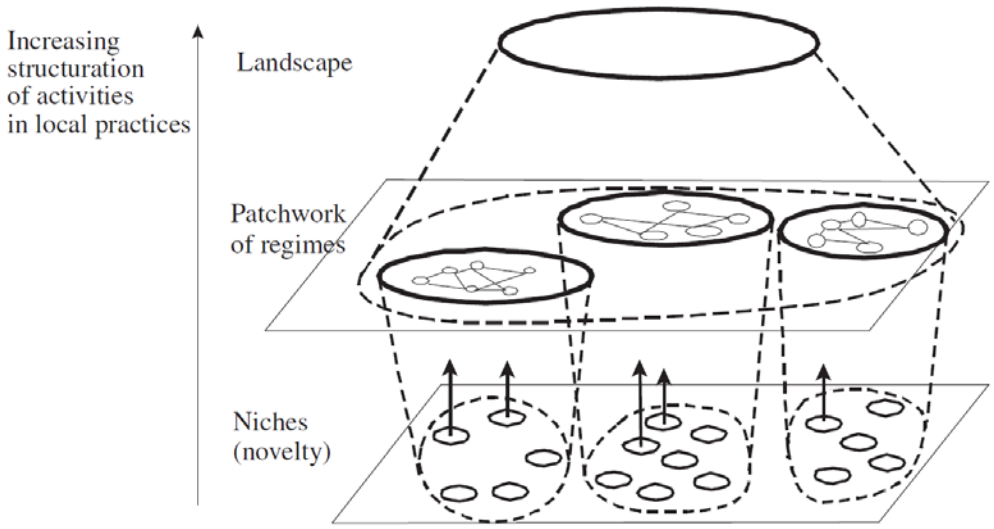

Figure 4 - The multi-level perspective level as of Geels (2002)

They are nevertheless combined in a single landscape category, as they all share the characteristic of forming external context that cannot be changed by the niche and regime actors on the short term. The global transition model initially developed by Geels (2002) argued that when envisioning future solutions, the transition had to spread from the niche to the regime to finally in the long-term perspective reach the landscape.

In response to criticisms regarding a presumed bottom–up, niche-driven bias in the understanding of transitions, four differentiated typologies of transition pathways (Figure 5 to Figure 8) were later defined, taking into consideration different timing and nature of multilevel interactions:

- Transformation pathway: in the case of a landscape pressure called 'disruptive change', if niche-innovations are not yet sufficiently developed, then direction of development paths and innovation activities is modified by the regime actors (Figure 5);

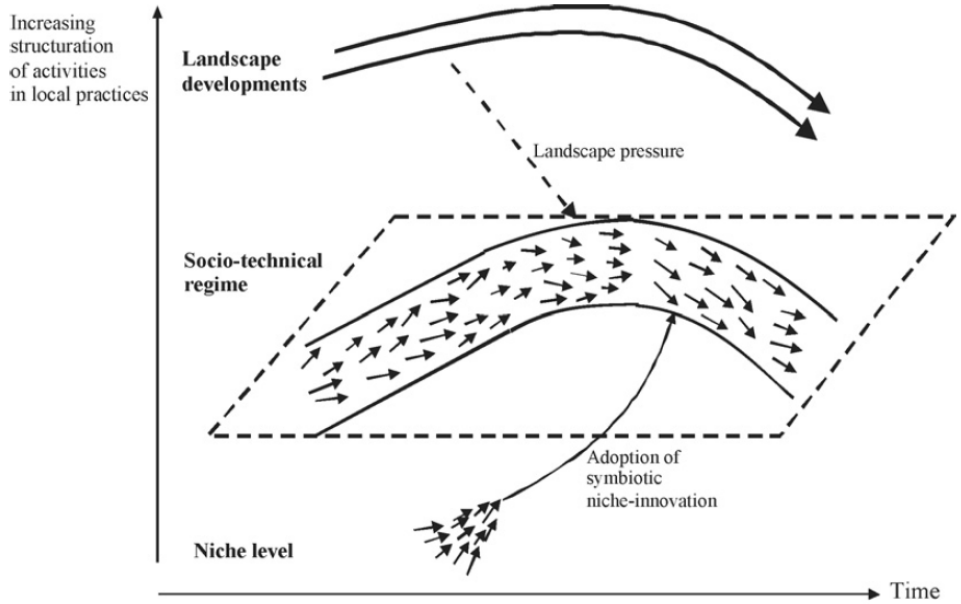

Figure 5 - Transformation pathway within the Multi-Level Perspective (Geels & Schot, 2007)

De-alignment and re-alignment pathway: in the case of divergent, large and sudden landscape change, an ‘avalanche change’, if regime problems cause de-alignment of the regime and niche-innovations are not yet sufficiently developed, then multiple niche innovations will co-exist and compete before one dominant niche reaches the regime causing its re-alignment (Figure 6);

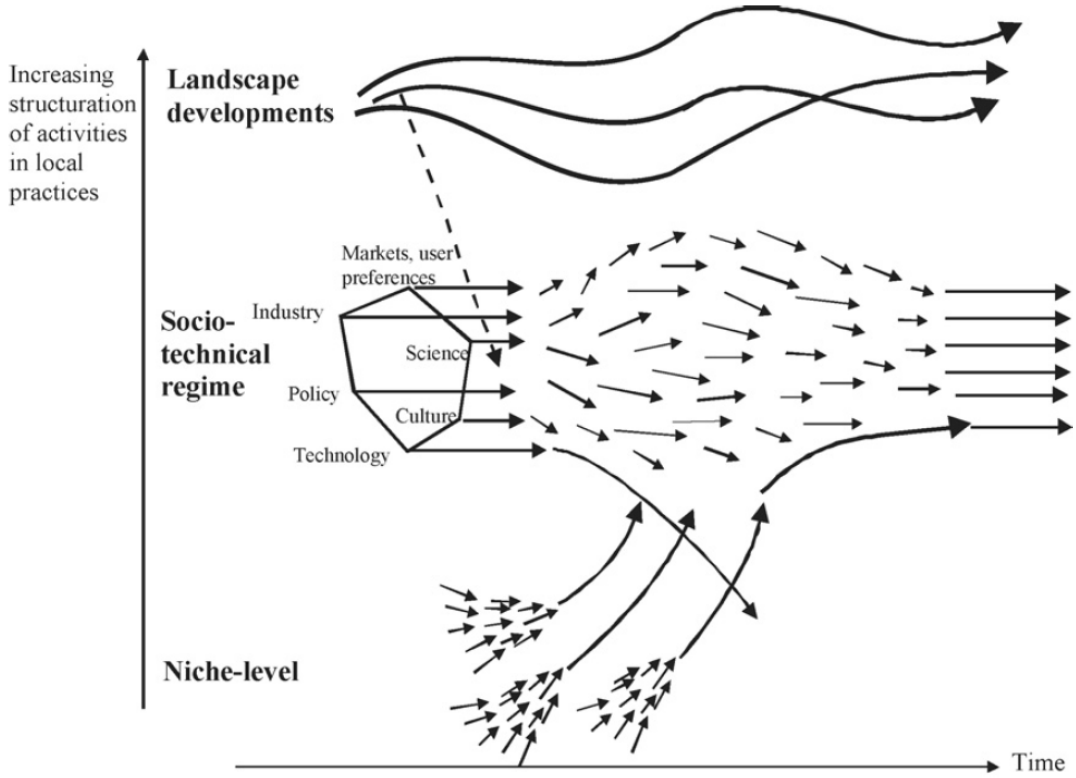

Figure 6 - De-alignment and re-alignment pathway within the Multi-Level Perspective (Geels & Schot, 2007)

- Technological substitution pathway: in the case of a landscape pressure, either a ‘specific shock’ or an ‘avalanche change’ or a ‘disruptive change’, if one niche innovation has developed sufficiently, then it will break through and replace the existing one in the regime (Figure 7);

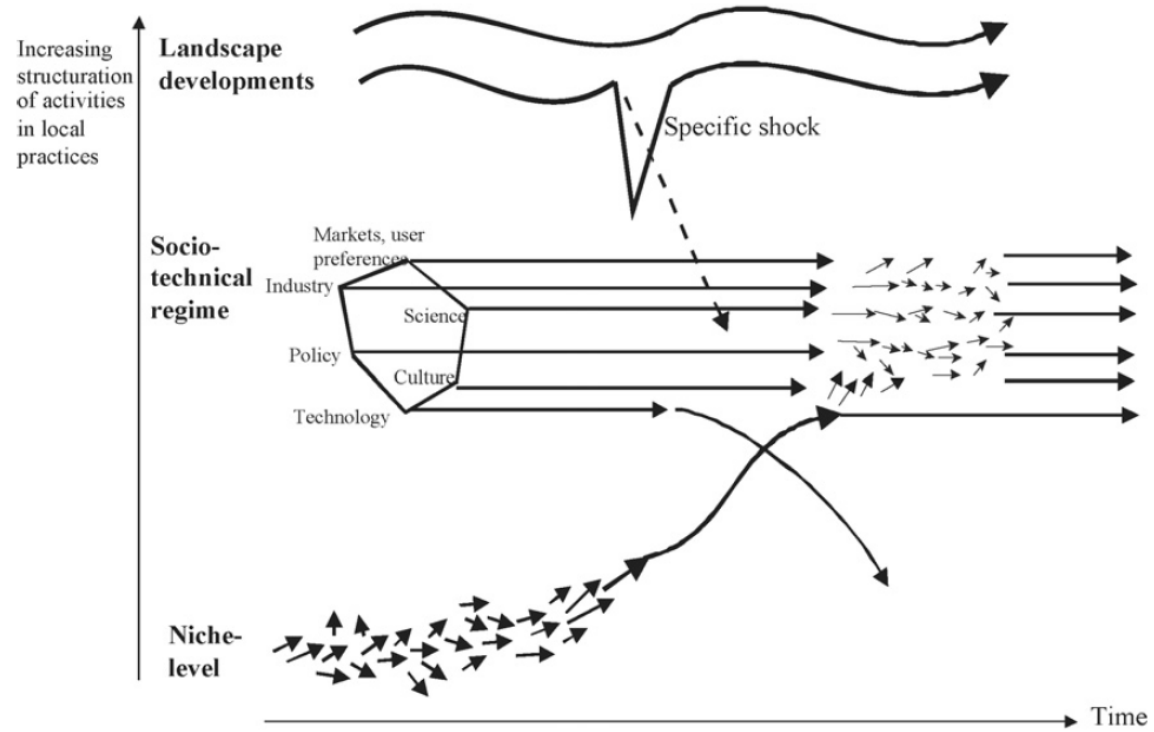

Figure 7 - Technological substitution pathway within the Multi-Level Perspective (Geels & Schot, 2007)

- Reconfiguration pathway: in the case of landscape pressure, if symbiotic innovations are developed, then they are first adopted in the regime to solve local problems and then trigger adjustments in the regime (Figure 8).

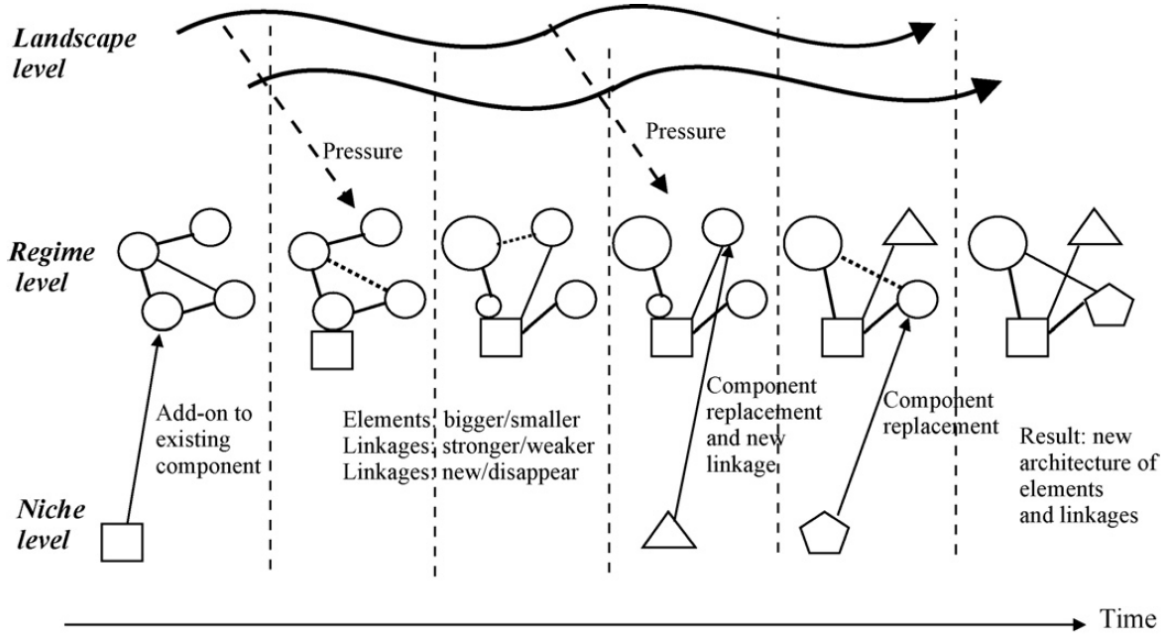

Figure 8 - Reconfiguration pathway within the Multi-Level Perspective (Geels & Schot, 2007)

Theses four different pathways are ideal types of transition, and the typology may not be as clear for “real” cases of transition. Also, these pathways are not deterministic in the way that the succession of events within each pathway may not always lead to a successful transition. The main actors of the transition are either niche or regime level depending on the type of pathway (Geels & Schot, 2007).

This framework has been recently applied on low-carbon transitions by Geels (2014) in an attempt to shift the attention from green niche-innovations to regime resistance to fundamental change. Unlike many studies on low-carbon transition focusing on niche-innovations hoping that 'green' innovation will be enough for the low-carbon transition to happen, Geels (2014) found out that the resistance and resilience of current regimes actors could impact the transition by negating the benefits from the development of 'green' innovation from the niches. The regime players have more power to resist climate change-related pressures and to take part in low-carbon futures without having to fundamentally change because they can mobilize more ressources then the niches (Avelino and Rotmans, cited in Geels, 2014). Four types of power that are used by the regime actors to resist fundamental change have been identified as:

- Instrumental power, which is used by regime actors to directly influence other actors in the pursuit of their goals and interest. Different resources can be used for that purpose including a position of authority, money or access to the media.
- Discursive power, which makes use of rules, resources and dominant images to set the agenda about low-carbon transition in a favourable way.
- Material power, which relies on technical capabilities and financial resources to improve the technical dimension of socio-technical regimes.
- Institutional power, which corresponds to the power given to the regime actors in the form of institutional support from political and governance structures in line with their strategy.

This implies that "politically-inspired regime destabilization and decline may be necessary to create opportunities for the wider diffusion of ['green' innovations], which now face uphill struggles against resistant regimes" (Geels, 2014, p.37). Using the 'David versus Goliath' storyline, this would correspond to working on identifying 'Goliath' weak points in order to eroded and destabilized it (i.e. the regime players) in order to enhance the chances of 'David' (i.e. the niches). It should be quite obvious that 'Goliath' can defend himself and his ability to resist transition in many ways need to be taken into account. Nevertheless "stimulating green alternatives remains important, a strong focus on new innovations may serve to protect existing regimes" (p.37) by detracting attention from the main climate issues.

More generally, analysing power and politics into the MLP framework resulted in conceptualizing policymakers and incumbent firms "a core alliance at the regime level, oriented towards maintaining the status quo" and resisting fundamental change (Geels, 2014, p.26). They tend to join forces because of mutual dependencies: firms and industries need the government for establishing governance structures and market rules, while "capitalist societies are systematically dependent on economic growth, which implies that a central role of the state is to advance the general interests of capital" (Brunham, cited in Geels, 2014, p.26). As a consequence, the laws are often designed to be favourable to the regime players. It should also be noted that allows that regime players tend establish a 'discourse coalition' (Hajer, cited in Geels, 2014, p.36) with policymakers which allow them to influence what is being discussed, resulting in the preferred pathway being presented as the only alternative available, but also how the issues are being discussed.

This conceptualization of low-carbon transition, based on relationship between actors at different levels of the societal system, provides an explanation about why alternative transition pathways, found in the niches, receive less attention and resources and why they are side-lined. This should also be related to the fact that the dominant discourse does not privilege the interests of less organized and local actors (Geels, 2014).

2.5 Stakeholder engagement

While the stakeholder engagement concept is not new, it is being recognised more and more by private companies as well as public authorities as a crucial element for an organisation's success. The first international standard on stakeholder engagement (AA1000) was published in 2005 and defined stakeholder engagement as "the process used by an organisation to engage relevant stakeholders for a clear purpose to achieve accepted outcomes" (Accountability, 2008, p.6). Nevertheless, finding a definitive definition of stakeholder engagement isn't so easy. There are many definitions with different perspectives on stakeholder engagement; some are less project oriented and focuses more on the continuous nature of the stakeholder engagement mission of organizations.

The OECD Guidelines' General Policies states since 2011 that "stakeholder engagement involves interactive processes of engagement with relevant stakeholders, through, for example, meetings, hearings or consultation proceedings. Engaging with relevant stakeholders [is done] in order to provide meaningful opportunities for their views to be taken into account in relation to planning and decision making for projects or other activities that may significantly impact local communities. Effective stakeholder engagement is characterized by two-way communication and depends on the good faith of the participants on both sides" (OECD, 2011).

The term stakeholder engagement should not be confused with stakeholder management, as "stakeholder engagement implies a willingness to listen; to discuss issues of interest to stakeholders of the organisation; and, critically, the organisation has to be prepared to consider changing what it aims to achieve and how it operates, as a result of stakeholder engagement" (Jefferey, 2009). In addition, it is necessary to acknowledge that all stakeholder engagement processes are different in their objectives, methods of engagement and results but stakeholder engagement is essentially a way to deal with complex relationship in order to work cooperatively to seek mutual beneficial outcomes. The objective can vary from keeping good relationships with stakeholders to creating shared value with them and include methods for involving more actors in the planning and decision-making processes (Accountability, 2008).

The next sections will review some of the most important steps to realise stakeholder engagement, from the identification and selection of stakeholders, the selection of an engagement approach and the use of specific tools before reviewing the main benefits and limitations of stakeholder engagement.

2.5.1 Stakeholder identification

The definition of what a stakeholder is was historically built upon the concept of shareholder (*Freeman, 1984)*. Shareholders or stockholders are the owners of a company. A company has to put the shareholders' needs first for financial binding reasons, so the company creates value to generate more profit for the shareholders. Freeman argued that a company can also create value by taking into consideration and involving other parties like governmental authorities, political groups, trade associations, trade unions, communities, financiers, suppliers, employees, customers and competitors. Their stakeholder status comes from their capacity to affect the company and its other stakeholders. For public authorities actors related to communities, NGOs and the wider civil society can also be considered as stakeholders (Jefferey, 2009).

Many different definitions can be found in literature (Mitchell et al., 1997), but a stakeholder can simply be defined as someone who has a stake in a certain issue or decision. It includes actors that can be affected by or affect either positively or negatively the achievement of an organization's objectives (Freeman, 1984). This definition can be nuanced in different ways. For example, some definitions only consider organised groups as stakeholders where others also include individuals (van de Kerkhof, 2006).

To identify the stakeholders relevant to the purpose of an engagement process, several mapping tools can be used. The stakeholders are often classified in categories of the Triple Helix (Etzkowitz & Leydesdorff, 1995). The Triple Helix model of academia-industry-government relations has several times been transformed into a quadra-helix or penta-helix (Figure 9) in order to add "civil society" or "the public" back into the model as a fourth helix (Carayannis & Campbell, 2010; 2014).

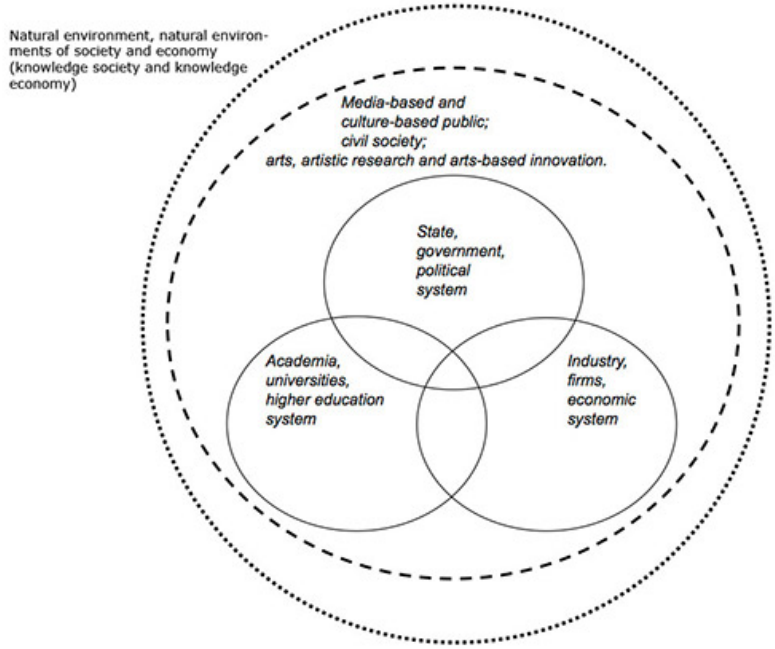

Figure 9 - Carayannis and Campbell conceptualization of the penta-helix.

2.5.2 **Sakeholder engagement approaches**

Once the stakeholders have been identified and selected, the engagement is realised following a certain engagement approach. There is no single framework for stakeholder engagement as the objectives of the process vary but different approaches of stakeholder engagement have been identified. A well-known categorisation of these approaches was developed by Arnstein (1969) in the form of “the ladder of citizen participation”. Though specifically intended to distinguish different degree of citizen involvement, it is a useful framework that can be applied to stakeholder participation more broadly as it mainly demonstrates that there are significant graduations of how to engage stakeholders in a participatory process, via a simplified categorization of them (Figure 10). At the bottom of the ladder there are presented rungs of “non-participation” where the stakeholders are not enabled to participate in the decision in any way. While going up the ladder, consultation is a level of participation where the citizens may be heard but they lack the power to ensure that their views will be taken into consideration in the decisions, which is only achieved in the three last levels of the ladder, with different degrees of power.

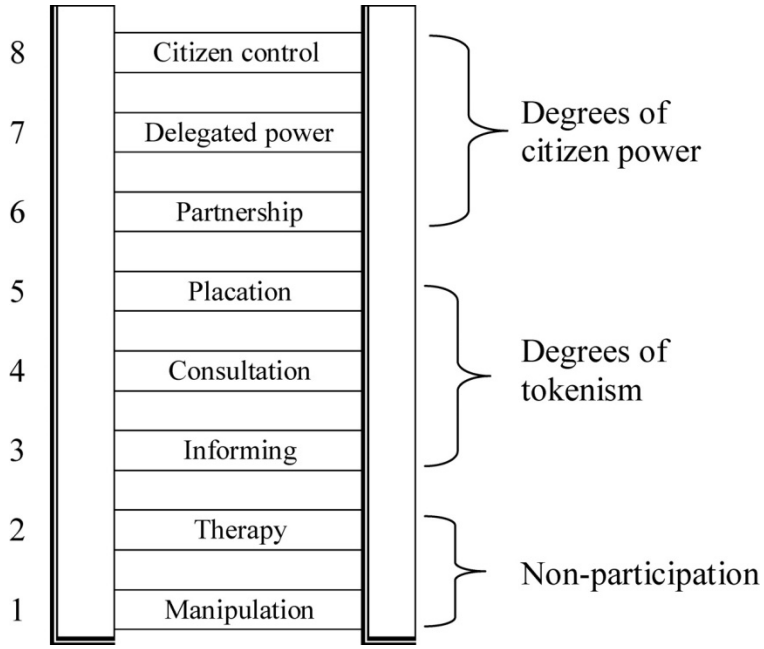

Figure 10 - Eight rungs on a Ladder of Citizen Participation adopted from Arnstein (1969)

Each approach is well suited for different expectations from the stakeholders. For example, the lowest levels of the ladder of participation are appropriate for stakeholders with low interest where an attempt of consultation or partnership may not be beneficial or successful. On the opposite, the highest levels of engagement could be appropriate for stakeholders with high interest and influence

Push communications are appropriate for low interest/low influence stakeholders. Attempts at partnership would be a waste of resources and time. Collaboration and partnership would only be appropriate for key players, stakeholders with high influence and high interest who could bring considerable benefits to the organization or project, but conversely - if not managed - bring considerable risk (Jefferey, 2009).

2.5.3 **Tools for stakeholder engagement**

Many varied tools and techniques can be used to engage stakeholders. These methods of engagement are adapted to specific needs and requirements, and are appropriate for certain level of engagement. As an example, workshop settings should not be considered alone when the objective is to engage a whole community as they present the disadvantages to involve a relatively limited number of stakeholders and because "individuals may not necessarily be representative of a stakeholder group as a whole" (Jefferey, 2009, p.46). There is equilibrium to find between the intensity of engagement and the number of people engaged and different kinds of tools and participatory approaches can be used in combination with each others from public involvement software (Section 6.1 about MetroQuest) to dialogue workshops (Accountability, 2008).

Dialogue can be used in workshops and all setting where participants are engaged physically in a process. Dialogue is a specific type of conversation. Defending conversations include debates and can be defined as a conversation where the different actors in presence try to convince each other of their own opinion, whereas in suspending conversations the actors are listening to each other's points of view with resistance or interruption. Suspending conversations can lead to generative dialogue in which the participants will generate new possibilities and insights collectively and overcome the dualistic situation of one majority opinion trying to win over the opposition (Isaacs, 1999).

Dialogue makes it possible for a collective intelligence to emerge within the discussion. It is possible to distinguish the effect of listening and observing when a disruption happens in a double-loop process (Figure 11) that is self-reinforcing and triggers an increase of the participation level (Sandow and Allen, 2005).

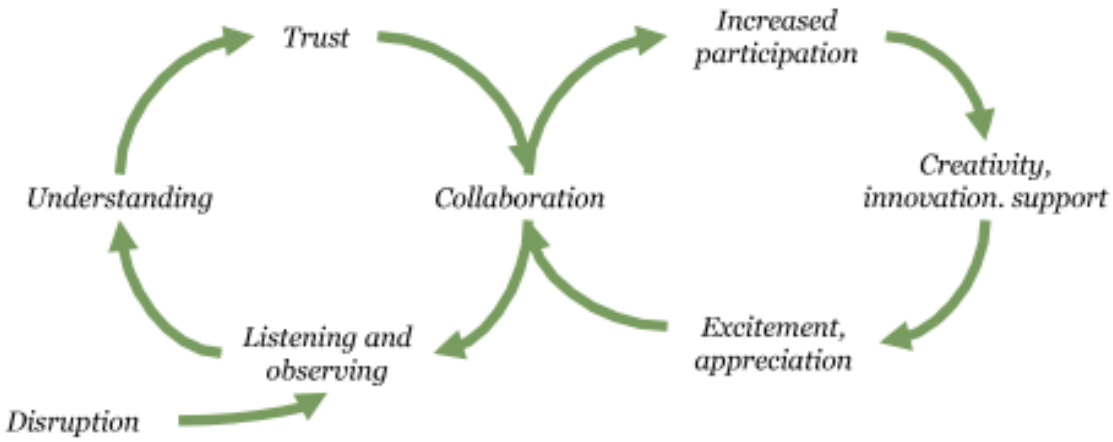

Figure 11 – The reinforcing double-loop benefits of listening (Sandow & Allen, 2005)

Not using dialogue tools when facing disruptive events will at the end generate separation instead of participation, as well as a negative impact for the organization. The lack of trust can impact the efficiency of the whole (Figure 12) (Sandow and Allen, 2005).

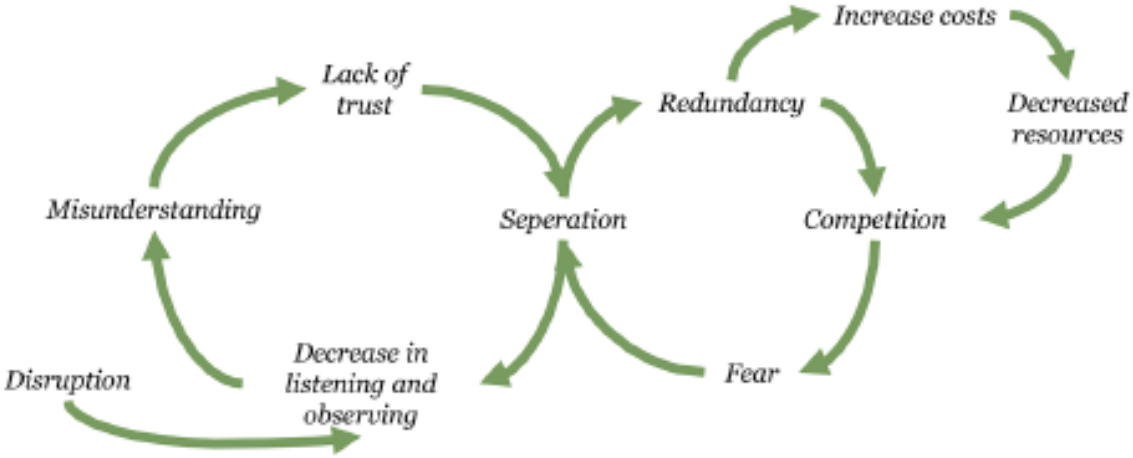

Figure 12 - The reinforcing double-loop effect of decreasing dialogue in organizations (Sandow & Allen, 2005)

2.5.4 Motivation and limitations of stakeholder engagement

Several publication related to the practice of stakeholder engagement have acknowledged the value and benefits of engaging stakeholders. Van de Kerkhof (2006) identified as the main drivers for stakeholder engagement that it may:

- lead to better decisions as it includes relevant viewpoints and a variety of information about other dimensions from the stakeholders that would not have been taken into account otherwise.
- have a positive impact on the legitimacy of the decision-making process and on its transparency and accountability, as the stakeholders can witness and are co-responsible for the decisions taken during the process.
- increase the feasibility of action after the decision is taken, as the participatory process strengthen the commitment of the participants and some problems are prevented from taking into account different dimensions during the decision process.
- stimulate learning. Indeed, when "stakeholders, government and scientific experts enter into a dialogue […], by interaction and debate, they learn about the nature of the problem, about possible solutions to this problem, and they learn to deal with conflicting views and interests" (van de Kerkhof, 2006, p.9).

Researchers have also studied more specifically the impact of engaging citizens in developing new policies and projects lead by government authorities. Irvin and Stansbury highlighted that "with citizen participation, formulated policies might be more realistically grounded in citizen preferences, the public might become more sympathetic evaluators of the tough decisions that government administrators have to make" as a result of an increase awareness about the challenges the society faces (Irvin & Stansbury, 2004, p. 55).

The downsides of stakeholder engagement can be related to the interactions between the different participants, with a perceived higher occurrence of conflict during the dialogue as well as the necessity for a group of participants to share a common understanding of the challenges. It can be argued that this is a complicated to achieve because of the following apparent contradiction: "in order to act meaningfully in a participatory process on matters of environmental complexity, stakeholders must have a reasonable level of scientific information [but] the stakeholders have a 'natural' tendency to mistrust scientific experts" (van de Kerkhof, 2006, p.10) Also a "participation paradox" has been identified as participation may be counterproductive when reinforcing the power of the already powerful actors as they influence the decisions to be taken in their favour by an illegitimate exercise of power (Irvin & Stansbury, 2004).

2.6 Organizational learning

Organizational learning involves the detection and correction of errors as a way to continuously learn from action. The theory of organizational learning was developed by Argyris and Schön (1978) and distinguishes two types of learning: single loop and double loop learning. They compared single-loop learning to a thermostat that decides to turn the heat on or off, where the underlying mechanisms in the thermostat do not question the decision. A thermostat reflecting on why it should turn the heat on or off by asking questions such as 'is it a good time to switch settings? Are people in the room? Are they dressed for a colder temperature?' would be the equivalent to double-loop learning in that case (Argyris, 1977).

To understand the concept of single- and double-loop learning, it is necessary to start from the theory of action concept (Argyris, Putnam & McLain Smith, 1985):

- *Espoused theory*, corresponding to what people say they do or how they would like to act based on their world view and values they believe in;
- *Theory-in-use*, being the world-view and values corresponding to the way people actually behave and base their actions upon.

Theory-in-use comes into place when the consequences of an action matched with the expected outcomes. *Espoused theory* gets revealed when there is a mismatch between the intention of an action and the actual outcome, leading to an unexpected outcome that might be against the person's governing values. To this mismatch there are according to Argyris and Schön (1978) two responses: single and double loop learning.

In the context of organizational learning when an error is detected and the correction process allows the organization to continue with its current policies and norms or achieve its current goals the process can be characterized as a single-loop learning process. If the detection and correction of errors involve the modification of the company's policies, norms, and goals second loop learning is achieved (Figure 13). Double-loop learning is the opposite of single loop learning which mainly focuses on problem solving without questioning the goals, values and frameworks within the organization (Argyris & Schön, 1978).

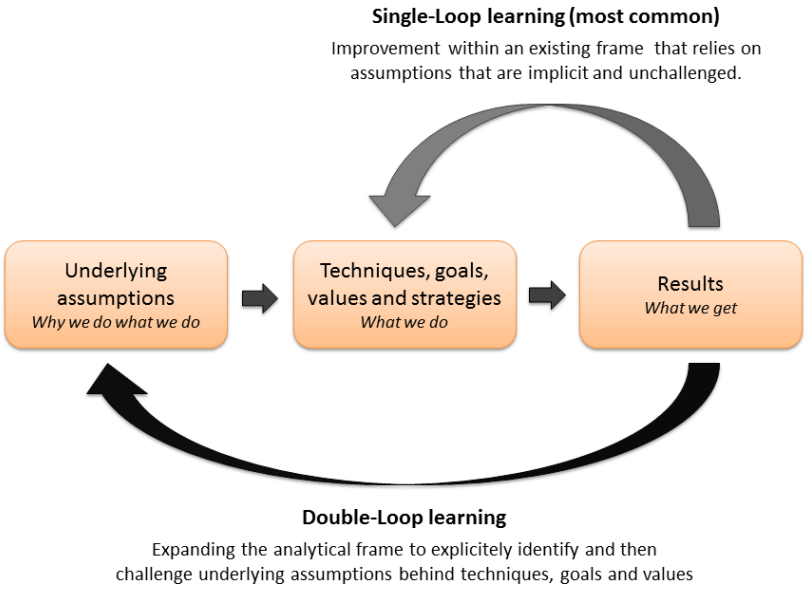

Figure 13 - Comparison between single and double loop learning (adapted from Argyris and Schön, 1974)

	Model I theory-in-use	Model II theory-in-use
Governing values	• Achieve the purpose as the actor defines it • Win, do not lose • Suppress negative feelings • Emphasise rationality	• Valid information • Free and informed choice • Internal commitment
Primary Strategies	• Control environment and task unilaterally • Protect self and others unilaterally	• Sharing control • Participation in design and implementation of action
Usually operationalised by	• Unillustrated attributions and evaluations e.g. “You seem unmotivated” • Advocating courses of action which discourage inquiry for example “Let’s not talk about the past, that’s over” • Treating ones’ own views as obviously correct • Making covert attributions and evaluations • Face-saving moves such as leaving potentially embarrassing facts unstated	• Attribution and evaluation illustrated with relatively directly observable data • Surfacing conflicting view • Encouraging public testing of evaluations
Consequences include	• Defensive relationships • Low freedom of choice • Reduced production of valid information • Little public testing of ideas	• Minimally defensive relationships • High freedom of choice • Increased likelihood of double-loop learning

Table 1 - Model I and II theory-in-use characteristics, adapted from (Argyris, Putnam & McLain Smith, 1985; Anderson, 1997)

As double-loop learning is an essential capacity for organizations to act in rapidly changing circumstances characterized by uncertainty, Argyri's and Schön's (1974; 1982) research explored what may increase the capacity of organizations to perform double-loop learning. The worldview **inhibiting** double-loop learning is identified as Model I, while Model II *theory-in-use* **supports** double-loop learning. The defining characteristics of Model I and II are summarised in Table 1.

The underlying strategy of model I is based on unilateral control over others and protection of self - resulting in inhibition of communication, defensiveness, maximisation of winning situations for self. As such it is less likely to lead to double-loop learning. Maintaining this strategy often involves distorting facts and evaluations, making inferences about others' behaviours without checking their validity, and 'face-saving' behaviours. Argyris et al. (1985) suggests that the prevailing culture in most organizations correspond to Model I. The defensive routines associated with Model I *theory-in-use* can happen at individual, group and organizational levels (Argyris 1990; 1993).

When Model II is the theory used for action in an organization, the different views and experiences of the participants are included to build a common view, the strategies are explicit and tested and the underlying assumptions should be justified and open to exploration. Double-loop learning is more likely to take place in an organization with 'learning agents' and shared leadership (Argyris & Schön, 1978). To facilitate the uncovering and communication of errors, organizations have to shut down learning anxiety which makes members feel anxious when agreeing to a learning or change process because it implies that something is wrong or imperfect (Schein, 1996). It is also necessary to promote the questioning of the goals and rules of the organization, as well as challenging the common assumptions – games and norms within the organization (Meadows, 1997).

Senge, Hamilton and Kania (2015) acknowledge that facing "systemic challenges beyond the reach of existing institutions and their hierarchical authority structures […] requires a unique type of leader – the system leader, a person who catalyses collective leadership" (p.27-28). System leaders focus on creating the conditions necessary within an organization to foster second order learning and change. For them double-loop learning happens when they "pay better attention to how their often unconscious assumptions shape their perceptions, from the data they notice and do not notice to the conclusions they draw" (Senge et al., 2015, p.31). Three core capabilities for system leaders to foster collective leadership are:

- See the larger system in order to build a shared understanding of complex problems;
- Foster reflection, thinking about our own thoughts to identify the limitations of our mental models, to building trust and fostering generative conversations;
- Shift the collective focus from a reactive problem-solving attitude to co-creating a positive future vision by seeing problems as opportunities for innovation (Senge et al., 2015, pp. 28-29).

A variety of tools are available to support those three leadership capabilities. As it is not possible to directly change how a person thinks because our thinking is based on personal assumptions, the tools used should combine two different functions: "they produce practical benefits *and* they affect how people think and see the world" (Senge et al., 2015, p.31).

3 Methodology *Phase 1*

This master thesis is divided into two phases (*Phase 1* and *Phase 2*) whose methodologies and results will be presented separately. *Phase 1* was a common process with the 13 participants of The Challenge Lab, which resulted in a team formation as well as the formulation of a research question related to a certain topic. The results that came out of this methodology will be presented right after this chapter.

3.1 Formulate a research question

The Challenge Lab participants (from now on referred to as "the participants") took on challenges related to sustainable urban development, following a backcasting methodology (Holmberg, 1998; Holmberg & Robèrt, 2000) starting with defining criteria for sustainability, followed by a description of the present situation in relation to the criteria, an envisioning of future solution and finally elaborating strategies towards sustainability (Figure 14).

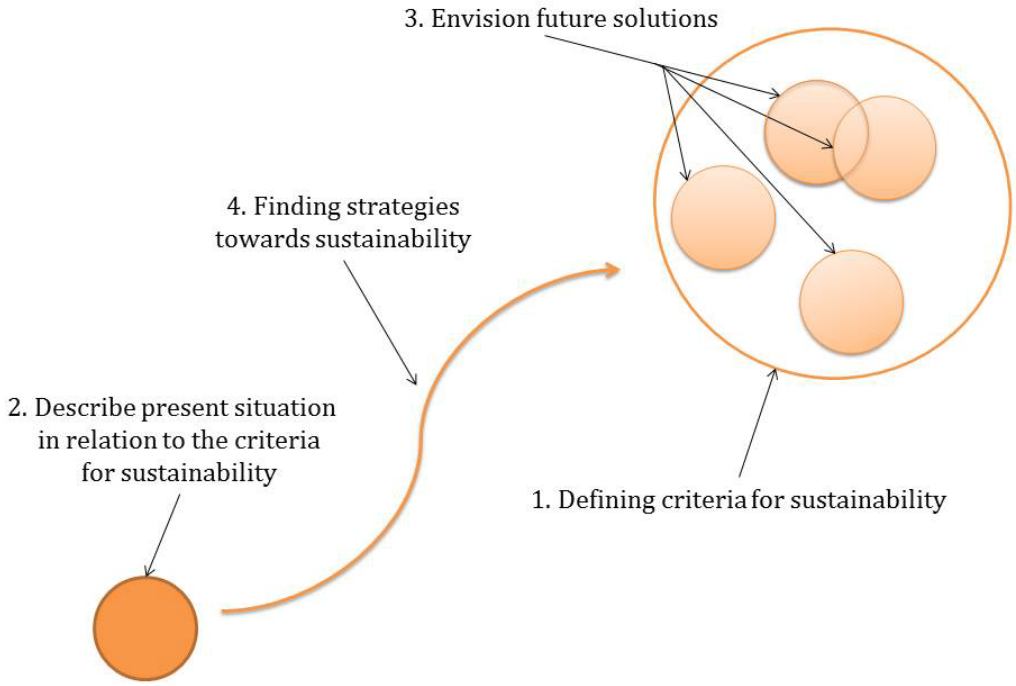

Figure 14 - The steps in the backcasting methodology, adapted from Holmberg (1998), Holmberg and Robèrt (2000)

In order to work through step (1)-(4*), outside-in* and *inside-out* perspectives were combined (Holmberg, 2014). The *outside-in* perspective was created with both a system- and actor analysis, enabling the participants to understand current urban systems, identify the sustainability challenges from a global to a local perspective and to map stakeholders working in different fields with the challenges identified during step 2.

The *inside-out* perspective took into consideration the knowledge of the outer system in relation to the inner space of the participants (AtKisson, 2010). The values of the participants in combination with skills, knowledge and motivation would determine how well the problems were solved. . A SelfLeadership workshop was held to clarify the values, strength and inner motivation of the participants. This was done by creating a meaning map with patterns showing each participant's strengths and weaknesses, which then were further elaborated by having a session showing what happens when strengths and weaknesses are overdone.

Further on, to be able to interact with the stakeholders the participants were equipped with dialogue and listening tools. Another part of the inside-out perspective was to provide the participants with autonomy; where there was a freedom to find and chose a research question that created inner motivation. The exercises held during the inside-out perspective sessions helped the final choice of research topic as it not only was valued based on the needs of the outer system.

Stakeholder dialogues taking place at the Challenge Lab were then organized; to gain further insights from the current local projects addressing the challenges identified and their main barriers from advancing the field further.

From the system analysis leverage points could be identified, which are places within a complex system where "a small shift in one thing can produce big changes in everything" (Meadows, 1997). With an identified leverage point one or two participants in the Challenge Lab could intervene the relationship between academia, the private sector and the public sector which together make up the triple helix (see Figure 15) (Etzkowitz & Leydesdorff, 1995) triggering or catalysing change from the outside.

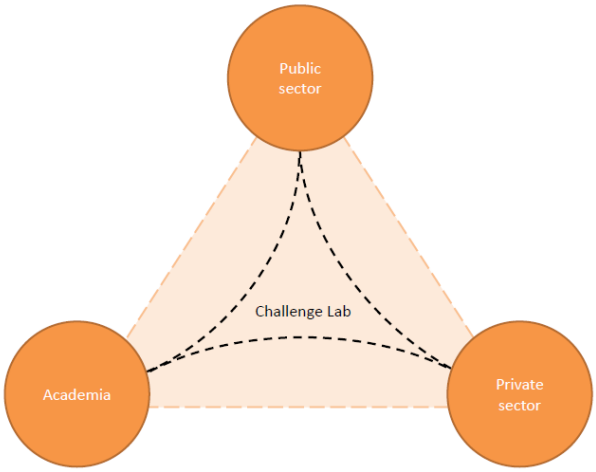

Figure 15 - The triple helix and the participants in the Challenge Lab (adapted from Etzkowitz et al., 1993)

Finally a research question was formulated, in case of a too vague leverage point, at least a research topic was decided upon. Since the intervention of the system would create a deeper understanding of the problem, some space was created in order to specify both the topic and the research question to be relevant to the challenge.

The general methodology chosen to formulate a research question was backcasting. It was used to create pathways for a sustainable urban development. A distinction was made between creating and problem solving, as “creating is different from problem solving. In problem solving we seek to make something we do not like go away. In creating, we seek to make what we truly care about exist” (Senge, 2003, p.4). Backcasting enabled the participants to let go of current dominant trends in the society to develop projects based on the principles of a desirable future.

3.1.1 Step 1 – Define criteria for sustainability

During the first step, a list of non-overlapping criteria for a sustainable urban future was to be created, guiding the whole process towards the vision of a desirable future. The sustainability compass (AtKisson and Hatcher, 2001) was used to guide the participants towards four categories of sustainability where there today are challenges (Figure 16):

- The N for nature comprising all natural ecosystems.
- The E for economy comprising all human systems for the conversion of nature’s resources including goods, services, and ideas.
- The S for society comprising all human systems and components of our collective life including institutions, organizations, and social conditions.
- The W for wellbeing including what contributes to our individual wellbeing including health, happiness, and quality of life.

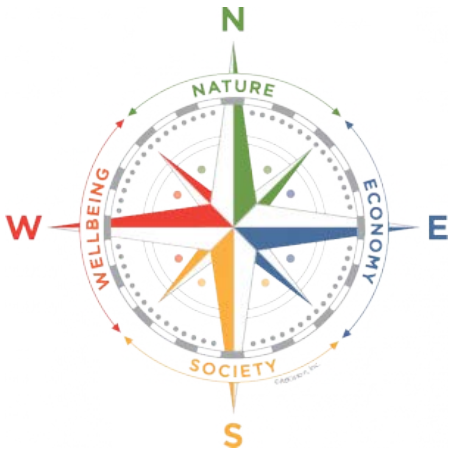

Figure 16 - The sustainability compass (retrieved from http://wp.auburn.edu/sustainability/people/ssa/)

To develop a common understanding of sustainability and to understand their own vision better, the participants explored literature on sustainability, wellbeing and envisioning during three dedicated workshop. The first session consisted of a split in four different teams, one covering a direction of the compass each, creating a list of five criteria for each dimension, which then was amended and improved successively by the other teams. The criteria were then reviewed twice within the whole group in a dialogue setting. It made sense to start from existing publications and internationally renowned reports to establish the criteria, though also necessary to iterate to make sure the criteria were not overlapping ‘nor contradictious.

3.1.2 **Step 2 – Describe the current situation**

The second step had two main objectives:

1. Give the participants a good understanding of the current state of the different urban systems, making it possible to identify the gaps between the current and the envisioned future situation;
2. Identify driving forces in the current situation, such as ongoing projects and trends.

The urban systems and current trends were described using six trend categories applied on the double challenge funnel (Figure 17). It describes the double challenges the world is facing today, where we on one side see an increasing demand on energy and materials, an increasing population and an increasing wealth. On the other side we see an increasing pressure on natural systems regarding their assimilation capacity, resource availability and land use. Together they visually symbolise the narrowing window of opportunities for humans to live sustainably.

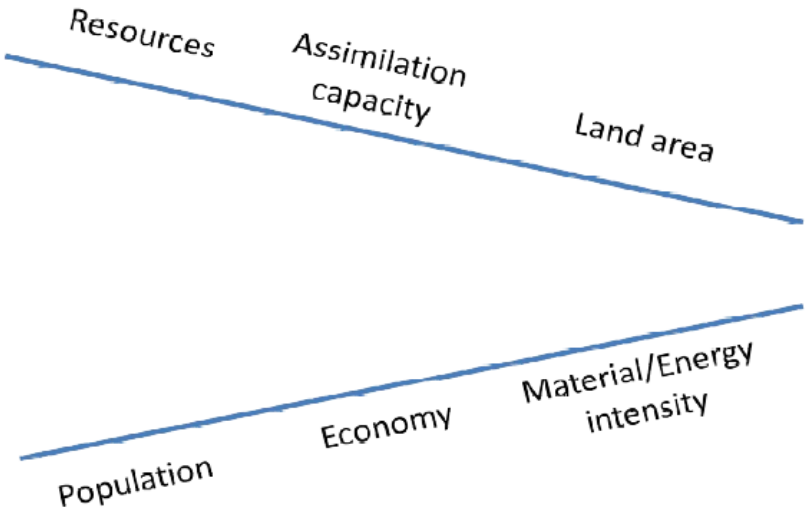

Figure 17 - Representation of the funnel adapted from Holmberg (1998)

The information used to describe the on going projects was based on reviews of local activities on the university-, city- and regional levels. Dialogue sessions were held with stakeholders involved in these projects to get an understanding of current trends as well as the main challenges faced when searching for sustainability. The review was not aimed at being exhaustive, rather the objective was to find leverage points by identifying urban fields with high potential of improvement in relation to the sustainable criteria, inspiring enough to motivate some of the participants to team up and initiate and identify a research topic. For the dialogue sessions to run smoothly the participants were educated in the core values and principles of dialogue, as well as being prepared to apply some dialogue tools.

The inventory of activities, processes and trends within the urban systems was the starting point to assess what components of the systems were counterproductive for achieving sustainability and what needed to be changed. Slowly the gaps between the current situation and the envisioned future started to emerge, leading to a sense of what needed to be done, where more crystalized pictures of the gaps were brought into step 3.

Not only external factors were to motivate which project to pick up, why the methodology also included an inside-out perspective connecting the intrinsic motivation with extrinsic factors; exploring how a task could be fulfilling someone else's needs being aligned to one's personal values (Ryan and Deci, 2000). Pink (2009) argues that the inner motivation and sense of achievement relies on the three components autonomy, mastery and purpose. Autonomy was provided through the Challenge Lab environment, and sessions were held focusing on mastery and purpose.

3.1.3 Step 3 – Envision future solutions

With the gaps between the current system and the future vision, the participants could now elaborate and consider different solutions creating scenarios filling the described gap. At this step the aim was not to reach detailed solutions but rather to some extent explore the scope of possibilities to reach the future vision, having a broad picture enough to select a leverage point (as described earlier) to intervene the system and filling a gap related to sustainable urban development.

One framework applied when identifying future solutions was a tool used in transition management theory to understand societal transition processes: The multi-level perspective to understand the roles of niches and regimes (explained in 2. Theoretical framework). Together with the multi-level perspective design thinking (Söderberg, 2014) (Figure 18) was used to develop different future solutions. The solutions would then be function-focused on satisfying needs rather than being specified in technical terms. Söderberg also mentions that there is a gap between what people want and what they really need, implying that semi-structured interviews with end-users and main stakeholders would allow a deepened information gathering as the interviewee would give you facts you didn't even consider asking for in the first hand.

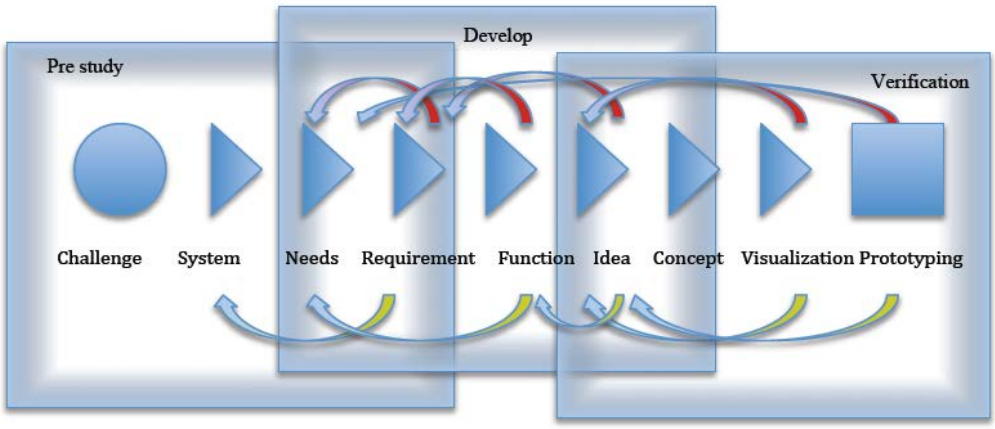

Figure 18 - The design thinking process (Söderberg, 2014)

3.1.4 Step 4 – Find strategies towards sustainability

Based on the understanding of the gap between the current situation and the envisioned future scenarios and solutions on different scales (from technology-specific to system-regional solutions) it was time for the participants to evaluate in which projects there would be a possibility to have an impact towards a sustainable future. This evaluation was based both on external factors (such as resources invested, people involved) and internal factors related to the motivation and background of the participators.

The organic decision process was organized in a workshop setting where ideas on research projects on different topics related to urban systems were put on post-its, to visualize possible synergies and interests between the participants.

The *Phase 1* ended somewhere between step 3 and 4, depending on the state of the different groups, where the ideal outcome of this process would be the participants having formed teams two-by-two with an identified research topic and a research question to continue developing during

4 Results *Phase 1*

This chapter is dedicated to present the results of the collective work made by The Challenge Lab participants during the *Phase 1* process, resulting in the identification of a research topic and a research question. *Phase 1* results are presented using the same structure as mentioned in the methodology, and a visualization of the process can be found in Figure 14.

4.1 Formulation of research question

Below the results from each step during the backcasting process will be presented in more detail. Everything that was discussed and came out of the *Phase 1* process will not be presented here, but the main outcomes of each step that were considered relevant for this thesis, things that made the authors pick up and work further on one of the issues presented by formulating a research question.

4.1.1 Step 1 – Definition of sustainability criteria

The criteria created to describe a sustainable future were to be used further on in the process to evaluate the sustainability of different scenarios created. They are not-solution oriented, rather describing the characteristics of a sustainable future, generic enough to be valid for very different future scenarios.

The challenge for the participants of The Challenge Lab was centred on sustainable urban development, but it was soon realised it did not make any sense trying to define sustainability criteria only for sustainable urban development because of the two concerns:

- How to distinguish and set boundaries on what is related to urban development and what is not.
- How to avoid setting up criteria being too solution-specific in the field of urban development

Criteria were then set up in relation to sustainable development creating a vision for sustainability. It was here important to make clear what is sustainability and what is sustainable development, using a definition such as “sustainable development is a strategic process of continuous innovation and change in the direction of sustainability” (AtKisson, 2010).

By using the sustainability compass criteria were identified within the four dimensions of it. The main finding from the criteria identification was a human-centred vision where social and economical structures are pillars to support human wellbeing, by building upon natural environmental criteria (Figure 19).

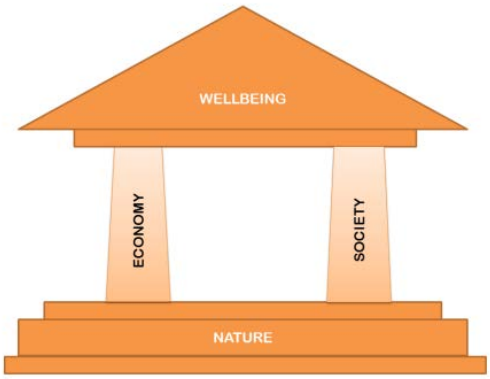

Figure 19 - The challenge Lab representation of the four dimensions of sustainability (adapted from Herman Daly's triangle of means and ends, in AtKisson (2010))

The criteria could be seen as guiding principles for the achievement of the participants' overall vision for sustainability: "A sustainable future where we, approximately 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"

It vision was largely inspired from the definition of sustainable development from the Brundtland report (UNWCED, 1987), the planetary boundaries introduced by Rockström et al. (2009) with the safe operating space for humanity consisting of nine planetary life support systems essential for human survival.

The setup of criteria for nature, economy, society, and wellbeing was done with a review on literature. As it was an iterative process, only the final version of the criteria will be presented below. They should be seen as a description of the participants' world-view and as such only represent the ethnology of this group.

- Nature

Human activities affecting nature's function and diversity are done in such a way that they:

i) do not increase the concentration of substances from the lithosphere in the ecosphere.
ii) do not increase concentration of human made substances in the ecosphere
iii) do not systematically deteriorate the resource base; such as fresh water, fertile land, and biodiversity through manipulation, mismanagement, or over-exploitation

Adopted from Azar, Holmberg and Lindgren (1996) and Holmberg & Robèrt (2000).

- Economy

The economic system is designed in such a way that it:

i) enables us to meet the other criteria efficiently and effectively
ii) should be influenced by the other dimensions (society, wellbeing, nature) and not the other way around
iii) enables further use of resources and avoids dissipative use of materials
iv) is resilient in a way that it functions as a buffer against destructive disturbances, such as environmental catastrophes or economic mismanagement
v) has an inherent mechanism of maintaining and serving societal infrastructure and institutions that permits human wellbeing to be met over time.

Adopted and inspired by Sen (1999); Anand and Sen (2000); Martin and Simmie (2010), Pisano (2012).

- Society

The societal system is designed in such a way that:

i) it is an instrument for individuals to live together within the other criteria
ii) its institutions are built on transparency, accountability, and mutual trust. They enable the wellbeing of the individuals in the society.

Adopted and inspired by The UN General Assembly (1948), Raworth (2012), UN (2012), Open Working Group on Sustainable Development Goals (2014), OECD (2015).

- Wellbeing

The goal of the society and economy, lying on the nature as its fundament, is to serve the human wellbeing, where:

i) everyone has their basic needs fulfilled, such as food, water, health, energy, shelter, and safety.
ii) human life includes subsistence, protection, affection, understanding, participation, idleness, creation, identify, and freedom
iii) 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.
iv) social and economic inequalities are not justified unless they are to the greatest benefit to the least-advantaged members of society.

Adopted and inspired by UN (1948), Rawls (1971), Max-Neef (1992), Oxfam (2008), International Wellbeing Group (2013), OECD (2013).

4.1.2 **Step 2 - Description of the current situation**

Below the current situation related to global trends (outside-in) as well as inner “trends” (inside-out) will be presented.

4.1.2.1 The outside-in perspective

A good understanding of today's trends as well as the local and global status of sustainability was obtained after a group work on global trends based on the funnel as well as more specific review and stakeholders meeting related to climate change and climate mitigation. The major trends regarding the present state of global natural resource supply capacity and the global demand for natural resources in connection with climate change challenges were defined (Appendix 1).

4.1.2.2 The inside-out perspective

Before initiating contact with stakeholders conducting projects in the local context linking the global trends to the local context a workshop on the theme "enabling dialogue frameworks and tools" was organized by Martin Sande working in the "co-lab" of PreEra. Here he shared his experience in facilitating dialogue and fostering transformation within organizations. Apart from exploring the benefits of listening as theorized by Sandow and Allen (2005), four practices to encourage during a dialogue (Figure 20) were discussed based on the following practices and the corresponding roles (Isaacs, 1999):

- Listening: active listening is one of the techniques to listen to others and encourage them to speak their true voice. Listening is achieved when it allows the listener to identify on what underlying assumptions the how a person bases its views on;
- Respecting: respect allows the listener to be in opposition while recognising the legitimacy and coherence of others' point of view. Inquiry is not possible without true respect;
- Suspending: suspending certainties is achieved when "we simply acknowledge and observe our thoughts and feelings as they arise without feeling compelled to act on them" (Isaacs, 1999, p.5). It is necessary to really analyse what is said by taking a step back from the conversation to see the bigger picture and implications of what is being said, without being either supportive or in opposition;
- Voicing: "speaking our voice has to do with revealing what is true for each of us, regardless of all the other influences that might be brought to bear on us" and is according to Isaacs (1999) one of the most challenging practice in dialogue.

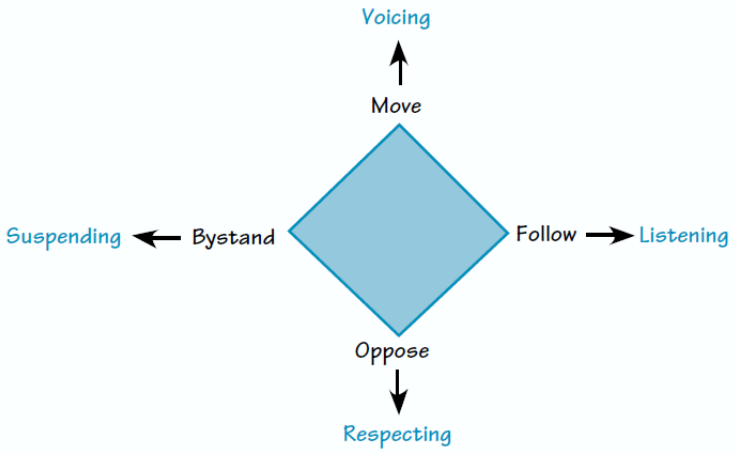

Figure 20 - Four practices for dialogic leaders (Isaacs, 1999)

A self-leadership session was organized by Dominic von Martens from SelfLeaders guiding the participants through their values and motivations. The results from this session included a value clarification among the participants and a mapping of the strengths and goals of the group. A deepened relation emerged within the team based on openness and active listening. Intrinsic motivation was fostered by "going under the surface to find true drivers", to be of guidance towards the future selection of a research topic.

4.1.3 **Step 3 - Envisioning future solutions**

To facilitate the organic decision process of picking up a research topic a workshop was organised where each Challenge Lab participant had to put post-its with ideas for a project on specific boards for each urban system or dimension, from built environment to water management including integrative approaches such as stakeholder participation, open innovation or circular economy. Based on this activity, which made it possible to visualise the possible synergies between students to team up, the research project for each team was formulated and lead to the beginning of the work in teams, starting with the paragraph below.

To connect the challenges arisen due to the global trends with on going projects in the local context meetings were arranged with institutions working with issues related to urban development and climate change. Contact was taken with public authorities (Gothenburg City environmental administration, the section for environment and regional development at the Regional Council Västra Götaland), Mistra Urban Futures, university staff, city planners, and grass-root organizations working with local issues on a small scale.

An understanding started to emerge of the gap between top-down and bottom-up approaches to problems, especially regarding global trends such as resource use, climate change and more broad sustainability challenges related to resilience.

Most projects identified were working in the context of this challenge sharing the same idea that "something has to happen" but with vastly different approaches and ideas of "how". To further dig down in this work the authors asked themselves the following questions:
Where and on what scale could there be a potential to connect bottom-up and top-down approaches? Is there any ongoing project linking national and international targets to the local level (district, municipality, region)?

After a meeting with a representative from the Regional Council of Västra Götaland it was found that they currently were about to initiate a major process involving stakeholders from different sectors, creating an action plan with the goal (or at least showing what would need to be done) to meet the county's climate goals of being fossil independent by 2030. The background of this project is described in *1.2 Project background* and the current progress of it in *6.4 Regional Council Västra Götaland – Strategiska Vägval* .

There was a wish from the project team to use a backcasting methodology as they had been inspired by the work of J. Holmberg and the authors had themselves experience from this certain methodology, why it was considered a good match for the authors to try helping the region towards successfully implementing backcasting in their work. A purpose for the study was formulated as well as a research (*1.3 Purpose and research question*).

4.1.4 **Step 4 – Strategies towards sustainability**

This step is what was considered as *Phase 2* of the project that included:

1. A benchmarking study of three backcasting projects
2. A mapping of the current situation at VGR
3. An analysis of the backcasting projects benchmarked in relation to the theoretical framework resulting in a list of potential enablers of transition
4. An analysis and discussion of the current situation of VGR and what the analysis of the benchmarked studies and theories presented might imply for the current VGR project including some conclusions and ideas how the results could be integrated.

5 Methodology *Phase 2*

Phase 2 encompasses the work dedicated to get insights into what the main enabling factors for a backcasting project could be to reach its full potential and how they could be applied when designing a process for a low-carbon transition. The low-carbon transition process in mind will be the Regional Council Västra Götaland who currently is conducting a project with the purpose to develop an action plan with sharp actions towards a fossil independent region 2030.

Below the methodology for the *Phase 2* of this thesis will be presented which started right after the research question was formulated. Benchmarking was chosen as a methodology as it provided tools not only to collect data on what others had done but also a framework for setting these "best practices" in relation to a current process and implement them.

Ideally the methodology would enable not only the first part of the research question to be answered finding enabling factors for a backcasting project to reach its full potential, but also give some key insights and ideas from "real-life" processes using backcasting. This would aid when giving a recommendation on how the enablers identified actually could be applied when designing a low-carbon transition process and tightening the gap between the current process and the best practices found elsewhere, potentially delivering improved knowledge, practices and processes (Camp, 1989).

The benchmarking process was divided into the five steps: *planning, analysis, integration, action, and maturity* (Camp, 1989). Due to time constraints and the fact that VGR not yet has designed much of the process this thesis aim to contribute to, focus will lie in planning and analysis, where integration, action and maturity is something to start doing once this thesis has been presented. Ideas on the integration step will be given in the section *9.2 - further recommendations.*

5.1 Benchmarking

The purpose of using benchmarking methodology was to find best practices elsewhere and set them in relation to the current processes at VGR. This would reduce the risks of reaching a final result only presenting "nice cases" without a linking to the current operations in the region. It provided tools to analyse current situations and data in a structured way as well as advice on how to make a comparison between two practices. It should be seen as a direction rather than quantifiable metrics that immediately can be achieved (Camp, 1989).

5.1.1 Planning

During this phase questions focusing on what to benchmark and how to do it were answered.

For finding what to benchmark, criteria were set up to identify the leaders within backcasting (best practices, highest level of satisfaction, desirable results) as well as being comparable to the current VGR process and challenges. Projects to be benchmarked were defined partly from the purpose of the study, they should:

1. Have followed a backcasting-methodology;
2. Have tackled long-term complex problems involving multiple stakeholders, preferably within the topic of climate strategies, regional planning and in the cultural context of Sweden;
3. Have been conducted in such a way that both the process and the results can be reviewed by reading articles, published documents and by conducting interviews.
4. Be up to date from a research point of view.
5. Have been considered successful in delivering satisfactory results so that insights can be gathered from these projects as enabling factors, and when applicable an acknowledgement of its limitations hinting about improvements for future projects.

No weighting between the different criteria was made, but the projects were seen as a whole and the criteria were used as guiding principles when selecting what to benchmark.

5.1.2 Data collection

Data was collected by reading scientific publications, literature reviews and project summaries. When possible, semi-structured interviews were held with people involved in the projects to collect data. These interviews (Appendix 2) made accessible information that cannot easily be found in literature or project summaries, as well as more personal experience of the process. An interview guideline was created as a basis when holding semi-structured interviews (Appendix 3).

In parallel with the benchmarking of the selected cases a dialogue was held with some representatives from VGR to clearer understand their current process, needs and challenges.

The collected data on the projects is presented in chapter 6 - Results *Phase 2*.

5.1.3 Analysis

During the analysis the collected data from the benchmarked projects had been documented and were to be analysed. This included a merge of the benchmarked projects into a list of practices identified as “success factors”. These were found by drawing conclusions on smaller steps in the projects benchmarked believed to be crucial for the process to succeed, as well as more general conclusions on the project design. These were translated into main enabling factors for a backcasting project, which were produced by setting the “success factors” in relation to the theories presented in chapter *2 Theoretical framework*.

When this list of enablers was completed it was ordered in a fictive process design following a backcasting methodology having considered success factors from the benchmarked projects all together. The insights from this fictive process could then be used to analyse the current situation at VGR trying to identify areas that could be developed (weaknesses) as well as areas that already were strong within their operations (Camp, 1989).

5.1.4 Integration, action, and maturity

The analysis would not make any sense unless it was integrated into the current operations at VGR, why it after the conclusion under the section *9.2 further recommendations*, will be a short description of what needs to be done next if one wishes to integrate parts or the full findings of this study. However, due to time constraints this was not considered in the thesis.

5.2 Ethical considerations

As the results of this thesis could be implemented in a processes related to regional development conducted by politicians it has been a priority for the authors to present the findings in an objective, un-biased way without any influence from political ideology. When interviewing people the purpose of this thesis was made clear on forehand, including information given how the information gathered was to be used and distributed, including information regarding confidentiality (Vetenskapsrådet, 2002).

6 **Results *Phase 2***

Out from the criteria as mentioned in the benchmarking methodology a research for relevant projects to benchmark started. Based on Quist (2007) most experience from backcasting approaches were to be found on projects in Sweden, Canada and The Netherlands. A research on on-going and finished projects in these countries was made and resulted in the selection of three projects to study, on in each country.

In Canada MetroQuest came out as an interesting approach that among others has been used by Chicago Metropolitan Agency for Planning (CMAP). It was used to include large numbers of people in the regional planning towards 2040 (Lyons et al., 2014) based on a backcasting approach (Robinson, 2003). It matched well with the criteria set up since it is:

1. based on a backcasting-methodology;
2. used to tackle long-term complex problem involving multiple stakeholders within the topic of regional planning;
3. well documented and several articles has been published on the matter;
4. currently used in several regional planning projects;
5. considered commercially successful.

In the Netherlands the DRIFT approach towards transition management (Roorda et al., 2014) seemed interesting, as it includes a step called backcasting in the process, most recently used for urban low-carbon transitions on a city level Since the generic framework of transition management had already been applied to several projects and translated into a guidance manual, a search was made towards a project that could add a new dimension being a project on a larger geographical scale, as the DRIFT approach towards transition management has so far mostly been used on a city scale.

A multi-stakeholder dialogue project called Climate OptiOns for the Long term (COOL) came out as a project dealing with similar challenges as the ones identified by VGR. The project:

1. dealt with a transition on a country scale (The Netherlands) using a backcasting methodology;
2. was a multi-stakeholder dialogue that produced climate change strategies towards 2050 to develop long-term climate change policy in The Netherlands;
3. is well documented including an evaluation report at the end of the project;
4. was one of the few projects which implemented multi-sectorial backcasting on a scale bigger than a city;
5. had generated interesting findings and learnings from the process via an extensive evaluation at the end of the process.

In Sweden Holmberg and Robèrt (2000) have developed a backcasting framework which was applied for the transportation sector in a project initiated by VINNOVA (the Swedish government agency that administers funding for research and development). It produced a research agenda towards a sustainable transportation system 2050 where stakeholders

from the field were brought together to co-create such an agenda. Moreover VGR showed an interest in that specific project, as they heard about the work of J. Holmberg, who was involved in the design and facilitation of the National joint forces transport Sweden 2050. The project:

1. followed a backcasting-methodology;
2. dealt with long-term complex issues involving multiple stakeholders;
3. was considered easy to get data from the project as it finished recently with participants who were close geographically;
4. was facilitated and designed by people who currently do research and work with backcasting;
5. received positive response by VINNOVA for its systemic approach

With these three projects - the MetroQuest, COOL and Transportation 2050 projects - to collect data on and the theories presented, it was considered sufficient to combine them in order to draw some conclusions. This is why no further projects were identified to benchmark.

The three benchmarked projects will be presented below, followed by a presentation of the current VGR project *Strategiska Vägval* (en: Strategic Pathways), which is a project currently conducted by VGR within the frame of the climate strategic program *Smart Energi* (en: Smart Energy) of VGR.

6.1 MetroQuest and GB-QUEST for participatory regional planning

MetroQuest is a commercial backcasting application (made available on a website dedicated to each project) which can be included in the process to vision sustainable regional futures (Robinson et al, 2011). It was developed as a spin-off project, based on the more rigorous GB-QUEST methodology used in The Georgia Basin Futures Project (Robinson et al., 2004; Tansey et al., 2002; Robinson et al., 2001).

As MetroQuest can be considered as a commercialized “light-version” of the GB-QUEST methodology a presentation of this methodology will be given first, followed by a short introduction of MetroQuest and its main applications including some key insights from processes using integrated assessment modelling tools.

The Georgia Basin region in western Canada was searching for sustainable development patterns to address the challenges of the future, including the increasing rates of urbanization and the pressure it sets on urban areas, water, energy, transportation, housing, waste etc. To tackle these challenges a project running from 1999 to 2004 creating 40-year scenarios of the region was initiated.

6.1.1 Goals and objectives

The purpose of the project was to through scenario analysis (Tansey, 2002) find policies that could enhance human wellbeing while reducing environmental effects of human activities, This was done by exploring trade-offs, creating dialogue, supporting policy and decision making, and to combine public, values, preferences, and beliefs with expert knowledge.

This was argued potentially being two contradictory goals, building both realistic future representations and engaging stakeholders to debate about what a desirable future might represent (Carmichael et al., 2004).

Another objective of the project was to map the general values related to sustainability within the region, and to better understand the interrelated dynamics of the ecological, economical and social systems in the area.

6.1.2 Project Design

It was believed that a challenge was to include several disciplines to take more than just one sector or aspect of the problem into consideration. Robinson et al (2001, p2) stated that "it has become increasingly clear that a wider focus that includes broader social and economic developments is necessary". Though, the project worked with integrative assessment, historically used on environmental issues such as acidification and climate change (Tansey et al., 2002).

The project was led by a team from the University of British Columbia and focused on creating 40-year scenarios starting at 2000 of the Vancouver region and Victoria in British Columbia. People involved in the project ranged from co-investigators and researchers to students, NGO's, government and private sector partners within the region.

The project was based on the four concerns:

- How to integrate natural sciences with social sciences;
- How to see the future and study different ways of working individually or collectively of reaching a more sustainable future;
- The awareness of involving various stakeholders in the research progress;
- The temporal and spatial scale of analysis.

The GB-QUEST computer-modelling tool created was built on an earlier prototype, with a three folded approach, using backcasting, design and an interactive and social science approach (Robinson 2003; 2004) It was made substantial enough to be able to make sense of natural and social system modelling, still simple enough for the general public in workshop settings to be able to be interested and using the tool to explore regional futures.

The model contains three steps (Robinson 2004)*: (1). Set context, (2). Options for the future and (3). Results.* During the first two steps the user gets to answer various questions affecting the scenario generated, which then can be explored during the last step, presented below.

6.1.2.1 Set context

During the set context step three sections are presented, where the user is asked to rank priorities organized as value clusters (Planet first, People first, Rural Economy First or Urban Economy first) in relation to social, economic and environmental conditions of the region, based on the global scenarios developed by Paul D. Raskin, most recently described in Raskin et al., (2010).

The scenarios were in the GB-QUEST model translated into the local context by having a regional interpretation on the global conditions of which the user could chose (either to experiment or based on belief) which development path the world would take (Raskin et al., 2010):

1. market forces with a continuation of deregulation and trade liberalization;
2. a policy reform where government intervention deals with externalities from human activities originating from deregulations and trade liberalizations;
3. a fortress world where the militarism has increased, with social breakdown in combination with isolation and trade blocks;
4. a great transition where global values shift towards a higher concern of nature, equity and solidarity.

These characteristics were, because of their nature, not up to the participants in the Georgia Basin to decide upon, but rather a choice reflecting the view of the user what future conditions feel most likely. This will though have an effect of the preferred scenario and output of the model, which the user is exploring.

The last section is the *How the world works*, where the user is asked to put in its beliefs related to aspects of the human nature, technology and the natural world, where factors regarding peoples' willingness to change and adapt, the pace and role of technical development, and the natures' response to human activities.

The choices made are then used to give a better understanding of the uncertainty related to behavioural change and scientific processes, as well as the educational dimension where the user can explore how significant certain underlying beliefs are on the dynamics of the world we live in.

6.1.2.2 Options for the future

At this stage the user can make choices on three different hierarchy levels, from detailed questions in certain sectors to more categorical levels, related to regional development and choices which can be made within the boundaries of the region. Depending on the users preferences one can chose to explore some issues in great detail, or just touch some questions on a broader level.

6.1.2.3 Result section

Here the year 2040 scenario based on the user's choices is shown, focusing on the priorities of the user. They are set in relation to fixed targets representing what is considered to be sustainable within each activity. Social, economical and ecological dimensions are presented, in a total of nine themes; traffic congestion, students per teacher, hospital visits due to air quality concerns, government deficit, unemployment, cost of living, eco-footprint, greenhouse gas emissions, percentage of developable land remaining in the region (Carmichael et al., 2004).

It is also possible for the user to navigate through the results, studying a certain area more specifically or development patterns between 2000 and 2040 for the priorities. It is here possible to explore the results, comparing different scenarios and see how paths of consequences resulting from the choices made affect the outcomes. It is considered that "these 'storylines' offer a powerful way to provide integrated pictures of how individual outcomes fit together" (Carmichael et al., 2004, p180).

6.1.3 **Outcomes**

The interface took much inspiration from Sim City, but with working methods grounded in science. It was a second order backcasting process since it allowed not only experts but also community partners to decide preferable futures. It was stated by Robinson et al., (2011) that "by collectively building a desirable future scenario, and expressing preferences through discussion and voting, users become invested in the future scenario they create, and begin to identify enablers and barriers to their desired future" (p. 757).

The user provides desired outcomes rather than specific policies that would accomplish them, each user constructs his/her own desirable future and not a future that by definition is more sustainable than others.

The methodology used in GB-QUEST emphasized that social limits (behavioural change, social acceptability of technologies and willingness to bear short-term costs for long-term gains) were just as significant to deal with as applying sustainable development concepts based on the concern about human development violating environmental limits.

One conclusion Carmichael et al., (2004) draws is that "the greater challenge will be to create the political spaces for the application of these methods both in social science settings and to real social issues within the GB region. The success of the project in opening up this discursive space can only be judged from future applications of GB-QUEST". One such future application is MetroQuest, which will be presented below.

6.1.3.1 MetroQuest

MetroQuest is built on the GB-QUEST system enabling non-experts [2]to engage in creating and exploring growth scenarios for regions or municipalities. It is a deliberation tool with a purpose to improve decision-making in generating public and political support, supporting the participants to consider complex ecological, social and economic conditions and choices and reflect over them (Lyons et al., 2014).

[2] The definition of an expert is here related to someone with expertize in creating regional growth scenarios.

It was partly created due to that the GB-QUEST workshops just reached out to the “same ten people”, the ones being very motivated to participate and had a deep interest in the field. MetroQuest is for “the last 99%” being an online tool (that also can be used on tablets by people walking around on the streets etc.) where the time input to participate is between 5 and 10 minutes. In relation to GB-QUEST MetroQuest is “just” the interface, where the calculations and scenarios created are made on forehand by the part who orders the service. Still the user can rank its priorities related to his or her life and can see different outcomes based on their choices (Walsh, 2015; Lyons et al., 2014).

MetroQuest allows citizens to with a backcasting approach “explore the feasibility and implications of achieving a desired future through and emergent and participatory process” (Lyons et al., 2014, p. 25). It makes it possible for the citizen to discover consequences and trade-offs related to preferred policy choices needed to be in place to reach “a desirable future” which is built upon prioritizes and choices made when using the tool.

The use of such an application can “increase participant buy-in and also facilitate a broadening of scope from discrete goals to systemic development path changes” (Robinson et al., 2011, p. 757).

It is worth mentioning that the tool was used for the CMAP go to 2040 project where the most popular user scenario was a future focusing on compact growth in metropolitan and community centres, that “supported minimal investment in existing roadways, maximum investment in transit and alternative modes of transportation, and maximized use of existing natural resources” (Lyons et al., 2014, p. 28).

Though a conclusion drawn by Lyons et al., (2014) is that MetroQuest is not a substitute to workshops but something that should be used in parallel, as in workshop settings the tool can be used to trigger discussions, adding other valuable information to build upon the local knowledge of some issue by sharing experiences and knowledge.

MetroQuest is used by public sector organizations that want to interact with citizens on topics such as climate change, sustainability, land use, and transportation. It is used in an iterative way where the public are asked to identify desirable objectives and things they are concerned with. These objectives boil down into a series of topics, which then are ranked by the participants. Now the people are part of the conversation, and the data produced is used by the researchers developing scenarios, and then going back to the people asking if it was something like this they asked for to get more input (Walsh, 2015)

For some screens and further explanation of how MetroQuest has been used in different cases see Appendix 4.

6.1.4 Learnings from the process

Since community partners were involved in creating the scenarios themselves it opened up for having values, attitudes and people’s own preferences included in the scenarios. Combining this with the experts an emergent understanding came up of sustainable futures in the form of a preferred scenario. This showed the appeal and power that is not intended to educate or inform by providing information, but based on the **co-production** of knowledge in a social learning process (Robinson et al. 2011).

One strength with this methodology argued by Robinson et al. (2011) is that collective choices about sustainability are critically important, but politicians can't take decisions without having "the people on board", and companies just can't start producing sustainable products without a demand for them. This requires a public discussion and engagement in the questions, and they believe this process with a strong interactivity is essential for the development.

A learning from Robinson et al. (2014) is that "without early buy-in from decision-makers, results are unlikely to have strong practical effects: but such buy-in is very difficult when processes are open-ended and highly participatory". However, he continues the statement saying that there seems to be an escalating momentum for these kinds of backcasting processes that made it possible for industry, academia and government to converge around the idea to use participatory backcasting creating possible futures where they can discuss about possible actions to shift the paths of development.

A step towards a more interactive engagement of citizens in complex public policy, where MetroQuest shows it can involve significant amounts of participants. Citizens can see consequences and trade-offs from choices associated to policy choices, and can express their preferences as of desirable outcomes and policies (Lyons et al., 2014).

6.2 Climate OptiOns for the Long term

The Climate OptiOns for the Long term (COOL) project was developed within the Dutch National Research Programme on Global Air Pollution and Climate Change. It is a multi-level dialogue project carried out between December 1998 and June 2001. Dialogue processes were conducted at global (worldwide), European and national (Dutch) level, to take into account the reliance of Dutch climate change policy to international policy developments (Tuinstra et al., 2002).

To fit well with the criteria presented in the methodology only the national level will be considered in this presentation, though data from the overall project was considered to better understand the general design, process and outcomes of the entire COOL project.

Negotiations were on going between Dutch ministries and stakeholders about short term emission reductions when the decision was taken to organise dialogue – which had never been done before – and to use a backcasting methodology for its ability to connect a long-term perspective (2050) to the current situation. The stakeholders involved were national and local government members, policy makers from a wide range of sectors including industry, energy, transport, housing, agriculture, private companies as well as consumer NGOs (W. Tuinstra, personal communication, April 13, 2015).

6.2.1 Goals and Objectives

The first objective of the COOL project was the "development of insights and recommendations for long-term climate change policy in The Netherlands, within an international context by identifying (elements of) viable strategies for drastic GHG emission reductions" (Tuinstra et al., 2002, p.6). In order to do so, questions such as 'Is the climate target achievable?' and 'What resources would it require?' were to be answered during the process. The target for the national dialogue was a reduction of 80% of the GHGs by 2050 based on 1990 levels

The second objective was to contribute to the development of methods for stakeholder involvement in dialogue processes about complex issues, by learning from one year of interaction of the participants from the academia, the private sector and societal groups in dialogue settings (Kasemir, Jaeger, J. & Jaeger, CC., 2003). In order to improve the effectiveness of participatory methodology for decision-making processes, three methodological issues (Hisschemöller & Mol, 2002) were evaluated regarding:

- the added-value of the stakeholder participation to the integrated assessment, and how the dialogue structures supported it;
- the knowledge supply as well as its demand and utilization by the participants;
- the interactions between science and policy for policy making.

6.2.2 Project Design

A project team in charge of the organization and the reporting of the results carried out the national dialogue. A scientific support team (thereafter referred to as the scientific team) was part of the project team and delivered to the groups 'state of the art' scientific information related to the different options considered for GHGs emission reduction. The dialogue was structured in four groups working on potential emission reduction in four different areas of interest: Industry & Energy, Transport & Traffic, Housing & Construction, and Agriculture & Nutrition, with approximately 14 participants in each group. In each group a chair person who was well-known in the scientific community was nominated from the participants to trigger their commitment to the process and giving more status to the dialogue but also to facilitate the communication between the participants and the project team (Tuinstra et al., 2002).

The project was following the three phases: a design phase, a dialogue phase and a reporting phase.

6.2.2.1 Design phase

During the design phase, 100 interviews were conducted with stakeholders from the four sectors greatly contributed to specify the focus of the discussion. The suggestions from the interviewees also influenced the composition of the four groups in term of participants. The participants were given an occasion to influence the design of the dialogue phase via two approval notes about the scope of the dialogue and the 'Rules of the Game' for the dialogue and later about the dialogue's process and schedule (Tuinstra et al., 2002).

6.2.2.2 Dialogue phase

The dialogue phase was based on a backcasting methodology (Figure 21) in five steps (Tuinstra, van de Kerkhof, Hisschemöller & Mol, 2003):

- Step 1: problem definition and setting criteria for a solution;
- Step 2: development of Future Images, to characterize each sector in 2050 meeting the requirements set by the criteria;
- Step 3: path analysis divided in identifying necessary transformations between the images of 2050 and the current situation, defining the conditions in which different options could contribute to the Future Images;
- Step 4: comparison of current trends to identify the gap and the desirable trends for long term climate policy to close the gap;
- Step 5: formulation of an integrated strategic vision.

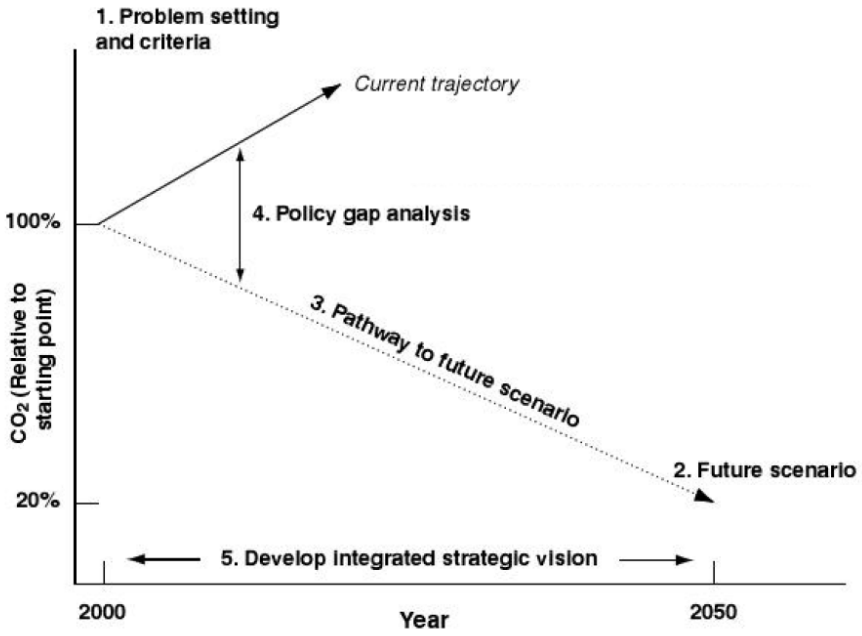

Figure 21 - Backcasting methodology applied in the COOL project (Tuinstra, van de Kerkhof, Hisschemöller & Mol, 2001)

In practice the phase took place during six meetings for each group over a period of one and a half year. Two joint workshops were also organised for representatives of each group first in order to exchange interim results and then to discuss the conclusions of each group and the conflicts between them. The backcasting phase was put into practice through the following steps:

- Each group developed two future images for their sector, based on the 80% GHG emission reduction target. This work was based on the two future images for The Netherlands in 2050 presented by the scientific team, themselves inspired from two different scenarios used by the IPCC quantified for the Dutch situation.

- The future images were the starting point for the selection and the analysis of the potential of 22 mostly technical options for the emission reduction target. The analysis was done according to the backcasting methodology to identify the opportunities (for the national government, EU, private actors), barriers and main problem solved for the options to have been implemented 50 years in the future. During the last step, the participants identified criteria to be met by the options to get support from long-term climate change policy, such as climate effectiveness, sustainability, cost effectiveness and social support.
- From the list of criteria, two to four trajectories combining different options feasible to reach the emission reduction target were defined for each sector. Calculations were made by the scientific team to estimate the GHG emission reduction potential of each trajectory.

6.2.2.3 Reporting phase

The reporting phase consisted for the project team to present the results of the four dialogue processes in strategic vision reports and policy brief for each sector and a synthesis report. The participants reviewed it all before publication (Tuinstra et al., 2002).

6.2.3 **Outcomes**

The national dialogue resulted in a strategic vision for the four sectors successfully accounting for about an 80% GHG reduction potential by 2050 for The Netherlands (Hisschemöller, 2001). In a few cases, the sectorial trajectories were in conflict with each other. Doubts were also formulated for example regarding the limited biomass availability given the various claims from the Transport and Industry & Energy sectors as well as the investment capacity, as different trajectories for energy requires different kind of costly infrastructure. These inconsistencies were discovered but not addressed further during the dialogue process (Tuinstra et al., 2002).

The strategic reports included “the possible options and necessary measures to be taken, the timing required for these options and measures, the conditions that support these options and measures, and the coalition of actors that are crucial for implementing these options and measures”. It was based on the analysis of the 22 options used to establish trajectories for each sector, some options like ‘Biomass’ were analysed by several sector (industry, agriculture and transport sectors) but most options were only considered by one sector (‘Modal shift from road to water’ for transport, ‘Passive solar’ for housing, ‘Replacement speed of buildings’ for housing, etc.). Recommendations to be taken between 2002 and 2012 per sector and regarding climate policy in The Netherlands were also produced, including for example the need to deal with the uncertainties and the conflicting views (between the different sectors’ trajectories) to prepare for the long-term actions (Tuinstra et al., 2002).

The backcasting exercises highlighted as the main barriers the need for a joint European approach as well as the lack of public acceptance for some options. The opportunities identified were summarised by van der Kerkhof et al. (2001) as “climate policies in the Netherlands can in a positive way contribute to domestic comfort, a reduction of traffic annoyance, a more pleasant landscape, and will not negatively affect matters that people care about, such as income and mobility” (p.7). The groups also formulated the need for long term climate policy for “an integrated approach to assess the effectiveness of instruments and institutions over time; knowledge and knowledge infrastructure; market development and the adoption of innovations; implications for space and infrastructure; empowerment of consumers; a trajectory for biomass, and a trajectory for CO_2 removal and storage” (Hisschemöller, 2001, p.23).

The general view from the participants at the end of the dialogue process was expressed as: “emission reductions of up to –80% are imaginable by 2050. Not all dialogue participants are, however, (equally) optimistic about the feasibility of such reductions. In particular, there is considerable doubt as to whether or not these reductions will be possible without causing or aggravating problems other than climate change either here or elsewhere” (Tuinstra et al., 2002).

It should be noted that the long-term impact of this project has not been demonstrated. Members of the project team did not know if the project had any impact on climate policy in The Netherlands. This can be connected with the fact that the “research programme [was] funded by money from a project running for a certain time” and the people involved either left the university or started to work on new projects. There was no follow-up, even if “there should be another project to investigate [the effect of the COOL project] after 20 years”. Monitoring of the long-term effects of such a dialogue process would be of great use to improve future projects. The only information available regarding this seems to be that some of the participants of the dialogues kept spreading the strategies developed during the process (W. Tuinstra, personal communication, April 13, 2015).

6.2.4 Learnings from the process

A list of nine main learnings from the National Dialogue process was released in the Synthesis Report of the Cool project (Tuinstra et al., 2002):

- “A dialogue group with stakeholders from different expert fields, with different opinions and views, will increase the possibility of generating new insights for policy.
- The success of the group depends heavily on the quality of process support. It is critical that the different steps in the process are transparent to the participants.
- In a demand-driven dialogue, it is crucial that the wishes, concerns and expectations of all participants are used as a starting point for discussion.
- A certain degree of autonomy from the dialogue groups will increase the participants’ involvement in the work of the group and in the end product.
- The role of scientific support in a dialogue deserves special attention. The information that is offered should be accessible, compact and tailor-made. Furthermore, a proper communication of information is of vital importance.

- The backcasting method results in insights related to chances and obstacles in the implementation of options for climate policy. However, it alone does not stimulate the participants to articulate and discuss conflicting views.
- Using future images and backcasting stimulates a long-term scope in the dialogue. These methods do not cut the participants off from their own experiences, opinions and interests. This should not be the project's intention.
- An extended preparation phase and a good budget are essential to ensure the satisfactory progression of the dialogue.
- To work in an interdisciplinary team requires careful communication and a good workplan. This takes time!"

The heterogeneity of the participants was important to get more ideas and alternative viewpoints during the dialogue, which would not be the case if the participants were part of the same network. This heterogeneity was achieved by using the snowball method to identify potential participants beyond the dominant Dutch science-policy network on climate change. The evaluation also conceded that a certain degree of homogeneity was necessary to ensure enough common ground between the participants in order for them to discuss options and envision actions (van de Kerkhof & Wieczorek, 2005). As the participants from private companies and NGOs are usually more interested in short term than long term issues, "the project had to link an informed debate on creative and innovative strategies for the long term to their specific implications for the here" (van de Kerkhof et al., 2001, p.3).

Having one of the participants instead of a project team member at the chair position contributed to create a feeling of ownership amongst the participants (Tuinstra et al., 2003). Regarding the involvement of the participants, a "major lesson from the COOL process is that it pays to invest in participants' involvement" which includes assisting them in meeting preparation, defining the agenda in close co-operation with the participants and encouraging them to present their experiences and point of views during the discussions. Having a real influence on the process particularly contributes to the commitment of the participants (Hisschemöller & Mol, 2002, p.100).

The participants did some of the presentations of scientific information related to their field of expertise, with the effect of increasing their commitment and active involvement in the process. Nevertheless it required extra attention from the scientific team to make sure the dialogue did not get influenced by personal interests (Tuinstra et al., 2003).

During the process, creativity appeared when the participants were interested, felt at ease but also had a sufficient degree of expertise on the topic. The knowledge supply was evaluated at the end of the process, as it was one of the three methodological issues the project aimed at contributing to improve. Several recommendations regarding the nature, the project team gave the form of the information and the presentation context. First, it was noticed that information needed to be provided several times, in different forms that people can relate to. Four key-factors that invited speakers and members of the scientific team should be aware of to provide information in an efficient way were identified:

- "Oral presentations turn out to be far more effective than mere presentations on paper;

- The use of interactive tools increases the attention and involvement of participants;
- Presentation skills are far more important than in a 'normal' scientific setting;
- Limiting the amount of information is crucial; too much information is clearly counterproductive" (Tuinstra et al., 2002, p. 113).

The speakers should also demonstrate interest in the process, the willingness to interact with the participants and dedicate sufficient time to preparation their information. The participants may need greater rough estimates than the scientists are used to produce. Because rough estimates can be particularly valuable to move the debate forward, the scientists need to be willing to produce them and explain the underlying assumptions and the range of uncertainty (Tuinstra et al., 2002).

The scientific team also played a role in scientific information input. They usefully provided information at specific moment of the dialogue for the Future Images and their adjustments, for the calculation of the contribution of different options to emission reductions but also as spontaneous interventions during the discussions "either because it felt that certain topics were neglected in the discussion, or to assist a dialogue group to structure the debate" (Hisschemöller & Mol, 2002, p.97).

Related to the debate of conflicting views, the experience of the national dialogue stressed the importance of investigating when and how the policy instruments may conflict with each other, clarifying who will take the final decision on which solution is the most suitable for the transition, guaranteeing transparency of the process and the complementarity of the policies. These challenges lie at the intersection of technology, economy and governance questions (Hisschemöller & Mol, 2002).

Finally, the project team acknowledged the contribution of the dialogue process in the learning process of the participants, which is twofold: "a learning process can result in a modification of the specific instruments that are used (the first form of learning), but it may also lead to a paradigm shift, which refers to a change in the framework of ideas and standards within which actors customarily work, including their basic assumptions (the second form of learning)". The evaluation revealed that "the starting point in the far future provides opportunities for the first form of learning, whereas the analysis of different pathways enhances the opportunities for the second form of learning" (van de Kerkhof & Wieczorek, 2005, pp.735&741).

6.3 National joint forces transport Sweden 2050

The National Joint Forces Transport Sweden 2050 (VINNOVA, 2012) was initiated by VINNOVA to create a research agenda for the future research within the transport sector. The action plans used before, or the ones currently being developed, were often focused on what needed to be done in order to reach a certain target, but did not take into account that there are other agendas with targets that might create contradictions.

6.3.1 Goals and Objectives

The purpose was to develop a strategic research- and innovation agenda in wide collaboration between companies, trade organizations, institutes, universities who were directly or indirectly involved within the area of transport. One precondition was the will of all participants to identify a collective vision based on criteria for the sustainable transportation society 2050.

6.3.2 Project Design

Six questions were formulated by VINNOVA:

- Why is the area an area of strength in Sweden and how can it be renewed?
- What are the common targets and needs in the short, medium and the long term?
- How can current resources, efforts, and infrastructures be used in a smarter way?
- What could and should our national focus and key skills be in an international context?
- What efforts and activities are needed in order to reach the targets and meet the needs pointed out in the agenda?
- What should the collaboration look like to realize the proposals made?

The project was conducted as a series of workshops (and a few meetings) during the spring 2013. Backcasting was used as a methodology to identify key activities. It not only followed the most important Swedish and European targets, but also took into consideration the action plans, agendas, projects and collaborations of today with a purpose to reach the sustainable transportation society, often with targets at 2020, 2030 and 2050. The four workshops had the themes: *Indicators of a sustainable future, system analysis and leverage points, innovations and initiatives, strategies and conclusions.*

A precondition to do the backcasting work was to see transportation as a system that could be changed, where backcasting became a tool to first create criteria upon what kind of results the transportation system should produce. These desirable results were then linked to the current situation - and challenging the mental models of the participants - of today's transportation system. When the gap between the future and today was clear innovations and strategies were to be formulated within the boundaries of the criteria and set in relation to agendas and practices already in place.

In total there were 20 participants from 15 different organizations. Industry, academia, government, competence centres or institutes. According to M. Blinge (personal communication, April 20, 2015) the process would have gained by having more people from industry present.

Below each workshop will be explained in more detail.

6.3.2.1 Indicators of a sustainable future

This workshop started with a brainstorming session where the participants were reflecting over the future of the transportation sector, fulfilling the climate goals in the Swedish transport sector 2050. The sustainability compass was used to discuss the future from the four perspectives; nature/ecosystems, economical terms, societal and social patterns, human wellbeing.

The next phase was to in small groups look at the visions category-wise, picking out the most important ones and for each of them reflect upon how one could measure this success, both in specific terms if the measure existed and in general terms if it did not. The groups were rotated so they got to reflect over all categories.

The session ended with a voting where each person had 7 votes, with a limit to put a maximum of 3 on one indicator, it was also stated here that there is no “lock-in” due to the voting.

6.3.2.2 System analysis and leverage points

Here a system model based on the results from the first workshop was developed using Causal Loop Diagrams. The collective knowledge of the group was used to analyse, review and develop the system analysis, ending up with an identification of leverage points in the system where efforts were needed.

6.3.2.3 Innovations and initiatives

This workshop started with a review of the system analysis, followed by a session where the participants in small groups were reflecting upon innovations needed to make the transportation system develop in the “right direction”. They were then presented, being voted on and the results were discussed to find out if there was something missing or did not feel right, opening up for a chance to add more ideas. Then a new voting round started and the “winners” were to be further developed and précised to create a clear understanding of what the ideas mean.

6.3.2.4 Strategies and conclusions

During the strategies workshop the results from the innovations workshop were reviewed. Then discussions were being held reflecting over how the proposals were to be further developed and be linked to current VINNOVA agendas, current research agendas and other proposals, industry actors and the government and other authorities.

Then the entire process was then reviewed to make sure the logic was being held and that the proposals were sound and well grounded.

6.3.3 **Outcomes**

The key factors identified during the indicator exercise were mapped based on the four dimensions of the compass as well with an explanation for the natural and economic indicators whether the indicators were measuring factors with either a vision to reach net zero, in balance, an increase or a decrease:

- Nature: net CO_2-emissions, other emissions, ecosystem services, biodiversity, noise and disturbance;
- Economy: long-term economy, non-dissipative use of materials, internalisation of costs, resource distribution;
- Society: Maslow level related to transport, accessibility, societal trust, use of capital in the transportation system;

- Wellbeing: Related to general satisfaction regarding usefulness, travel time, quality of vehicles and services, human health effect, perceived simplicity, experienced possibility to affect the system, choice.

By using Causal Loop Diagrams various targets and different activities to reach the targets were studied to find how they were interrelated. Then leverage points were identified and together they give a complex picture about the future demands. They were then analysed and some key findings were the heart of the transportation system, long term perspectives in economy and society, trust and a cluster based on equity, safety and a sense of belonging. The feedback loop also showed how significant social norms were for the human view of oneself and as a part of the eco-system. Some other participants found an important cluster of affection around the societal ability to think in the long-term and to create international competitiveness by investing in transportation, and factors that all together created complex dynamics. In general people were also mentioning the will to create a sustainable society and everything that affects this will.

The identified leverage points from the system analysis were grouped into the categories: technical, human, economical, societal and other.

The project took a bigger systems perspective on the agenda, managing to identify seven areas crucial for the sustainable transportation society 2050:

- Human behaviour, demands and wellbeing;
- Economy, management, and the long-term perspective;
- Technical development;
- The transportation system and systems of systems;
- Community planning and construction with focus on mobility;
- Dialogue and the competence needed;
- The energy system.

Five of them were taken into consideration in the related agendas, two of them weren't.

Regarding the boundary setting and the results of the project the following comment was given by A. Dubois (personal communication, April 15, 2015) "…this tends to expand over time and finding the interdependencies we identified, I think that is the general outcome of this process that the boundaries cannot be set in a simple way… So again the idea of articulating that as systems of systems I think is genius and it could be… probably be developed".

6.3.4 Learnings from the process

The steering group found the methodology very valuable and received positive feedback from the people involved, saying they'd love using the methodology again. According to M. Blinge (personal communication, April 20, 2015) the process got good comments from VINNOVA but was not taken further towards becoming a research agenda, where the outcomes of this process were long-term oriented VINNOVA were seeking for short-term innovations.

According to A. Dubois (personal communication, April 15, 2015) from the design team the key learning of the process was that the backcasting methodology opened up for the idea of “systems of systems”, where the transportation system is part of a bigger whole, and can be improved by not only putting measures on transport-related issues in order to change the system.

Time and availability of the participants was seen as a limiter of the process as the four workshops were held during half-days, and according to the interviewed people the process might have gained with more time “some people didn’t show up all time that is a problem as well, so maybe the best thing to do things like this is to take people go out to a house in a remote place and lock the door and stay there for two days... “(J. Holmberg, personal communication, March 26, 2015),

One leverage point identified dealt with the users, but there was no expertise regarding the users in place, which was seen as something to take into consideration the next time a similar process is conducted as this expertise might have been valuable for the outcomes.

The targets for 2050 were set with 2010 as reference year, though no respect taken towards the changed demand on transports. There was also a discussion related to if the emissions should be calculated from the transportation sector as a whole or accounted for on an individual level.

It was considered that lifestyle and attitude changes leading to a future reduced transportation demand will not come by itself, but being a consequence of economic control measures and policy (VINNOVA, 2012).

The time frame of 2050 was considered good to let the participants step out of today’s situation and envision the future, although some participants found it harder than others to step into the future.

When voting on criteria and priorities on innovation areas the process was made in two rounds. First the participants put some votes at whatever they valued the most important then all participants were given time to go through how other’s have voted before putting their last votes on ideas. This two-step voting seemed to open up for participants to combine their inner values and intuitions what is important with the outer perspective to together with others put emphasis on the most important parts, or vote on parts that were missed out during the first round (J. Holmberg, personal communication, March 26, 2015).

When identifying criteria for sustainability and working on a more abstract level, some participants were getting sceptical as “nothing concrete was being made”. However, as the facilitators had a deep belief in that the process should work it was possible to move on and get rid of the resistance and scepticism, and in the end they all were satisfied (M. Blinge, personal communication, 2015).

When performing the system analysis before things got structured and no patterns were found the process seemed a bit chaotic, and it seemed crucial here that some participants and the facilitators really believed in the process to structure the chaos and making sense of the data produced by the participants (J. Holmberg, personal communication, March 26, 2015).

As the project not only focused on short term deliverables but also on long-term changes needed to be in place it was hard to initiate the research agenda today (M. Blinge, personal communication, 2015).

6.4 Regional Council Västra Götaland – Strategiska Vägval[3]

The data gathered from the current VGR project will be presented here, according to the information made available to the authors, as well as being based on interviews and talks made with different members of the project group.

The climate strategy for the county of Västra Götaland is addressing targets adapted from adapted from the climate targets of Sweden and the European Union. The current trends within the region regarding greenhouse gas emissions give a hint that the current activities won't enable the region to be "fossil independent" by 2030 and fossil free by 2050 which is the goal set up by the politicians (Västra Götalandsregionen, 2014).

The regional representative assembly gave the environmental board a task to develop a plan regarding how these targets could be reached, which now has taken the form of a project led by the environmental department of the Regional Council Västra Götaland. During the spring and fall 2015 a major process is to be held involving inhabitants, companies, civil servants, researchers and politicians combining the goal of a low-carbon society with the vision of "the good life". This would potentially increase the political will to put efforts into the process by creating attractive and trustworthy win-win situations (Nilsson, 2015)

6.4.1 Goals and Objectives

The goal of the climate strategy is to by 2030 have a West Swedish economy independent of fossil energy, where the citizens and business have a safe and sustainable energy supply (Västra Götalandsregionen, 2009). Housing, transportation, and production as well as consumption of goods and services are resource efficient, energy efficient and based on renewable energy. The transition towards a fossil independent region should be done in such a way that it:

- gives all inhabitants the possibility to use the collective supply of work, education, culture and leisure in Västra Götaland;
- strengthens the attractiveness and competitiveness of Västra Götaland;

[3] English translation:
Strategic pathways

- seizes all resources in all parts of Västra Götaland using the power of the citizens creativity and entrepreneurship;
- is done in dialogue with the citizens and as such contributes to a strengthened and democratic participation in Västra Götaland.

The objective of this project is to create a regional action plan with some prioritized strategic pathways, where common resources can be used to reach a good result.

6.4.2 Project Design

The project is made in collaboration with civil servants from the environmental department and the regional development department of Västra Götaland, The County Administrative Board Västra Götaland together with researchers from Chalmers University of Technology and Gothenburg University.

The project follows a four-step process (Figure 22):

- Step A: future vision - Summation of earlier regional dialogue processes for “the good life” vision, VG2020 and various surveys. Most recently a survey among young adults (20-30 years old) within the region was made, looking for attitudes and values related to the field of sustainability. In combination with several one-day workshops for the same target group a target vision will be set.
- Step B: current state of the climate question - A report presenting the current climate challenges, based on data and research, needed to be addressed in order to reach the target of being fossil independent by 2030.
- Step C: brainstorm of solutions - By combining the climate challenges with the desirable future between six and eight prioritized societal challenges will be identified, and be deepened during the fall 2015. Some areas are already being taken care of in a satisfactory way today and need no further workshops.
- Step D: political prioritizations - Analysis of solutions and data for political decisions, to be made during the spring 2016.

An external facilitator has been procured to take both part of the workshop planning and to facilitate the autumn workshops (step C).

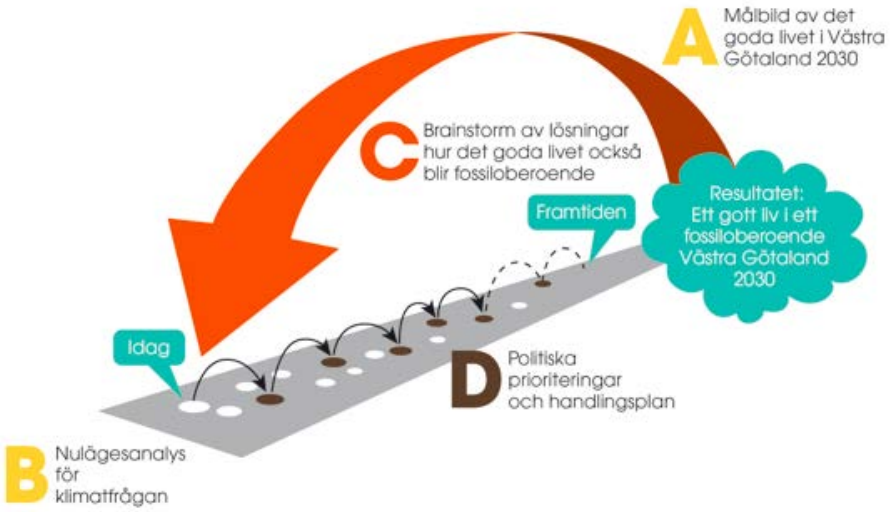

Figure 22 - The four steps of the VGR backcasting project

The workshop topics have been derived from the focus areas and have been decided by the project group, although they are still preliminary and changes might occur, as some topics also have to be confirmed by the politicians in the regional board etc.

Focus area [4] 1: Create secure systems with renewable and resource efficient transportations, energy systems and raw materials

This focus area includes industry, transportation and energy systems. The area has a description of the current climate challenges, the involved actors and some questions describing the challenges in the sector. Such as “How can the fossil resources in the industry sector be replaced with renewable?” or “How can we maximize the production of renewable and sustainable electricity?” The proposal of workshop themes are the following.

1. Bioeconomy - The resources of the countryside for a fossil independent future. Regarding materials and fuels, what raw materials can we produce?

2. How do we maximize the production of solar energy?

3. Climate smart freights with e-commerce.

[4]These focus areas are as of the beginning of May 2015, and have been changed since. From the discussions about backcasting with VGR regarding the focus areas they have been sent to revision to fit better with the framework.

Focus area 2: Create a demand of climate smart solutions among organizations leading the way (public consumption) where the public sector leads the way and welcomes other organizations to participate by signing the climate strategy.

This focus area includes buildings, travel, food and finance with a description of the climate challenges related to the involved sectors. Out of the list of challenges identified by the project group the workshop proposals are the following:

4. How can we reduce the transportation demand through planning and innovations?

5. Climate smart and social sustainable renovation of housing.

Focus area 3: Give our inhabitants good conditions for a sustainable life style. Not by controlling what citizens shall do but by creating the conditions in the society making it easier to live climate smart.

This focus area includes housing, commuting and travels, food, vacations, and shopping/leisure. The proposed workshops are the following:

6. How can we create conditions for a sustainable lifestyle, on the countryside and in smaller cities?

7. Climate smart tourism

8. More vegetarian lunches

6.4.3 Outcomes and learnings from the process

As the project is currently on going with no finalized material it is too early to see any official outcomes. Though a presentation will be introduced below to give the reader an idea of what has happened so far:

During the spring some participatory workshops were hold with young adults (20-30 years old) to produce material about what we (the authors are within this specified age range) would like the region to be like in 2030, combining the good life with the fossil independent society. A survey has been sent out to young adults asking about attitudes, values and priorities within the field of sustainability. In parallel, researchers and experts are creating material about the current situation in the region regarding GHG emissions, developing information material and recommendations regarding the main challenges to address.

7 Analysis

In this chapter the three benchmarked projects will be combined with theories presented on transition management, backcasting and stakeholder engagement to present the main enabling factors potentially leading to a backcasting process reaching its full purpose. This will be followed by a discussion on the implications of these factors and how they could be applied when designing a process for low-carbon transitions, specifically adapted to the case of the VGR project.

The cases studied are all claimed having used backcasting, but the processes are all quite differently designed and have different aims and objectives.

Before making it possible to start analysing the enabling factors found during this study a short explanation will be made about the transition management framework and the backcasting framework to make clear what is meant with the word 'backcasting' in the two different frameworks.

7.1 Transition management or backcasting?

The COOL project, GB-QUEST and the Transportation case were all based on a general backcasting methodology respecting the order of the steps of backcasting as presented in the theoretical framework. By combining the three projects a list could be created about what factors that might have been important for the projects to reach their purpose.

However, transition management provides another framework specifically designed for initiating transitions why it has been used in this report and includes a step called backcasting.

From now on, the concept of ***backcasting as a framework*** will be used when the process involves the same participants doing the four steps:

- Step 1: defining criteria for sustainability;
- Step 2: describing present situation in relation to the criteria for sustainability;
- Step 3: envisioning future solutions;
- Step 4: finding strategies towards sustainability.

Backcasting as a method will be used when following the Transition Management approach where backcasting is one **step** of the approach about linking the vision of the future with the present, elaborating pathways and identifying short-term actions in relation to the pathway considered. This represents step 3 and 4 in the **backcasting framework.**

Figure 23 - Transition management process for the participants where the pre-work made by a smaller project team is represented by dashed lines

In transition management the participants are asked to frame the challenges based on the system analysis that has already been made, followed by an envisioning of a sustainable future which is more about creating images, then the short-term and long-term are connected together to produce a transition agenda presenting what needs to be done, reaching out to a broader engagement (Figure 23). Transition management seems to focus more on initiating a transition by empowering niche actors to challenge the regime.

Figure 24 - Backcasting process for the participants where the pre-work made by a smaller project team is represented by dashed lines

In the backcasting framework the participants start off by defining together criteria for sustainability. The process continues with a system analysis made in relation to the criteria set to identify gaps, followed by the identification of future solutions fulfilling the criteria and ends with deciding upon strategies towards the sustainable future (Figure 24). Backcasting framework though focuses on bringing actors together to agree upon criteria for sustainability, not only focusing on coming up with new innovations or solutions, but also challenging the participants' own assumptions regarding how systems work and should work in an integrated way.

These are two ways of potentially initiating a transition, where Transition Management is focused on bringing in and empowering frontrunners to come up with or further develop niche innovations. The backcasting framework is more open, with a broader way of use (as illustrated by the differences among the three benchmarked projects) and could potentially initiate transitions on different scales (Multi-Level Perspective).

When considering the enablers listed below one first has to decide what process to apply the enabling factors to in order for them to make sense. Here the enablers are presented from a backcasting point of view in coherence with the benchmarking study. However, some identified factors from transition management will also be fed in as they are seen as important also for a backcasting framework with the purpose to deal with transitions.

7.2 Enabling factors for a backcasting project to reach its full potential

Below the benchmarked projects including theories from transition management and backcasting theory will be set in relation to each other and enabling factors for projects to reach their full potential will be presented. For transition management the Urban Context Guidance Manual was used as a baseline of what could make a good transition process. It has to be mentioned that the transition management has so far mostly been applied on relatively smaller projects having the main driver being climate mitigation, where "unavoidably many other aspects of sustainability will be considered as well" (UTM Handbook, 2014).

The enabling factors (enablers) might be quite general and some could be regarded as principles instead. For instance one could consider the backcasting framework itself to be an enabler of systemic change. It will be analysed from a low-carbon transition point of view, where one of the key challenges would be to address CO_2-emissions.

The findings presented in Results *Phase 2* together with principles from the transition management theories, backcasting and stakeholder engagement were extracted from the data (presented in Appendix 5). These findings could then be summarized down into a total of 38 enabling factors in the form of sentences, divided into 11 different categories (Figure 25). The order was set according to in which order each category is most relevant during a backcasting process. The 11 categories - each of them including several recommendations - created are the following:

1. Framing of challenges and systems perspective
2. Process planning
3. Backcasting framework
4. Stakeholder selection
5. Process execution
6. Useful tools
7. Facilitation
8. Stakeholder involvement
9. Knowledge input
10. Learning process
11. Evaluation and follow-up

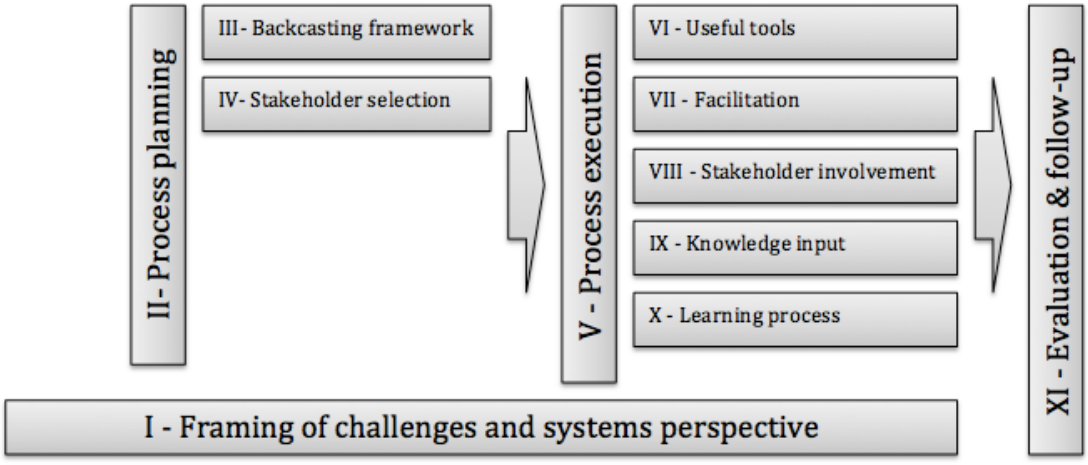

Figure 25 – Representation of the 11 categories of enabling factors

Below the enabling factors produced based on the findings from each project are presented, for the complete references related to from which project each factor comes check Appendix 5. The source given here is if there is a clear match with a given project or theory. However, the enabling factors mentioned here are already present in the data in the results and theories but not structured in this way.

7.2.1 Framing of challenges and systems perspective

Below enabling factors that seem to lead to a successful framing of the challenges in relation to the system that one wants to change.

Create a good understanding of the system including its key actors. This is done by **acknowledging complexity** rather than avoiding it, identifying underlying systemic challenges and problems from a holistic point of view instead of isolating them (Roorda et al., 2014).

Integrate the climate challenge in the development agendas, finding opportunities and **co-benefits** by applying broader sustainability criteria on the issue to be solved. Link the climate question to other societal challenges and development focuses as the systems are interconnected; hence it is important to let the climate issue grow out of the environmental field (IPCC, 2007).

Link global challenges to the local context including current agendas, projects and policy priorities to both motivate the participants to be part of something bigger and to get credibility from work currently being done in parallel (Roorda et al., 2014).

Frame the challenge in a participatory way, meaning it has to be iterated once the project has started in order to create a **shared perception** and sense of ownership of the problem (Tuinstra et al., 2002).

Integrate bottom-up and top-down perspectives rather than choosing either or, yet present the systems and challenges in such a way they are possible to understand for all participants (UTM Handbook, 2014).

7.2.2 Planning the process

The process planning is the work that is done by the project team before the actual process is executed. Below some key principles to think of when planning a backcasting process will be presented.

In transition management the processes are open and **designed for uncertainty**, meaning things might change over time. Thus the design proposal will have to be **iterated** several times by the project team and when possible also including the participants, to as precisely as possible evaluate requirements of the process i.e. needed time, workload and resources (Roorda et al., 2014).

Having an organic and open process design still demands a **clear coordination** from the project team, meaning once it is started it is important to have **transparency** towards the participants as well as having clarity in the information (J. Holmberg, personal communication, March 26 2015; M. Blinge, personal communication, April 20, 2015; UTM Handbook 2014).

7.2.3 Backcasting framework

Below is a presentation of factors that seem to be important within the backcasting framework related to the envisioning and scenario creation steps.

During the envisioning phase the **time-frame** should be far away enough to enable the participants to step out of their current situation (that might be characterized by short-term agendas, destructive trends, locked mind-sets, personal and/or organizational interests) but close enough to be relevant for the participants (usually a time-frame of about 40 years) (Hisschemöller & Mol, 2002).

The desirable future **vision** needs to be **owned and shared among all participants**, as the vision is not only a product to be created for the specific process, but something that can guide the participants in their future actions towards a desirable future (Transportation project).

By stepping backwards from the desirable future an **urgency to act** is created by shortening the time frame towards an intermediate goal (about 15 years from today), which will have to be reached to make the desirable future feasible (Roorda et al., 2014).

The scenarios produced benefit from being relevant to real world constraints and opportunities, making the participants aware of potential trade-offs and that priority has to be made between options, as they might be conflicting with each other. The group should reach a consensus around what kind of criteria should be valued when evaluating scenarios (e.g. climate effectiveness, sustainability, cost effectiveness, social support) (Robinson et al., 2011).

7.2.4 Stakeholder selection

This theme includes the identification of potential stakeholders (participants in the process), mapping them and deciding who to include in your project and who could be invited at a later stage (Roorda et al., 2014).

Identifying stakeholders can be made by having suggestions from the project team, actors from the system analysis and by using the “snowball-method” where identified persons are asked to come up with suggestions of other fitting persons.

Mapping stakeholders can be done based on their background, competencies, interests, and motivations as well as distinguishing what type of power they possess (innovative (niche), transformative (niche-regime), reinforcive (regime)).

Choosing stakeholders from a variety of perspectives to prevent tunnel vision and enable cross-fertilization. Reflect upon whether you want niche-players, regime-players or a mix of both depending on where in the system you would like to initiate a transition.

7.2.5 Process execution

Below some insights are presented about how the process could be designed to be conducted successfully.

Use **co-creation** principles acknowledging that everyone is a decision maker, as such the people supporting the process are client-oriented and do not influence the process with their own assumptions.

Coordination is necessary **between each session** in order to guarantee the coherence of the different groups' work. This is done by organizing coordination meetings and producing synthesis reports, which become a basis for each group before each session to go through what happened last time and what eventual decisions were taken. This makes it possible for the group to build on the same level of consciousness that left the last meeting (Hisschemöller & Mol, 2002; Tuinstra et al., 2002).

Offer space for participants to listen to each participant's expectations and needs to allow them to bring their **presence** into the process. This motivates the importance of building an efficient team working on group dynamics, relations and conflict resolution.

7.2.6 Useful tools for the process

Below some effective tools that could be used during the process are presented.

When participants come from different backgrounds it might be important to use certain tools to create ways to **understand each other and share perspectives**. IT tools are particularly useful to provide instant feedbacks on scenarios, building trust towards achievement of long-term objectives, and potential trade-offs (MetroQuest).

When **dealing with complexity** trying to understand what are the cause-effect elements of the different systems identifying leverage points and effective places to intervene the system causal loop diagrams can be used (CLD).

When addressing sustainability issues it is a key belief to take all dimensions of sustainability into consideration, The Sustainability Compass can be used to **map criteria**, affecting factors, and goals effectively covering all four dimensions of sustainability (AtKisson, 2010).

Use **dialogue settings** to make it possible for a collective intelligence to emerge within the discussion. Sharing perceptions, listening and observing can create self-reinforcing discussions based on mutual understanding.

7.2.7 Facilitation of the process

Sharp facilitation seems to be crucial for the process to succeed, below some insights on the complex issue of facilitating a process dealing with uncertainty, decision-making and long-term challenges are presented.

The facilitator needs to **guide the decision making** to ensure the perception of the challenges, scenarios and strategies is shared among the participants, ideally through a consensus decision. All views and opinions need a safe space to be shared among the participants, as there might lay wisdom in a concern challenging the majority.

As the characteristics of the outcomes of a backcasting process are unknown on beforehand the facilitator needs to be **fully engaged in the process and convinced** that the methodology works, in order to clearly guide the process in the right direction dealing with issues such as uncertainties and unexpected events, as well as participants faced with doubts, scepticism, chaos, and resistance (J. Holmberg, personal communication March 26, 2015; A. Dubois, personal communication, April 15, 2015; M. Blinge, personal communication, April 20, 2015)

The facilitator should create an environment among the participants that encourages stepping out of the box and that empowers participants to **push the limits** of what is seen as possible and impossible (Roorda et al., 2014).

A transition process needs to be as **free of presumptions and open as possible** being clearly facilitated, managed or controlled. The facilitator should focus on guiding the process rather than controlling it, still taking eventual time and resource constraints into consideration to make sure each step during the process reaches consensus and that the whole process is completed (Roorda et al., 2014).

7.2.8 Stakeholder involvement during process

Below some insights on how the stakeholders could successfully be involved in the process and what is expected from them are presented.

During the process it has to be **clear to the participants why they are participating** and what their role is. The participants have to invest their trust and full consciousness into the process, being clear on the way decisions are taken and how dialogues are conducted. One way of making the roles clear including some basic rules could be by having a contract or agreement signed among the participants (GB-QUEST and COOL project)

To create an inclusive atmosphere, a shared perception of the problem and a common ground it is important that everyone is **included in framing the challenges** (J. Holmberg, personal communication, March 26, 2015)

Since the participants can have a real influence on the process, they should **let go of their institutional perspectives** and personal interests in the process. There might be potential biases in their proposals and sayings, which needs to be corrected by others in the group or by an external scientific team (COOL project)

7.2.9 Scientific input

Below are presented some insights about how to bring in the process external knowledge when needed (Hisschemöller & Mol, 2002; van de Kerkhof & Wieczorek, 2005; van der Kerkhof, 2001).

Each group focusing on a specific theme might need to get **scientific input before and during the process**. This requires dedicated people that could be grouped in a **scientific team** connected to the project team. More specifically, **background information** about the challenge should be provided to the participants before the process to ensure as much as possible equal knowledge at the beginning of the meetings. This task is complicated by the heterogeneity of the groups, which is nevertheless an inevitable characteristic of the groups when including different stakeholders with different backgrounds. During the process, there is a need for knowledge input on participants' request and when necessary to bring the dialogue forward (if certain topic are neglected or to help structure the debate).

There is a need for **scientific input** regarding the different scenarios for emission reduction. In this respect, it is important to realise **rough estimates** which are necessary for the participants to compare different scenarios and explicit the uncertainties underlying the calculations. It should be noted that these rough estimates might be unusual request for the scientists who may show resistance to the process.

To ensure the knowledge provided to the participants is received and understood by all, it is necessary to apply a few **communication principles**. First, the information needs to be provided at the right moment of the process, several times, in different forms and adapted to the needs of the participants. It is necessary to limit the amount of information, and oral presentation (with good presentation skills) and interactive tools are preferable to text documents. To sum it up, the information has to be accessible for all participants, compact and tailor-made.

The speakers giving presentations need to be aware of and **agree on the communication principles** and willing to be part of a dialogue with the participants. It is also possible to **invite participants to give presentations**, which will positively reinforce their involvement and commitment to the process, with the need to monitor the information delivered to prevent or correct the situation in case of biased presentation.

7.2.10 Learning process

Below are given some basics related to how to stimulate learning among the participants enabling them to keep contributing to the transition once the backcasting process is over.

The **learning dimension of the process** needs to be part of the design and in the **objectives.** Some key principles to stimulate learning are commitment, fairness, transparency, and competence (Hisschemöller & Mol, 2002; van de Kerkhof & Wieczorek, 2005).

The process should be built to **support both first-order learning and second-order learning**, being educational for the participants and realizing that the process itself might be just as important as the outcomes.

By **engaging the participants in the assessment of scenarios and future pathways** they get actively involved in exploring trade-offs, and seeing consequences of their choices and creates a better understanding of the system dynamics (van der Kerkhof, 2001; Argyris & Schön, 1978)

7.2.11 Evaluation and follow-up

Evaluation is crucial to gain insights and to learn from a certain project to influence the projects in the future. Below some insights are presented about how other projects have dealt with it.

Several **evaluations** needs to be conducted at the end of the process and several years later to enable the project team as well as the participants involved to **learn and improve** the way of working. The learning should focus on the quality of the process for continuous improvement but also on the outcomes, their long-term impact, and the development of eventual spin-off projects (Roorda et al., 2014).

The **evaluation** has to be conducted in a scientific and **systematic way** to guarantee the validity of the findings. It needs to be **included in the process** and should be designed and thought of at the same time as one designs the process. The learnings gathered at the end of the evaluation has a value - both locally and globally - making it possible to build on and learn from the project in future projects (Hisschemöller & Mol, 2002; van der Kerkhof, 2001).

To ensure concrete actions follow the end of the process, some kind of **support** has to be provided to the **participants** to **empower** those who are willing to contribute on their own to implement the scenarios created during the process. Contributing to maintaining a sense of urgency and sustaining the political will to ensure consistency of policies can reinforce the long-term involvement of the participants (Roorda et al., 2014).

7.3 Current situation of VGR

The purpose of this thesis was to contribute to the low-carbon transition of Western Sweden by benchmarking backcasting processes to give input to the current VGR low-carbon transition project. Based on the benchmarking results and the enabling factors presented in section *7.2 Enabling factors for a backcasting project to reach its full potential* the current situation of VGR will be analysed.

Until May 2015 VGR has held a few workshops with young adults asking them to describe what is important in their life in 2030 and reflect upon how the good life can also be fossil independent. In parallel a survey has been sent out asking young adults in the region about their general attitudes and values related to sustainability. There is also a range of teams and researchers making a system analysis of the current situation related to the six themes presented.

The challenge framing is currently under development by the project team where each theme has been formulated in a couple of questions. The questions have been prioritized taking into account the political agenda of the region, interests of the municipalities and in areas where there currently is no clear coordination in place. To go too specific on questions will make the framing very solution oriented and leaves little left to the participants to decide upon whether this is a major leverage point towards a fossil independent region 2030 or not. This seems to call for a pure innovation workshop where the participants are asked to brainstorm solutions, which then can be summarized in the recommendation of some actions.

The six themes that has boiled down to more or less specific questions to further elaborate during a workshop have not yet been evaluated regarding the potential GHG emission reductions to be reached (as far as the authors know) in a best-case scenario.

When inviting participants to fast go through the vision and focus on solutions to specific challenges the process starts looking like a transition management process rather than a backcasting process. This means we can now identify two different pathways in which the VGR project can proceed - either by designing the autumn workshops to follow the *backcasting framework* as was desired by the project team at the beginning of the project, or using the *transition management framework.* At some time a decision has to be made in which way one should go since it will affect the design of the workshops, the stakeholders to invite and the use of the already produced data. Meaning that if things continue the way they are, there is a risk that the important step of defining criteria in backcasting is missed out.

By introducing the workshops with a too specific question or challenge to solve there might be a risk that even if everything within this specific question get solved the target of being fossil independent by 2030 will not be reached. The potential to integrate the question and broaden the perspectives gets limited and going to the root cause of the issue might be missed out. It also leaves little left for the participants to decide upon, more than coming up with innovative solutions that might address this question further.

In the backcasting way one would make sure the scenarios produced actually showed the pathway reaching the target of being fossil independent, then identifying concrete actions to make towards realising it. Before this the participants would have created consensus among criteria related to the sustainable future and challenged their own mind sets by together make an analysis of the current situation in relation to the criteria produced. This would potentially increase the buy-in into both the challenge framing and the understanding of the current system.

It can though be argued that to some extent it is good that the question is being limited to only include things that VGR actually can solve within the regional boundaries, but then it would make sense if a topic was added showing what “we wait for others to do” in order to fulfilling the goal of having a fossil independent region by 2030. Potential actions here could for instance been lobbying or finding other ways to influence and/or accelerate decision making which is outside the mandate of VGR.

Regarding using 2030 as a time-frame for backcasting it seems a bit short in relation to what has been mentioned elsewhere. One way to go around this problem would be to focus the autumn workshops on producing a vision and criteria towards 2050 when the region is fossil free, then stepping backwards towards 2030 to create an urgency to act. This is something that has already been acknowledged by the project team but as it is crucial for the process it is worth mentioning it again. 2050 could be used as the vision and the long-term time frame, then making an action plan being focused towards 2030.

7.3.1 Low-carbon transitions and the Multi-Level Perspective

The Multi-level perspective includes four types of transition pathways, where the actors of the regime and niche level may take quite different roles (Geels, 2005). Because the transition pathway for the low-carbon regional transition is still unclear, it is necessary to in the process include entrepreneurs and innovators as well as people from the bigger companies and organisations as they might all play crucial roles in initiating the transition leading to systemic change. It would be tempting to select only actors from the regime who are already "bought-in" in the transition process acknowledging that change must happen. In order to achieve a broader change in the region, the different voices of resistance from the actors needs to be listened to in order to have them on board.

Since all transition pathways (Geels and Schot, 2007) involve a disruptive event from the macro-level it would be interesting to consider what the main socio-technical landscape trends are. Though not all landscape characteristics can be changed (e.g. the planetary boundaries (Rockström, 2009) are external to our society), but in some cases it is possible to influence the evolution of the landscape. When mapping and selecting stakeholders for the autumn workshops it would be good to identify people who could ensure that "megatrends" at the landscape level are taken into consideration, such as people with a stake in national and European legislation discourse as well as including the fact that we live in a connected world (strongly influenced by IT on the different sectors) with a service-based economy (which is taking over the production/manufacturing economy in the developed countries).

Thus, when inviting actors from both the regime and the niches at the same time their interactions need to be handled carefully as some regime actors might use their reinforcive power to make sure that the transition strategies created during the process will not put their organization in danger (e.g. by putting constraints on their current activities, questioning of the business model). It may also be the case that some regime actors are interested in including the niche actors in their innovation and business to stay in control, or use their current position to scare new entrants away from the market (Geels & Schot, 2007).

Regarding the action plan to be created during the VGR process, it is likely that support will be provided to empower the frontrunners to develop niches, as a niche only gets a chance to enter the regime if its innovation is developed enough when a disruption at the landscape regime creates an opportunity (Geels, 2002). Some actions can also be designed to support the regime players that are willing to change their processes or activities to contribute to a low-carbon transition. Finally, other actions may be connected to the landscape trends, in order to incorporate them better in the regime if it can contribute to a low-carbon transition or to speed up change or strengthen new mega-trends within the landscape.

7.3.2 Openings for an integrated approach and organizational learning

Even if the issue with high GHG emissions is solved in the region, there are other sustainability challenges to address. The more you widen the boundaries the more you realize that the systems are interconnected forming systems of systems. Carbon emissions could then be considered as a symptom of some underlying mechanism not working, and changing the system at one place might produce big changes somewhere else.

So far the system analysis from VGR seems to be very focused on climate and has not been made in relation to the criteria that could be extracted from the young adult's visions. By covering the four dimensions of the sustainability compass (AtKisson, 2010) when setting up criteria then analysing the system in relation to those criteria, a broader approach would be achieved towards the climate challenge. This would potentially open up for wider collaborations and a broader interest among politicians, business, civil servants and the civil society.

Some work has been made by the environmental department at VGR to widen the perspective of the climate challenge combining it with other societal challenges including regional development, employment, and wellbeing. There are though some lock-in effects within the institution related to the presence of other boards within VGR producing their own agendas that might lead to results contradicting the agendas of the environmental department. If the environmental department widens its perspectives too much, it risks interfering with responsibilities of the other departments within the region. The motivation of the environmental board to develop integrated solutions is therefore limited by its mandate. As a result, the current process is mainly focusing on environmental questions, as the project group does not have the full mandate to come up with "too" integrated solutions.

The question then appears whether it would be possible for the environmental department to ask the regional politicians for a broader mandate and include other (ideally all) departments in the project? Currently the environmental board will be evaluated on what they have been asked to do (i.e. dealing with emissions, working on energy-related questions) and if the current work is not appropriate, meaning that not enough can be made to reach the goals set, will the environmental department start lowering the ambitions of the project or will they try resolving it working with the institutional lock-in?

These kind of issues may give indications about the organizational learning abilities of VGR as an institution including the civil servants, the politicians and the citizens. An organization capable of double-loop learning is not only able to solve problems to keep doing what they have been mandated to do but is also able to ask itself 'Why do we do what we do?' (Argyris & Schön, 1978) In the situation of VGR, this ability is crucial to question the underlying assumptions about the possibility to treat GHG-emissions as an isolated problem that can be fixed by an action plan dealing with emission reduction targets. This seems to partly have been addressed by the project team as they are widening the perspectives, though still being limited by the mandate they have from the politicians.

If a change in the nature of organizational learning is needed, to shift from a Model I theory-in-use to a Model II theory-in-use facilitating double loop learning changes of values and strategies will be necessary. The shift in organizational values evolves from *rationale*, *winning*, and *avoidance* of negative feelings to valuing *internal commitment, valid information* and *free and informed choice*. The challenge arises for VGR to develop new processes based on control sharing and participation in design and implementation of action plans, which are the primary strategy to create a safe space for double-loop learning.

A similar analysis can be made regarding VGR the project, where the first step of backcasting consists of creating a shared vision, criteria and system analysis not only serving the progression of the process but also contributes to change the mental models and assumptions of the participants (Holmberg, 1998). Supporting double-loop learning will not only improve the quality of the next steps of the backcasting process but also influence the further work made by the participants.

A final comment on the analysis could be to acknowledge the fact that it seems that many people living in Västra Götaland doubt on the ability to come up with strategies matching the 80% GHG reduction towards 2030. Maybe because the time frame is short, but it still should not be questioned before the actual backcasting sessions have started, as the first step (setting criteria for a desirable future) is really helpful in letting go of the fears, current trends and today's problems.

8 Discussion

The purpose of this chapter is to help explaining and interpreting the results for the reader. Here the entire Challenge Lab process will be reviewed trying to make sense of the results connecting it to the purpose, theoretical framework and the methodology chosen. As most reflections and thoughts regarding the results and connection to theory were made in the Analysis chapter, this part will be seen as a reflection upon the thesis as a whole.

The chapter will start with a reflecting discussion about the *Phase 1* process, followed by a description of how the results from *Phase 2* were interpreted, ending with a short reflection upon the choice of the methodology and how it might have influenced the results.

8.1 The Challenge Lab

Most presentations were done in dialogue settings where we got the opportunity to reflect upon the current challenges we met during our work, widening our perspectives.

During the intense first month where outside-in and inside-out perspectives were taken into consideration challenging our own assumptions about the outer system and our own values, we managed to team up and identify a research topic that emerged during the system analysis where we felt we could contribute with both our respective skills and interests. The inside-out perspective contributed a lot to our awareness about our own values and strengths, which helped us to identify a research topic in connection with our inner motivation and to work in an efficient team during our master thesis.

The sustainability criteria produced showed interesting patterns leading to a consensus within the Challenge Lab participants who defined the purpose of our current societal institutions and economic systems to be two pillars supporting the wellbeing of each person and were built upon the natural environment resources. It is interesting to notice that the sustainability compass was created via the opposite mind process: from a pyramidal categorization of the four dimensions, AtKisson (2010) created the compass to let go of the hierarchical relation between nature, economy, society and wellbeing but also because different culture have different perspective on the final aim of sustainability (i.e. wellbeing seems to be the top dimension in Europe whereas society is sees as the most important dimension in Asia). In our society, when talking about sustainability, the dimension most often mentioned is nature. It is interesting to compare what is commonly associated with sustainability and how it differs from what can be seen as the final goal of sustainability, individual wellbeing.

Some of the sustainability criteria formulated are rooted in our own values and ideologies representing softer values. The natural criteria were relatively easy to agree upon, as they are a measure of “dead matter”. Regarding economy, society and wellbeing it was way more challenging and hard to produce criteria that made sense for everyone. A debate started whether we should base our criteria upon principles of justice or utilitarianism, but they did not continue for long as no one was motivated to dedicate much more time to change the criteria again, mainly because we all wanted to continue the work towards the identification of a research topic.

One way of solving this would have been to apply principles of deep democracy carefully to facilitate the decision-making process when setting up the criteria and making the criteria really matter for the whole group. Now the criteria are seen as something that had to be done as a reflection exercise, but of no ultimate use to guide our common work.

Timing plays a big role in how much impact our research project will have had, for example we could have tried to influence the criteria setting for recruiting the facilitators of the VGR process but the analysis crystallized too late for our criteria to be looked upon by VGR as a facilitator had already been selected. Maybe this was for the best, as it would have been somehow difficult to set aside our knowledge about some of the applicant enterprises to come up with non-biased selection criteria.

The time-factor also played quite positively in our favour, as the workshop design started quite late in the process and because there has not been done much concrete work yet to prepare it, meaning that our recommendations will be more likely to actually be taken into account during the workshop design process. Nevertheless a limit has to be drawn between creating recommendations for the project group and the facilitator and being invited to directly contribute to the design process. Maybe there were some occasions to more strongly influence the process, which was tempting for us as we were willing to feed in our insights and ideas within the project and to contribute to its success but recognizing that this was surpassing our research role in this process. Finding the balance between delivering insights and recommendations for the process and directly influencing its content has been challenging for us, but one strong motivation by having a more external position has been to focus on really listening to the people involved in the project team, gaining insights about what they currently are challenging trying to find out what it is they want (what they are asking for) and what they need. This issue might be quite common when using external consultants to do part of the work, as it does not facilitate learning within the organization leading to a tendency to be dependent on consultancy firms and services, for missions that could have been internalized for the good of the project in a longer perspective.

8.1.1 Formulation of research question

The research question formulation was made carefully, taken into consideration different alternatives and making sure that we both had some personal interest in the subject of matter. Both of us have strong motivations in making the world a better place, and the climate change issue has been approached as a symptom of an underlying malfunctioning system producing unsustainable results that nobody wants.

During the first phase of the Challenge Lab we developed together a research project to combine our interests in energy related questions, broader sustainability issues related to urban planning and participation. Even if we did identify several local grass-root movements during our system analysis we did not manage to integrate the dimension of a bigger low-carbon transition in our master thesis work. The main focus then became the VGR project where the involvement of citizens had already been signposted to a series of workshops in the spring, which were made in parallel of our master thesis.

8.1.2 *Phase 1* methodology

The first month of the lab was focused on challenging our own assumptions building a consensus in the group setting up a vision for a sustainable future including criteria based on the sustainability compass, followed by a system analysis set in relation to the formulated criteria to create an understanding of the gap, where then groups were formed to identify a research topic where one or two students could intervene the system within the frame of a master thesis.

Regarding the several dialogue meetings and presentations that happened at the Challenge Lab during *Phase 1* in order to get an overview of the local projects and trends regarding sustainable development, one observation can be made. Even when the stakeholders were formally invited for a dialogue session, most of them came with the intention to present their research project or work in a teaching style, where the only role left for the Challenge Lab participants was to ask questions during the last quarter of the dialogue session. It may be linked to the unusual character of this setting for most of the stakeholders, but also to the fact that *most of these sessions were arranged by the project managers of the Challenge Lab for convenience reasons*. Having the students more in charge of the session or being perceived so by the invited persons may increase trust from the participants within the apparently quite unusual setting.

The process was very intense and first a decision was taken by the group to have a common documentation of the process, however this never became reality and each group had to sit on their own afterwards trying to remember and document what really happened. In that case, the initial focus was dedicated to pushing the *Phase 1* process forward rather than slowing down to reflect, evaluate and document the process. In that way, we have not always managed ourselves to integrate our way of working after the principles of organizational learning.

The team formation was supposed to be organic, and our facilitators were guiding and empowering us through the process saying that uncertainty is part of the process and that it is completely normal that you have not identified a topic (yet). Though, when the *Phase 1* process started to reach its end it was discovered that most participants already had ideas about what they wanted to write their thesis about earlier in the process, or that some teams had been made without the whole group being fully aware of it. Some participants had their area of interest decided even before the *Phase 1* process started, which made some of the system analysis and criteria setting rather useless for them, as they already had a clear view about where they wanted to intervene the system. For them this exercise was rather about tweaking their current assumptions to intervene the system from the “right angle”.

8.2 Benchmarking of backcasting projects

The results show that the backcasting projects benchmarked have been conducted in quite different ways giving a wide variety of choices regarding how one should design a backcasting project. It seems to be very important to dedicate time before initiating a project to reflect upon its core aim and objectives, and only then decide upon a certain framework and design.

Regarding low-carbon transitions one should reflect upon what kind of transition one wants to try initiating, if the framing is considering focusing on a niche, the regime, the landscape or a combination of different levels and with what tools the problem can be tackled.

The benchmarking methodology seems to go well in hand with the backcasting described in theory, which is not very surprising as the designers of the projects themselves have been developing backcasting frameworks and published articles on the matter. They have all started with an envisioning process related to desirable outcomes and criteria for the sustainable future.

As the search was made particularly for backcasting projects, there might have been other projects conducted using something close to a backcasting framework without calling it backcasting that was missed out in the search.

8.2.1 GB-QUEST

The purpose of the GB-QUEST project was to identify policy through scenario analysis that could enhance human wellbeing while reducing environmental effects of human activities. The methodology chosen was to involve citizens in backcasting-workshop settings exploring alternative regional futures combining values, preferences and beliefs about the uncertain future with expert knowledge. This would create a better understanding between citizens and experts making it possible to create policy reflecting the citizens' values to deal with the sustainability challenges in the Georgia Basin. It was discovered that the workshop settings only reached out to people who were already committed to the challenges and motivated to influence the work, which is why the community engagement software MetroQuest was created; tailored for shorter engagements with the possibility to reach out to more people and get a bigger variety of participants.

8.2.2 Sweden transportation 2050

The purpose of the Transportation project was to produce a research agenda pointing at important areas to develop towards reaching a fossil free transportation system by 2050 in Sweden. The methodology chosen was backcasting in order for the broad variety of stakeholders and experts involved to let go of their current situation and discuss a desirable future where "everything had been solved", then using the knowledge of the participants during the workshop to create an understanding of the system identifying leverage points consisting of areas where innovations were especially important to reach the 2050-goal.

In the project the participants were part of doing the system analysis, which was crucial as "transportation" was seen as a system that could be changed, and to change it one had to challenge the assumptions the participants had related to their understanding of the system. The stakeholder involvement was quite broad even though more people from industry could have been there. One thing to keep in mind when working in such a setting with wide boundaries is that leverage points identified could even be outside the range of action and knowledge of the stakeholders originally invited.

8.2.3 Climate OptiOns for the Long term

The purpose of the COOL Project was to give recommendations for long-term climate change policy in the Netherlands by identifying strategies for drastic GHG emission reductions, as well as contributing to the development of methods for stakeholder involvement in dialogue processes on complex issues. It was interesting to see how a backcasting methodology could succeed in producing a strategic vision for the four main sectors of the economy, successfully accounting for about an 80% GHG reduction potential by 2050 for The Netherlands.

Finally, it seems that the COOL project succeeded quite well in producing scenarios and delivering the expected outcome, which implies that the dialogue processes were conducted in an efficient way. There is no indication of any long-term impact from this project. Indeed, when interviewing a person who was involved in the design and execution of the project, it was clear that no monitoring was done after the project ended, and the people involved went to work on new projects, some even moved from a research position to a practitioner position in the private sector (W. Tuinstra, personal communication, April 13, 2015). In any case, it would be almost impossible to trace back to the COOL project potential evolution in the GHG emission or production of new climate policies. The issue addressed is highly complex and it seems improbable to identify with certainty what progress is due to this certain project and what relies on other factors.

The absence of monitoring of the recommended actions, specifically the recommendations emitted for the first 10 years ahead (between 2002 and 2012) have not been the subject of any intermediary evaluation or follow-up aiming at supporting the stakeholders involved in the project to achieve change in their own evaluation. Another weakness, looking at the outcomes of the project, is that the recommendations emitted for the short term were never assigned to organization or cluster of company to be executed, and it is highly probable that no one took charge of bringing these recommendations into reality, with the different actors going back to their normal missions as they haven't been officially assigned any new ones.

8.2.4 *Phase 2* methodology

The benchmarking methodology made it possible for us to use general principles how one should think when setting one process in relation to others. Though, most benchmarking methodologies seem to be based on improving characteristics that only cover part of a process. These characteristics are often ones that can easy be measured in time, money, energy, etc. The processes we have benchmarked have been broad and general making the methodology a bit limited, so our analysis was not made in relation to a certain gap but was rather made with inspiration from the benchmarked studies and the theories presented. At the end, it wasn't really possible to compare our findings with the VGR project planning, as the design of the process will be done later than what we though at the beginning. Even if this was a problem in conducting our methodology, it was also a great opportunity to actually have more impact on the design, as it will be done after we have had the occasion to discuss our main findings with the VGR project group and reflect on how our enabling factors could be taken into account while the design was being developed.

Another limitation when benchmarking is that nothing new is developed, meaning you can only become as good as the best in the market. Though, if you combine three projects that are best in some aspects but not all, you can become best in all aspects. Nevertheless one single operation will not be better than the same operation elsewhere. It is also difficult to find documentation from the actual processes, comparing to the summaries that are made after the project is finished and often they have ended up producing a report of the main findings. Thoughts, values and intermediate steps are often left outside the documentation, which motivates why interviews and dialogues have been very valuable for this work.

A main factor limiting the recommendations given is that there has yet not been found any region in the world that has gone through a low-carbon transition from 7-10t to below 2t GHG emissions per person and year why the “ideal benchmarking case” does not exist.

Also, it is hard to find parts of the projects considered as an enabler of change, as the processes are quite complicated and lots of factors could potentially influence the outcomes. This is another reason why focus could be put on what Transition Management has to teach us as it is based upon action research. The COOL project for instance is a good example of a well-conducted dialogue, still the long-term impact in absolute terms seems to be low or at least the trends are not following the direction of the scenarios produced. Still, the project design was rigorous and followed research knowledge but one has to be careful if copying elements of the process as some factors might have been limiting rather than enabling.

When trying to identify the best practice to be studied as case studies, the main problem is that there is no country, region or even city that has managed a climate transition or even to significantly reduce their climate impact. As such the achievement and role model of our case studies are limited, not because they were not good practices in the field, but because the ‘prefect project’ we are looking for doesn’t exist yet. Also because climate transition projects are relatively new, it wasn’t possible to identify a project that would match in all dimensions the characteristics of the VGR project, being an area with more than 1 million of inhabitants, with urban and rural municipalities, using a backcasting framework.

8.3 Data collection

When collecting data about the VGR project, it has been interesting but challenging to collect data on an on-going project, meaning that the project kept developing further and changing over time, while we were trying to get a static picture of the process to study it and make recommendations from our benchmarking study. As a matter of fact, the aim and direction of this thesis to some extent has also been redirected during the period. This has not made things easier but on the positive side the findings do already have a “place to be” once the thesis is finished, and some results have been communicated to the project team at VGR during the thesis work. Most theories and methodologies were new for the authors meaning that during the first meeting with VGR not any recommendations could be made, although looking back now some input could potentially have changed the direction of the project a bit.

When viewing things from the outside with official publications, reports and trends most situations we have looked at seemed rather unproblematic, exception made of research publications presenting evaluation of projects. Though we know that there are many sustainability challenges to solve, indicating that the information gathered with people currently involved in projects must be listened to carefully, because in one interview it is hard to create such a level of trust that the interviewee can freely express challenges and problems related to an ongoing project. We have observed that the longer the period is between the end of the project and the interview, the better the information about real challenges and issues we can collect.

9 Conclusion

In this thesis three different backcasting projects have been benchmarked and set into relation to the current low-carbon transition project conducted by VGR. Below the main conclusions from the study will be presented, followed by some recommendations on the future low-carbon transition process at VGR.

Past studies have been focusing on the evaluation of a single backcasting process, and the findings of our research project implies that there is a lot of potential in developing further research to identify enabling factors by combining best practices from different contexts. We have also pointed at one of the major gap in research being the lack of analysis and understanding of the long-term impact of backcasting projects. It is hard to confirm the validity and efficiency of the enabling factors presented here as they are only related to the quality of each process benchmarked and its specific topic, without any long-term impact evaluation in place.

9.1 Contribution to future research and practice

The differences between transition management and a backcasting framework have been discussed and set into relation to past and current projects. An alternative way to compare them has been discussed, mainly arguing that each framework corresponds to a specific aim for the process. Nevertheless insights from both methodologies in theory and action have been included in the formulation of the enabling factors.

As backcasting can be done with different stakeholders, process designs, aims and level of detail it seems important before one initiates such a process and picks the methodology to reflect upon what kind of objective one wants to achieve and how the current challenge should be formulated and tackled.

In transition management the way of doing things right now seems to be to empower niche-players to enter the niche-regime, but other transition perspectives could be taken into consideration such as trying to weaken the regime or trying to identify alternative ways to directly influence the landscape. In short, the multi-level perspective seems to be both a useful and interesting approach to use for stakeholder mapping for further development of the transition management framework as well as the backcasting framework.

The contribution to future practice will mainly concern the further development and execution of the VGR project, which will be discussed in the next section. Nevertheless, the list of enabling findings has been developed in a way that the recommendations are general enough to be of use for any project team willing to design a project working with backcasting and especially in the field of low-carbon transitions.

9.2 Recommendations on future low-carbon transition work of VGR

The recommendations here will partly be presented as reflections and presentations of pathways and potential trade-offs as it is desirable to guide VGR through their work in a future integration workshop. There is also a risk reaching a low validity giving recommendations as in some cases VGR might know better than we how things work and how they best could internalize the conclusions from this study. However, it should not be denied that an evaluation of an organization from the outside could provide valuable insights as well.

To successfully combine the low-carbon society with the good life the sustainability compass could be used to get the hierarchy right and broadening the perspectives even more by including economic criteria (e.g. regional development, resource use) and societal criteria (e.g. healthcare, education).

There are organizational limits regarding the mandate the environmental department at VGR has to take decisions and initiate change to solve the climate challenge. To broaden the scope of the project the concerns about climate change and the good life has to be reformulated into a sustainability challenge affecting everyone. Continuous work should be done pushing the limits trying to integrate the question with the other departments of the region as well as the municipalities in the region, and not least among the politicians and citizens.

9.2.1 Choice of framework for the autumn 2015 workshops

- Initiate a design process carefully going through what backcasting would really mean for what currently has been done by the project team and how to successfully implement the framework.
- If actions and own initiatives are expected from the stakeholders in line with the pathway decided upon after the project is finished make sure consensus on the criteria and the common strategy is created in each group.
- Communicate towards the facilitator what are the demands of a backcasting process and carefully explain each step and make sure there is support available.

9.2.2 Stakeholder selection process

- Use the 3 Multi-Level Perspective categories when selecting stakeholders
- To change the landscape you will need people who can represent legislation (Swedish or European) as well as IT-trends and the shift from a product-based to a service-based economy.
- Finding stakeholders with transformative power might be difficult to locate as whether they can be considered change agents or not depend on the strategies chosen, supporting the fact that the question could be made small enough to locate people with transformative power but wide enough to not design for lock-ins.

9.2.3 Public involvement and democratic decision-making process

- As MetroQuest has shown IT-tools can be used to include citizens in decision-making processes, to create an understanding between a policy choice and a desirable long-term target and to have the citizens on board when taking more radical decisions.
- The last decision regarding the action plan produced is taken by the politicians, this put constraints of the process being in a full co-creation setting where everyone is a decision maker, though it is hard to get an early buy-in from decision makers in open-ended participatory processes.
- The youth vision created during the spring workshops has to be included in the autumn process, still acknowledging that this is not a gather of all different views within the region. The survey could be seen as being at the consultation-level of participation.

9.2.4 Bearer of the long-term responsibility

During this thesis it has been identified that there is currently a big lack of institutions in Sweden (and internationally) who actually takes care of the long-term issues, meaning that VGR is already a frontrunner. However, it can be questioned whether the problem can be solved when it is owned by the environmental board, so a recommendation here would be to keep working for an integrated approach towards the problem and get a broader credibility. As the project seems to be quite unique in relation to what we have found it should be invested in evaluation, monitoring and follow-up to become a benchmark for other regions that wants to conduct similar projects.

- Backcasting processes could be conducted later at VGR as well (e.g. to update the strategies in place) and the criteria produced can also be updated looking at them again (a few years after project) to both check the progression and redirect actions towards a development in the right direction.
- At some time an action plan towards 2050 will be needed, and should be made several years before 2030 to both check if the actions for 2030 are done and to build on this for the next one.

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11 Appendix

11.1 Appendix 1 – Global sustainability trends summary created during *Phase 1*

Dimension	Global trends
Increasing demand for natural resources and ecosystem services	
Population	The world population is expected to grow from 7.16 billion persons (2014) to 7.4 to 10.6 billion persons (2050) (USCB, 2014; United Nations, 2012). The global share of people older than 60 years old is expected to increase from 11.7% (2013) to 21.1% (2050) (United Nations, 2013). The urban population represented 29% and 50% of the population respectively in 1950 and 2010. By 2050, 69% of the global population is expected to live in urban areas (United Nations, 2011).
Economy	In the period 1960 to 2012 the GDP growth per annum was 3.6% and the GDP per capita growth was 1.9%, translated into an increase of the household wealth. While economic activity grows, the inequality is increasing as well with now 50% of the global wealth earned by the richest 1% of the global population (Global Growth Tracker, 2014; Keating et al., 2013;). There is a close relation between GDP and GHG emissions with Asia, North America and the EU sharing almost a third of the global GDP each being the highest CO_2 editors (The Carbon Brief, 2013; Simple Climate, 2012). A structural change in the economy is the tartarisation of the economic activities with the service sector increasing from 52% to 68% in the period 1970 to 2005 as well as the development of outsourcing (Memedovic and Lapadre, 2009).
Material and Energy intensity	In the period 1970 to 2005, the demand for oil, ore and biomass products (including polymers, metals and ceramics that require non-renewable resources) has more than doubled. Today, a third of the global material demand comes from the industry sector, which is also the largest energy consuming sector with 60% of the primary energy used to produce the four materials steel, cement, paper products and aluminium alloys (Gutowski et al., 2013; Allwood et al., 2011;). Between 1973 and 2011 the global energy consumption has almost doubled. The global energy intensity in industry is expected to decrease between 1.5 and 1.9% per annum between 2003 and 2030 (International Energy Agency, 2013; Peck and Chipman, 2007). The challenges of decoupling material and energy flows from social and economic progress are only starting to be addressed. Globally, resource consumption is still a reliable factor of economic growth and human wellbeing (UNEP, 2011).

Decreasing natural supply capacity	
Resource availability	The last 25 years resource extraction has durably been increasing due to the population growth and an increasing demand for products and services from a population with rising income. In consequence, the overall amount of extracted resources increased by 45% between 1980 and 2005 to reach 58 billion tons. The growth rate was quite variable for the different material categories, with higher rates up to 65M for metal ores for example. This will eventually lead to the exhaustion of these key materials (Allwood et al., 2011; United Nations, 2010; WRF, 2008). Even if the proven reserves of oil are sufficient to supply the world for potentially 40 more years (based on 2008 consumption rates), it is now accepted that the production has surpassed the volume of discoveries (International Energy Agency, 2008). Raw materials used to be very cheap in the 20th century but the prices more than doubled in relation to the increase demand and industrialisation of China and India. As a consequence, the prices have also become more volatile, also because of short-term events like flooding and droughts, labour strikes or export regulations (McKinsey Global Institute, 2013).
Land use	Half of the total ice-free land area, 149 million km^2, had been modified by humans and half was still natural land in 2007. The 46.5% of natural land was divided into 18.7% of land unsuitable for agriculture and is 27.8% of natural forest. Amongst the 53.5% of human modified land was 25.8% of permanent meadows, 12.8% of cropland and 6.4% dedicated to human living (urban and rural area, transportation infrastructure)(Central Intelligence Agency, 2013; Hooke, Martín-Duque and Pedraza, 2012). The quality and future opportunities of land use are limited: some agricultural land deteriorated from the intensive cultivation and are no longer suitable for agricultural purposes. Due to human activities, biodiversity, ecosystem services and soil quality diminished. The urbanization is limiting the land available for agriculture. Concerns arise when considering that the food production should double by 2050 to supply the increasing population, with an increasing scarcity of available land for good production and freshwater resources (FAO Statistical Yearbook, 2013; Hooke et al., 2012). The change in land use made it possible for humanity to produce food, extract raw materials and produce goods. But these actions potentially impacted the capacity of land to regulate climate and air quality as well as providing biomass in relation to the decrease of the forest. Adapted from (Hooke et al., 2012; European Environment Agency, 2010).

	Eight biophysical systems or processes were identified as planetary boundaries to describe limits in the assimilation capacity required from the earth that should not be exceeded to avoid major environmental disruptions. The biodiversity loss, the nitrogen cycle boundary (biogeochemical flow) and the climate change boundary have already been crossed. Some are close to being crossed: the global phosphorous cycle (biogeochemical flow), the ocean acidification, the global freshwater use and change in land use. Finally, the impact for the atmospheric aerosol loading and the chemical pollution hasn't been defined yet (Rockström et al., 2009).
Assimilative capacity	The atmospheric carbon concentration is know for the last 800 000 years and has been varying between 180 and 300 ppm. The concentration level has been increasing since the industrial revolution and reached the unusually level of 393 ppm in 2012, and has been put in relation with human activity and the changes in global temperature, sea and ice level as well as the ocean acidification (Le Quéré and al., 2013; Lüthi et al., 2008; IPCC, 2007). The assimilative capacity is limited and is even decreasing when it comes to CO_2-assimilation, due to the decrease in the terrestrial sinks, i.e. the Earth ability to assimilate carbon. Increase demand in biomass resources resulted in an increased deforestation, which accelerate global warming (UNEP, 2012).

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11.2 Appendix 2 – List of interviews conducted during the research project

Name of interviewee	Project	Date
Amanda Martling	VGR	February 17th, 2015
John Holmberg	Transport Sweden 2050	March 26th, 2015
Mike Walsh	MetroQuest	March 27th, 2015
Willemijn Tuinstra	COOL	April 13th, 2015
Anna Dubois	Transport Sweden 2050	April 15th, 2015
Birgitta Nilsson	VGR	April 15th, 2015
Kristina Jonäng	VGR	April 16th, 2015
Magnus Blinge	Transport Sweden 2050	April 20th, 2015

11.3 Appendix 3 – Interview guideline

About the prework

[Challenges]	How were the questions about the challenges formulated, who developed them?
[Background]	How have these challenges been addressed before the backcasting process started? What was the motivation of starting this process? (any barriers limiting stakeholders to go from strategy to action?)
[Process design]	What was the objective regarding the deliverable result and the process in itself? Why was backcasting chosen? (Who chose it?) What assumptions did you have before you started the process? What was your role in the process design?
[Stakeholders]	How was decided which stakeholders would be involved? (Who decided? Why were they considered as relevant?)

During the backcasting process

Can you describe the process in general, your role, the different steps followed and the tools/methods used in each?

[Backcasting]	How well was the backcasting methodology applied during the process? How were the economical, environmental, societal and wellbeing aspects taken into consideration?
[Tools and methods]	How important were the tools and methods used? (How critical for the success of the process / of solving the problem?)
[Stakeholders]	What role did the different stakeholders had in each step? Who had power/control? What motivation/interest did they have in participating? (experts, industry, citizen, society, …) How was the dialogue process? (Identifying critical issues and taking decisions) Were someone (or organisation) missing during the process? Who? Why?
[Process]	In which way was the process successful? What were the biggest issues in making the process successful? (information, knowledge, experts, education, will.. of people involved, leadership) What problems/unexpected situations occurred during the process? How were they dealt with? Could they have been avoided? If you were to do it again, what could be done differently? What was invigorating and scary during the process from what you remember? Were norms being challenged? If so, in what way?

After the end of the backcasting process

When did you consider the backcasting process was finished?

What insight did you get from being part of the backcasting process?

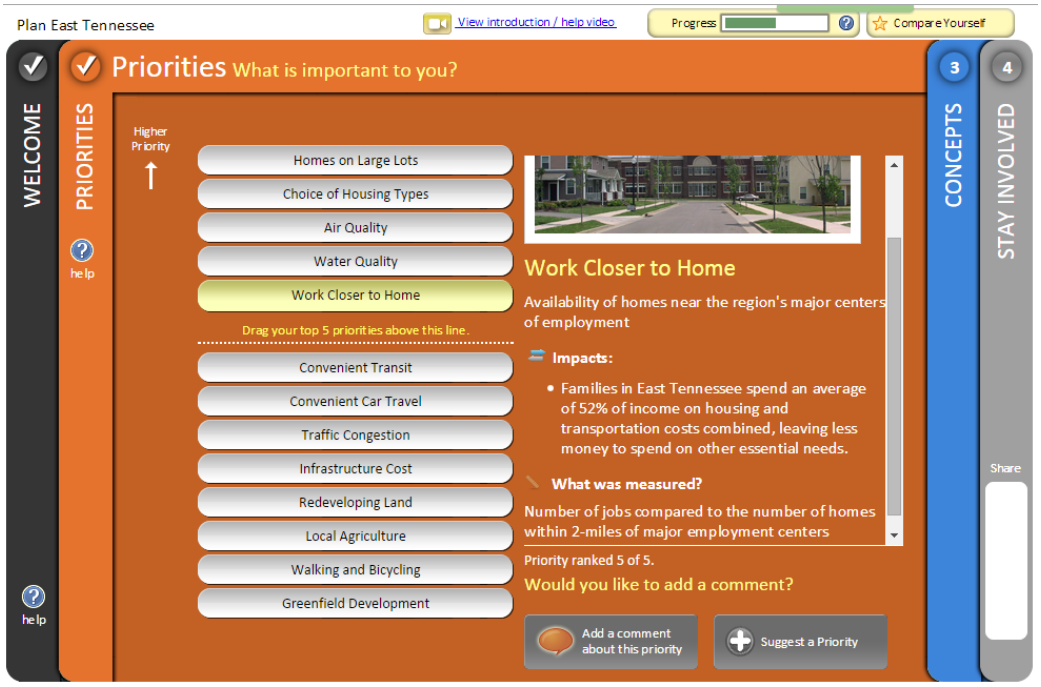
Were there any magic moments, ”wow”-moments?

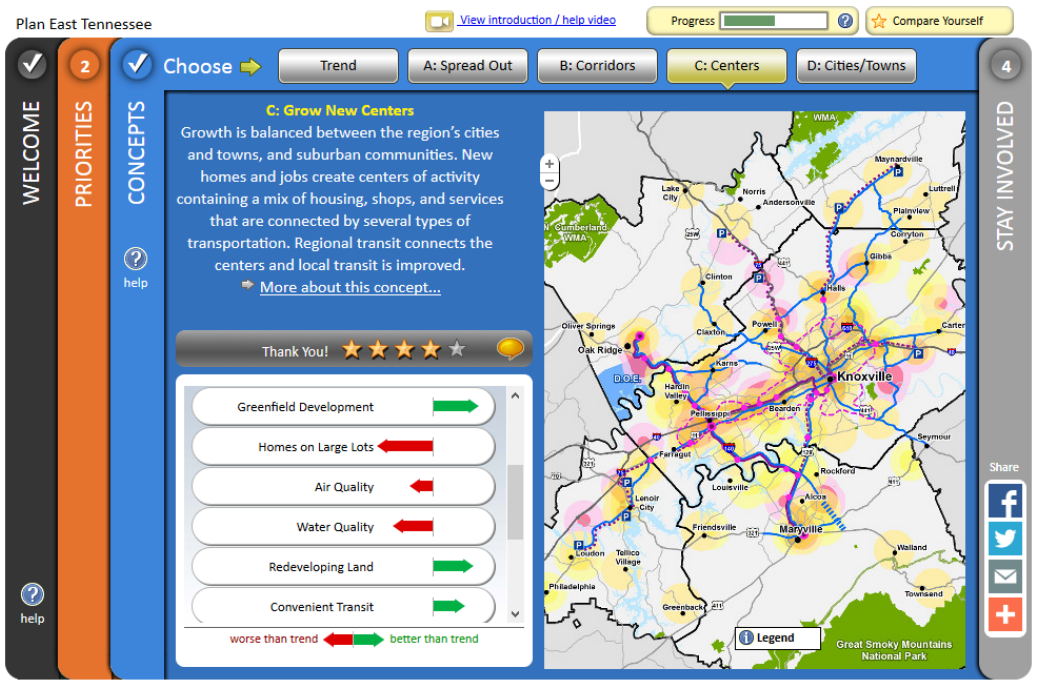
[Evaluation]	How to measure that the process was successful?
	What expectations were fulfilled by the outcomes? (which ones not and why?)
	Were norms, assumptions and BAU mind-sets challenged during the process?
	Would you say the process enabled co-creation and intimacy between the participants and the contracting authority? How was it made possible?
	How was uncertainty taken into account?
[Impact]	How would you characterize the short and long-term impacts of the process? Were they spin-offs and concrete actions? Any binding decisions?
	What made it possible to go from a vision and insights to concrete action?
	How to avoid that the process outcome is just one more report?
	Are there still barriers limiting the implementation of actions? Which ones were properly addressed during the process? (engaging long term action versus prototyping)
[Stakeholders]	What role did you have after the end of the process?
	Do you know who is staying involved today? Who is not working on those challenges anymore?

11.4 Appendix 4 – MetroQuest application as used in three regional development projects in the USA

11.4.1 Plan East Tennessee project

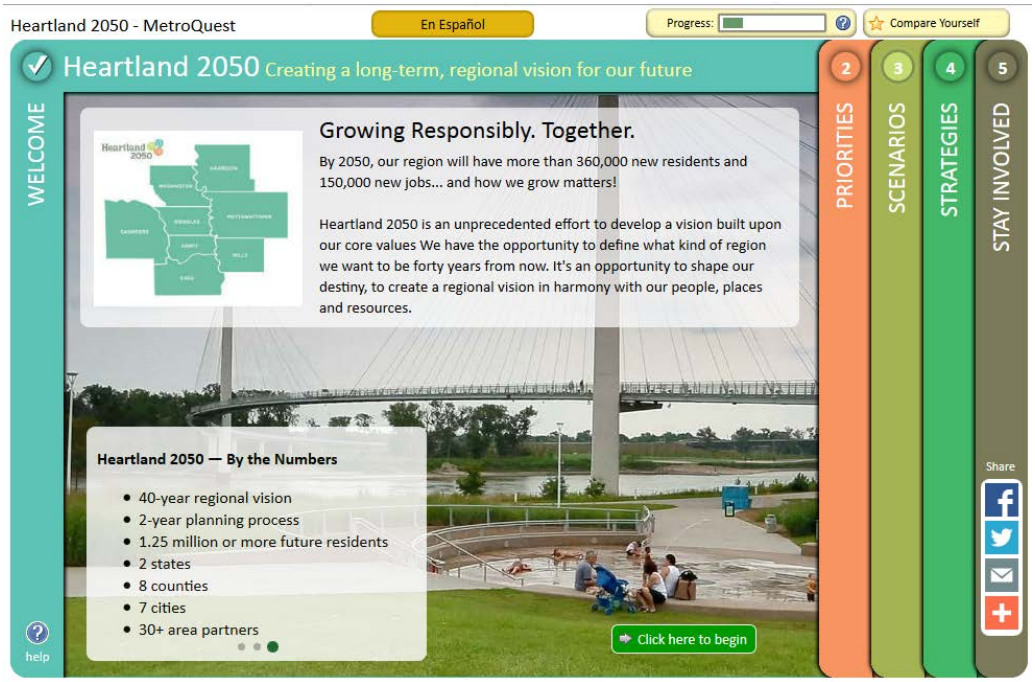
In this project, MetroQuest was designed to collect input from East Tennessee residents about how the region might grow over the next 30 years. It enabled users to explore a variety of regional growth concepts and gain an understanding of how each might make the region stronger, but in different ways.

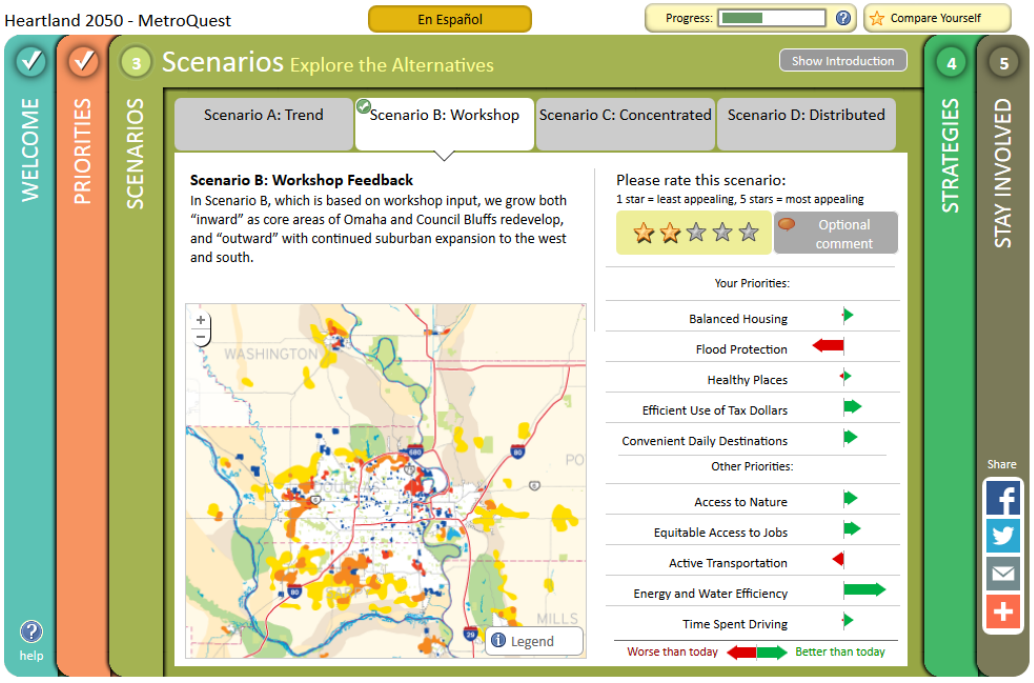


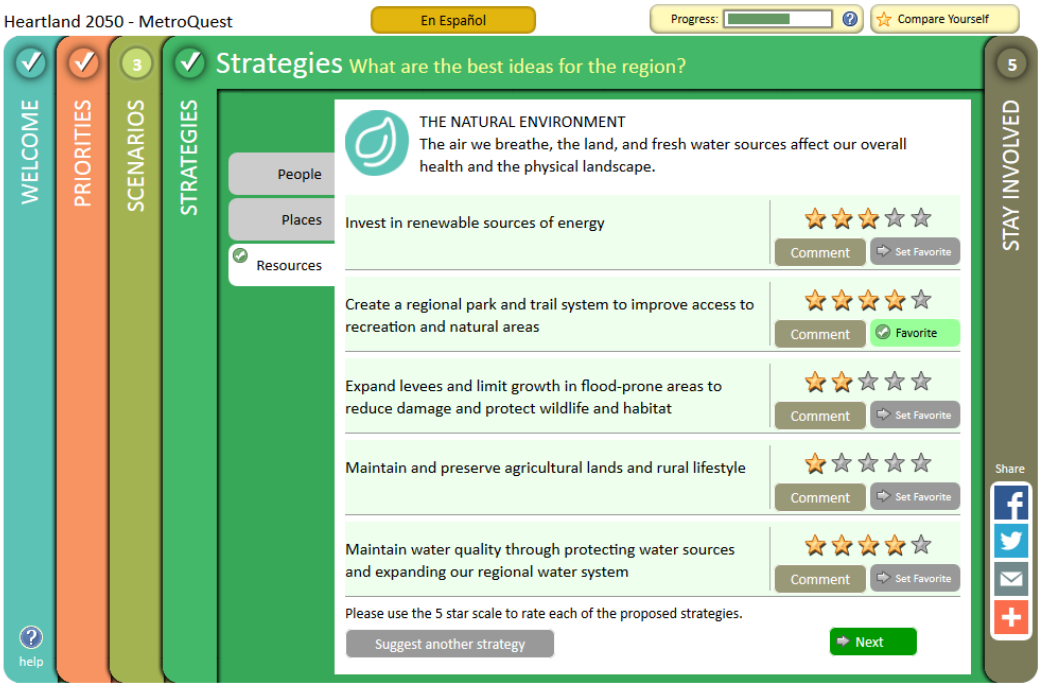


11.4.2 **Heartland 2050 project**

MetroQuest for Heartland 2050 included four potential growth scenarios for the region's future (the greater Omaha-Council Bluffs metro area) so that the residents could create a long-term, regional vision in by evaluating the potential growth scenarios. To create a long-term vision for the regional development, the residents were also asked to rate different strategies regarding people, places and ressources to develop the priorities and strategies for action and cooperation within the region.

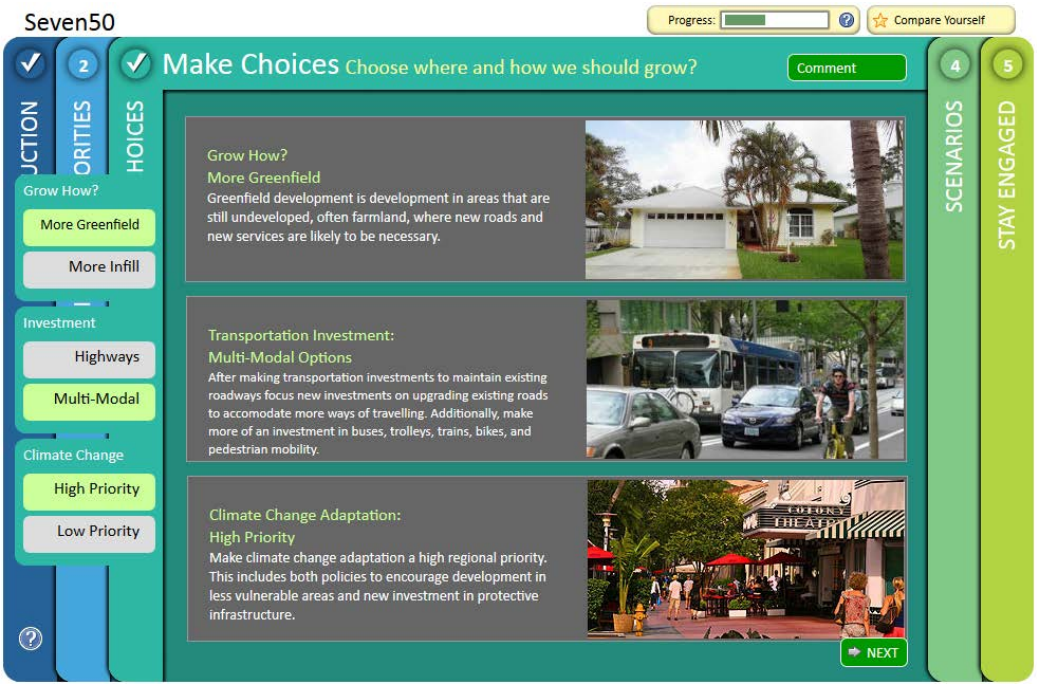


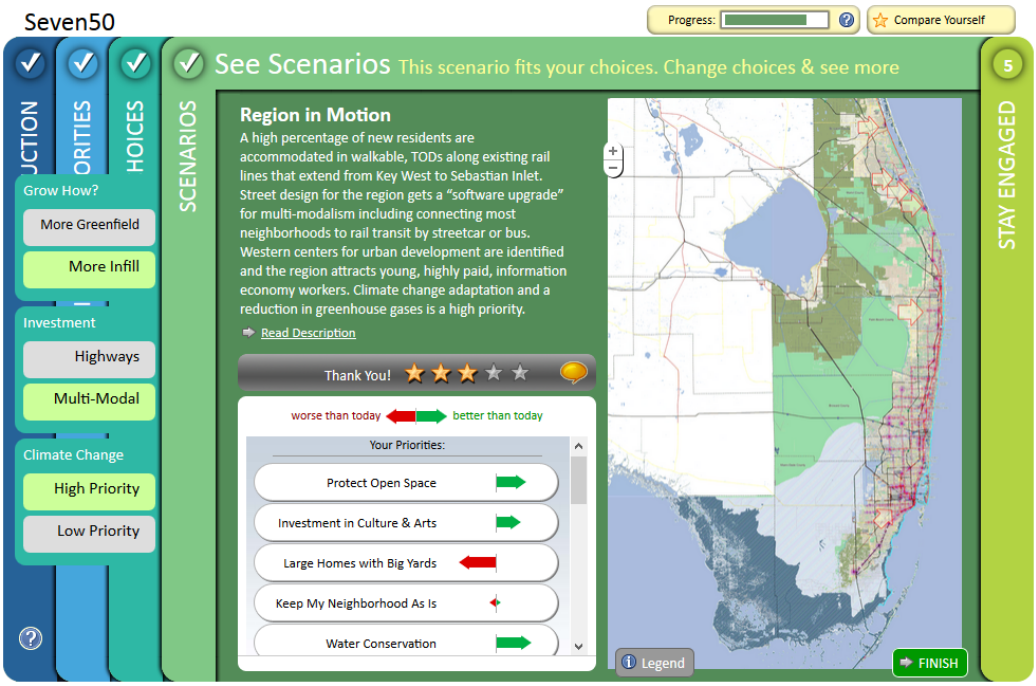




11.4.3 **Seven 50 project**

The Seven counties 50 years version of MetroQuest application provided an opportunity to explore different scenarios for growth and development in the seven counties of Southeast Florida for the next fifty years and beyond. It reache more than 1 million residents who were asked to rate their prefered future scenario (automatically generated according to their choices about growth, investment and climate change).


Seven50
Progress:
Compare Yourself
2
Make Choices Choose where and how we should grow?
Comment
4
5
SCENARIOS
STAY ENGAGED
Grow How?
More Greenfield
More Infill
Investment
Highways
Multi-Modal
Climate Change
High Priority
Low Priority
Grow How?
More Greenfield
Greenfield development is development in areas that are still undeveloped, often farmland, where new roads and new services are likely to be necessary.
Transportation Investment:
Multi-Modal Options
After making transportation investments to maintain existing roadways focus new investments on upgrading existing roads to accomodate more ways of travelling. Additionally, make more of an investment in buses, trolleys, trains, bikes, and pedestrian mobility.
Climate Change Adaptation:
High Priority
Make climate change adaptation a high regional priority. This includes both policies to encourage development in less vulnerable areas and new investment in protective infrastructure.
NEXT


Seven50
Progress:
Compare Yourself
See Scenarios This scenario fits your choices. Change choices & see more
5
STAY ENGAGED
SCENARIOS
Region in Motion
A high percentage of new residents are accommodated in walkable, TODs along existing rail lines that extend from Key West to Sebastian Inlet. Street design for the region gets a "software upgrade" for multi-modalism including connecting most neighborhoods to rail transit by streetcar or bus. Western centers for urban development are identified and the region attracts young, highly paid, information economy workers. Climate change adaptation and a reduction in greenhouse gases is a high priority.
Read Description
Thank You!
worse than today
better than today
Your Priorities:
Protect Open Space
Investment in Culture & Arts
Large Homes with Big Yards
Keep My Neighborhood As Is
Water Conservation
Legend
FINISH

11.5 Appendix 5 – Full list of findings from the three backcasting projects and the transition management framework[5] that were later translated into enabling factors

11.5.1 Framing of challenges and systems perspective

Have a clear understanding of the systems and actors (D)
There is no belief in isolating problems (D)
Complexity has to be acknowledged rather than avoided (D)
Transition management is used to accelerate social innovation and influence transitions (D)
There is a clear global challenge translated to the regional context (Q)
The context is broadened, addressing not only what could be seen as symptoms (D)
Take into account systems of systems and human behaviour (T)
Broad connection to external challenges and a holistic approach (T)
Asking people about the local context improves the quality of information (Q)
Don't leave the context and underlying systemic challenges and problems (D)
Integrate top-down and bottom-up (D)
Use principles such as "no net increase" and "mutual benefit" (Q)
Multidisciplinary to tackle complex questions with a wider focus (Q)
Cover all direction of the sustainability compass for the vision (T)
Take into consideration different geographical levels, policies and behavioural changes (C)
Address technology, economy and governance aspects of policy (C)
Initiate a process from the basis of the big trends and challenges
Development is visualized through the lens of sustainability (Q)

11.5.2 Process planning

Build a close relation to the regime, offer free space, relate to their agenda and respect regular policy processes (D)
Use café-settings and aim for a co-creation mode (T)
Design so that everyone can be a decision maker (D)
It is an alternative/complement to regular policy processes (D)
Design in relation to policy priorities, societal dynamics and local opportunities (D)
Make it fun to participate still having it true to life (Q)
2030 as urgency to act, 2050 as final state (D)
Policy process through participative scenario analysis to create successful policy (Q)
Communication gap : politicians taking decision, having people on board (Q)
Create a common language between policy makers, experts and others. (Q)
Mapping of feelings and values related to sustainability : to reach a common language (Q)
Need to develop an integrated result from the different groups at the end (C)

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[5] Referring to the different projects will here be made by the following etiquettes:
Transition management as of DRIFT and the MUSIC project (D for Drift)
The COOL project (C for COOL)
GB-Quest and MetroQuest (Q for Quest)
National joint forces transport Sweden 2050 (T for Transport)

Define who will decide which strategy is the most suitable solution (C)
Link common knowledge and action (Q)
How to connect the ideas with the people doing innovation and policy (Q)
Take into account population context to share what you're doing (make it hipe, FB friendly etc.) so it's more spread (Q)
Short term actions to gain credibility and attention (D)
System innovation in small but radical steps (D)
Transforming from inside (D)
Short term actions and experiment related to long term goals (D)
The planning phase can be iterated with gradual improvements building trust in a smooth dialogue process (C).
Each step in the design should include activity, workload and budget (C)
Design so that everyone can be a decision maker (D)
It is an alternative/complement to regular policy processes (D)
Design in relation to policy priorities, societal dynamics and local opportunities (D)
Design with clarity (D)
Link with current agendas and targets (T)
Reflect on the time needed for each phase and plan closely as time often is (very) limited (T)

11.5.3 Backcasting framework

Used to explore implications and impacts of long term trajectories, to see if there will be social support (C)
Use future images to stimulate long-term scope in the dialogue(C)
During the envisioning the process is just as important as the final result (D,T)
Backcasting is central in finding the gap between the desirable future and where we are today (D)
Work on different future image to build the vision (C)
Backcasting is used to explore trade-offs and cause-effect chains through real time modelling (Q)
Backcasting is used to learn about alternative policy choices and their implications (Q)
Backcasting lets the participants step out of their current situation and think about the future (T)
Time frame should be long enough to enable participants to step out of current activities and close enough to still feel relevant (C)
Backcasting is both a methodology and a tool, used to open up deeper discussions among the participants, leaving their current context instead focusing on co-creating a positive future. (C)

11.5.4 Stakeholder selection

Broad variety, from different expert field, different views on climate change and transition, people out of the usual networks to have unorthodox nd innovative point of views (D,T,Q,C)
Frontrunners are crucial in the process (D)
Stakeholders chosen on criteria related to ability to initiate change (D) , three categories.
Give room to actors who adopt new ways of thinking (D)
Find people who already challenge what is considered possible and impossible (D)
Involve variety of perspectives to prevent tunnel-vision and enable cross-fertilization (D)
Balance between niche-players and change-inclined, innovative regime players
Consider the various reason one participates; curiousity, scepsis, future collaboration opportunities, belief that we together can identify future needs and possibilities (D)

Chairperson role : to facilitate connexions between participants and project team. Also increase continuity and quality of the dialogue. It triggers participants' confidence and commitment to the process and "ownership feeling" by having a well-know /Famous figure from the sector. (C)
Make clear to the participants what their role is (Q)
Participants agree on presence to all the meetings and dialogue rules = participant contract, also commitment on the goals of the process. (C)
Call for big transition due to current trends : motivation for the participants (T)
Participation grounded on : curiosity, scersis? Collaborative future, can identify future needs and propositions (T)
A certain degree of homogeneity necessary for common ground between participants for discussion and envisionning actions (C)

11.5.5 Process execution

Active and client-oriented support from project or scientific teams (C)
Participants can put their mind to scientific input after they have had their own needs, wants, expectation and views voiced (C).
Create a synthesis of the results during the process, which will be the basis to continue the work on a common base (C)
Build a close relation to the regime, offer free space, relate to their agenda and respect regular policy processes (D)
Use café-settings and aim for a co-creation mode (T)
Make it fun to participate still having it true to life (Q)
Coordinate work in different groups and have joint workshops if needed (C)

11.5.6 Useful tools

The discussions once computers shut down are sometimes the most important (Q)
Use causal loop diagrams to find leverage points to initiate system change (T)
Use the compass to sort out affecting factors and desired goals (T)
Backcasting as a tool to open up (T)
Dialogue tools to enable generative dialogue between the participants (C)

11.5.7 Facilitation

That the facilitator has a belief in the process is central (T)
Prepare for people not agreeing on the future solutions and pathways (T)
The process is quite different and the facilitator must be aware of that things might be unclearly defined (D)
The success of the group depends heavily on the quality of process support (C)
Empower the participants trying to stretch what is possible and impossible (D)
Guide the discussions and don't make any assumtions for the participants (D)
Guide in chaos and prepare for the unexpected (D)
As the process is complex and the outcomes are unclear, it has to be very clearly coordinated (D)
Let go of control (D)
It has to be clearly stated what is expected from the participants (Q)
The different steps of the process should be clear to the participants (C)
Take wishes, concerns and expecations from the participants at the beginning, making them a starting point for the discussions (C)
Don't let participants settle for artificial consensus or hide difference of opinions (C)

11.5.8 **Stakeholder involvement**

Look for cross-fertilization (D)
Not only focus on short-term deliverables, also what need to be done in long-term (T)
“People don’t care about process? But they care about outcome?” – backcasting (Q)
Develop societal pressure so newly emerging niches and innovative regime actors can co-create new societal regimes (D)
Let go of institutional perspectives (D)
Participative framing of challenge (D)
Feeling to play a small part in big context. Inclusion (D)
Scientific input: presentation by the participants increase their involvement, commitment, feel they have real influence on the process. Carefull about potential biais, corrected by others or scientific team (C)
Assure an equal participation of participants and informal atmosphere (comes with backcasting) (C)
Need strict criteria to choose amongst different options (for long term climate strategy) for example in their case 4: climate effectiveness, sustainability, cost effectiveness, social support (C)
Important to explore how different policy instruments (or actions) may come into conflict with each other (C)
Strategies include: possible technological pathways, role of different actors in those, policy instruments needed (C)
Need to address inconsistencies between the different scenarios (per sector) and if they are in conflict with each other (for exemple: use of limited biomass, different need in heavy infrastructure) (C)

11.5.9 **Knowledge input (C)**

Invited speakers: important they are interested by the process and participative approah, ok to interact with participants
Hard to provide heterogeneous group with equal knowledge at the beginning
Scientific information: provide several times, in different forms, adapted to the needs of the participants and at the right moment in the process
Scientific support information: accessible, compact, tailor made
Scientific communication:

- presentation skills extra important
- oral presentation better than text on paper
- interactive tools increase the attention and involvement
- limit the amount of info

Rough estimate necessary for the participants but the scientist hardly want to do it (need to explicit the uncertainties)
Scientist may lack communicative experience : then info not received
Knowledge input:

- factsheet beforehand didn’t work (not used)
- on participants’ request
- when need to jump in conversation (certain topic neglected or to help structure the debate)

Process important, sometimes mandate missing to implement outcomes (Q)
It is educational (Q)
The deliberation tool increases the participants' knowledge and understanding of the challenges (Q)
There was a clear goal to produce a research agenda but the participants said the process was just as important for their work (T)
Indirect effects: discourse, elan, language, trust and shared perspectives (D)
Participants can compare their scenarios with the expert's scenarios (Q)
Learning by doing and by experimenting, see consequences of choices (Q, D)
Stimulating learning: project management has to be based on commitment, fairness, transparency and competence. (C)
Importance of learning for the participants both on 1st and 2nd order (different vision, assumptions, breaking through cognitive fixation) (C)

11.5.10 **Evaluation and follow-up**

Need for evaluation of the process: after and years later about spin-off and long term impact. (C)
From goals and the agenda an inventory was made to see if what we do today is enough. (T)
Ensure sustained involvement with the issue amongst the stakeholders and the society : sense of urgency maintained on the long term, sustained political will to make sincere efforts, consistency of government policy : empower private actors for them to make their own contribution (C)